

# Final Report with Executive Summary

*Consultancy Services for Development  
of Design for Safety Management  
System and Training Programmes for the  
Hong Kong Construction Industry for  
Construction Industry Council*

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# EXECUTIVE SUMMARY

## Introduction and Objectives

The Hong Kong Construction Industry Council (CIC) has been striving to strengthen the sustainability of the construction industry in Hong Kong by increasing awareness of health and safety. In this respect, Design for Safety is an important element in further improving construction health and safety in Hong Kong. Arcadis was appointed by CIC in June 2021 to conduct a study to develop a Design for Safety (DfS) Management System and training programme for the Hong Kong Construction Industry with three key objectives:

1. To develop a Design for Safety Management System applicable to various types of construction projects in the Hong Kong Construction Industry
2. To prepare Design for Safety Management System reference material for the CIC
3. To design and develop a basic Design for Safety training programme for industry stakeholders to facilitate the adoption of Design for Safety in the Hong Kong Construction Industry

## Project Overview

The overall approach to this Consultancy has followed a four-stage methodology, namely:

- 1) Review & Collection
- 2) Survey & Analysis
- 3) DfS Management System & Stakeholder Engagements
- 4) Training Programme & Material

Stage	Deliverables	Key Findings
Review & Collection	<b>Inception Report</b>	<ul style="list-style-type: none"> <li>• Provide brief overview of the project, detailed project approach, methodology and consultation strategy to meet the objectives of the project scope, potential key issues and their mitigation measures, a detailed work programme, and the individual roles and responsibilities of the project team members who will execute this Consultancy.</li> </ul>
	<b>Literature Review Report</b>	<ul style="list-style-type: none"> <li>• Review the existing acts, regulations, practice notes, industry guidance, and academic material that are related to Design for Safety Management System or its equivalent in Hong Kong, the United Kingdom and Singapore.</li> <li>• Provide a deeper understanding on the current effectiveness of DfS and its limitations or areas for improvement to be addressed in the development of recommendations going forwards.</li> </ul>
Survey & Analysis	<b>Interim Survey Report</b>	<ul style="list-style-type: none"> <li>• Key issues identified in the survey include –               <ul style="list-style-type: none"> <li>○ Insufficient risk management and DfS awareness in early project stages</li> <li>○ Lack of clarity in duty holders’ roles and responsibilities</li> <li>○ Lack of DfS knowledge, skills and competence</li> <li>○ DfS has not been as prioritised as programme/cost in business decisions yet</li> </ul> </li> </ul>

**Phase 1 Draft Report with a separate draft reference material**

- Key enhancement (compared to the Guidance Notes of Design for Safety published by Development Bureau in 2016) with the comments/recommendations made by industrial stakeholders include the following:
  - Four “CORE” guiding principles that aim to cultivate safety best practices to strengthen the safety culture in Hong Kong and can be applied throughout the Design for Safety Management System and future training.
  - The improved clarity on the demarcation of roles and responsibilities of responsible parties across the construction life cycle by applying ‘CORE’ principles.
  - An enhanced focus on safety mentality by promoting the integration of Health and Safety (H&S) into key business decisions.
  - Development of a systematic DfS framework that can be followed by each key duty holder by setting out the interactions among duty holders and process flow of key files.

**Consultation Report**

- Five workshops were conducted from 20 April to 6 May 2022 with four main parts and major elements of the proposed DfS system being discussed –
  - Project Flow for Each Duty Holder
  - Application of ‘CORE’ Guiding Principles
  - Key Roles & Responsibilities
  - Feedback on Reference Materials

**Phase 1 Final Report with a separate draft reference material**

- Further assess stakeholder feedback, compare and contrast insights, and review transferrable international best practices (raised in the discussion) and their applicability to Hong Kong’s construction industry. These practices have been incorporated into the Final Report and development of the Design for Safety management system.
- The Reference Material was published on the CIC website in December 2022



**Phase 2 Draft Report with a separate draft detailed training plan with course content/materials**

- In the training programme, 17 independent modules have been included in the DfS Designers Course 1 and 5 modules for DfS Awareness Course 2 to cover all the required topics as per the Contract. In addition to the course materials, Arcadis has also developed a Train-the-Trainer kit with a set of instructions that provide guidance on how to conduct the training programme and improve the training quality.

**Phase 2 Final Report with a separate draft detailed training plan with course content/materials**

- Conduct two types of DfS courses in the form of Masterclass by CIC:
  - DfS Designers Course 1 – for planning, procurement, cost, design management personnel
  - DfS Awareness Course 2 – for general construction personnel
- Facilitate the adoption of Design for Safety in the Hong Kong Construction Industry by considering more local case studies in terms of safety in design.
- Incorporate comments and recommendations from industrial stakeholders/course participants into the Phase 2 Final Report to further enhance the final training program and course materials.

## Next Steps

Going forward, CIC should encourage the construction industry to select pilot projects to incorporate DfS according to the published Reference Material. Any feedback or suggestion during the implementation of DfS for these pilot projects should be captured by CIC as this will help to further enhance the content of the Reference Material or training materials for next revision with the aim to improve Hong Kong’s DfS practice in the construction industry and to ultimately enhance awareness and reduce incidents in Hong Kong.



01

**REVIEW & COLLECTION**

# 1 REVIEW & COLLECTION

## 1.1 Objectives

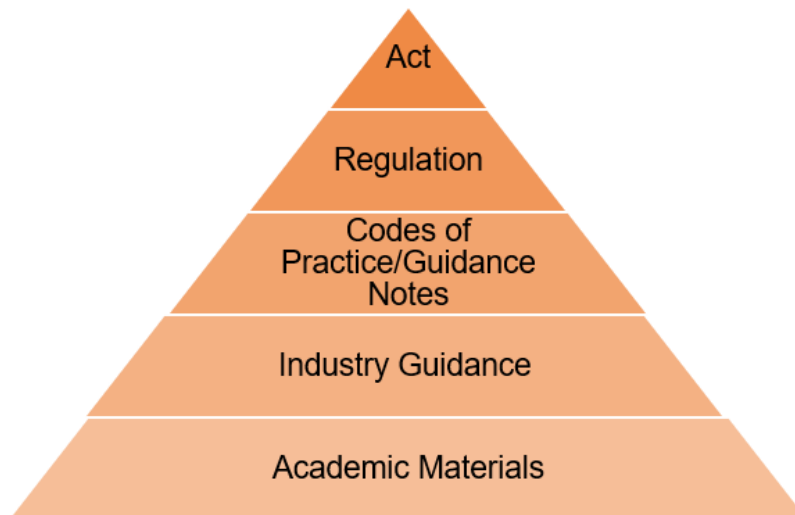
The current Hong Kong and Singapore's DfS practices broadly follow the UK's Risk Management approach and are based on its Construction Design and Management (CDM) model. Specifically, Hong Kong's CDM 2006 model was based on the United Kingdom's CDM 1994 model, while Singapore also implemented a similar model.

While there are currently no mandatory DfS enforcement measures or penalties in Hong Kong, the Government's efforts towards DfS adoption are reflected in the *Code of Practice on Safety Management* and *Code of Practice on Access for External Maintenance*. In Stage 1, reviewing the local and overseas publications aims to achieve a deeper understanding on the current effectiveness of DfS and its limitations, and/or additional efforts for DfS implementation that can be explored based on the best practices of other locations (i.e. the United Kingdom, Singapore).

## 1.2 Methodology

The Literature Review was conducted using a system of document type hierarchy to cover acts, regulation, codes of practice, industry guidance, and academic materials from three selected locations; namely, Hong Kong, the United Kingdom and Singapore, to ensure a comprehensive capture of the current processes, methods and regulatory intent, relevant to DfS and equivalent systems across geographies, and to identify gaps, which may present opportunities for enhancement in Hong Kong. The list of literature review sources has been shared with CIC for approval prior to the start of the review and has incorporated comments received from the CIC Task Force.

Figure 1 Review Hierarchy



In each of the documents reviewed as per the hierarchy described in Figure 1, the following key elements have been noted down for further comparison:

- Context, background and objectives of DfS (or its equivalent)
- Key frameworks and principles
- Supporting legislation and regulatory requirements
- Roles & responsibilities of duty holders
- Application under different project stages
- Information flow and documentation
- Effectiveness, limitation or potential improvement.

The review of the publications has included three steps.

- 1) Identify the information required, developing a review template and approach to extracting defined information from the literature.
- 2) Collect and reviewing relevant literature.
- 3) Conduct a gap analysis with assessment of the applicability to this study and opportunities for improvement.

### 1.3 Findings

In addition to the variance in practice models amongst the three locations, there are preliminary indications of major opportunities for enhancement in the Hong Kong model that include the following:

- Lack of progress with CDM system to enhance Design for Safety
- Inefficient communication and collaboration among duty holders
- High site mobility and fragmented contracting culture
- Lack of 'Safety First' mentality
- Cost concerns limit adoption of safety measures, especially in the private sector
- Labour-intensive construction methods
- Lack of incentives for RMAA works

Possible transferrable best practices from the countries reviewed that include regulation simplification, coordination enhancement, cost-saving measures, and consideration of tools and technologies, etc. are considered as potential solutions for evolving local construction landscape. Furthermore, the findings of literature review have been included in the survey in Stage 2 used to validate the current state of DfS in three regions and identify challenges by the industry stakeholders. All findings and results have been taken into consideration when developing the DfS Management System with Reference Materials in the following stages of the project.

# 02

## SURVEY & ANALYSIS

# SURVEY & ANALYSIS

## 2.1 Objectives

Based on the literature review completed in Stage 1, Arcadis has launched a survey that aims to gather insights on –

- The current state awareness and application of existing Regulations and/or Guidance on DfS
- The current effectiveness of DfS and the role of Health and Safety for key duty holders
- The areas of improvement, current concerns, and future solutions for DfS application and implementation
- Possible transferrable best practices from the UK/Singapore in CDM/Workplace Safety and Health Act and the applicability to the local setting of Hong Kong (e.g. Relevant tools and technologies that could support the implementation of DfS)

## 2.2 Methodology

The following approach has been taken to conduct the survey:

- Determine a representative sampling strategy of survey respondent groups that can reflect the appropriate range of relevant duty holders across the construction industry.
- Develop a question set that can meet project objectives.
- Pilot the question set with a representative internal team to refine and validate the survey.
- Develop an illustrative dashboard to monitor and report weekly survey findings to CIC.

Following the above approach, the survey is structured into four parts, as outlined below:

- Part 1 (Q1-6)– **About the organization and your role:** This section includes general information on the respondent, including their primary role in construction projects, project sector, and approximate project value on an annual basis.
- Part 2 (Q7-15) – **Current awareness of DfS:** This section includes questions about the current state of project Health and Safety, current awareness, and application of existing Regulation and/or Guidance on Health and Safety and Design for Safety (DfS) in the construction industry.
- Part 3 (16-43) – **Existing DfS practices:** This section is designed to gather insights of each main duty holder on the existing Design for Safety (DfS) practices (For Designer/Consultants, and for Others – including clients, contractors, and maintenance supervisors), key elements that influence the health and safety project performance, and the perceived benefits and obstacles of DfS implementation.
- Part 4 (Q44-50) – **Future considerations:** This section determines the future considerations for DfS including areas of improvement, solutions to address concerns, and supporting technologies that can support the future implementation of DfS in Hong Kong.

## 2.3 Findings

After the survey launch in October 2021, a total of 485 survey invites have been successfully sent via email to Hong Kong duty holders, 207 survey invites to the United Kingdom, and 200 survey invites to Singapore. Survey responses (as of 14 December 2021) are summarised below in the Table 1 below:

*Table 1 Survey participation by survey groups*

Location	Hong Kong		United Kingdom		Singapore	
	Total Responses	% of total survey responses	Total Responses	% of total survey responses	Total Responses	% of total survey responses
Clients and Developers	74	20.9%	9	13.4%	21	41.2%
Designers	9	2.5%	7	10.5%	2	3.9%
Contractors	152	43.1%	3	4.5%	12	23.5%
Consultants	88	25.0%	34	50.7%	10	19.6%
Maintenance supervisors/ Facility management	10	2.8%	1	1.5%	0	0%
Others	20	5.7%	13	19.4%	6	11.8%
Total answers	353		67		51	

Key issues have been identified in the survey with proposed solutions for additional analysis in the following stakeholder engagements, as illustrated in the Table 2 below.

Table 2 Key survey findings with proposed solutions

Strata		Key Issues	Proposed Solutions
Findings across Project Lifecycle	Design	<ul style="list-style-type: none"> <li>• Insufficient resources and time</li> <li>• Lack of clarity in roles and responsibilities</li> <li>• Lack of priority in of management focus</li> <li>• Permanent designers not considering or flagging up temporary works solutions with the Lead Designer and / or Lead Contractor</li> <li>• Clients and their initial designers not embracing BIM (digital engineering) and incorporating health &amp; safety for the benefits of the project.</li> <li>• BIM (digital engineering) not utilised early as possible in the design by the initial design team lead by the Client and to continue through the phase with the Lead Designer and Lead Contractor</li> </ul>	<ul style="list-style-type: none"> <li>• Add clarity to assessment checklist for Duty holders</li> <li>• Client strategy brief to incorporate H&amp;S and RAACI*, gateway and significant risk register</li> <li>• Permanent designers to incorporate temporary works solutions within the permanent design of the structure</li> <li>• To incorporate BIM (digital engineering) integrating Health &amp; safety, as early possible and no later than before the end of the preliminary design stage</li> <li>• On design &amp; build contracts the Lead Contractor to adopt the above working with the Lead Designer and the Client prior to and during construction phases</li> <li>• To follow the upcoming Client's guidance for PIRs in line with ISO 19650 to be available via UK BIM Alliance in 2022</li> <li>• Guidelines in regular review of DfS registers to reduce risks</li> </ul>
	Tender	<ul style="list-style-type: none"> <li>• Lack of procurement specifications</li> </ul>	<ul style="list-style-type: none"> <li>• Add in DfS focused tender and include in the contract requirements</li> <li>• Assessment of tenderers experience, knowledge and skills relevant to the project.</li> </ul>



Strata		Key Issues	Proposed Solutions
	<b>Construction</b>	<ul style="list-style-type: none"> <li>• Subcontractors have difficulty achieving standards</li> <li>• Lack of guidance between lead contractors and sub-contractors</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate Lead Contractor performance objectively by Performance Assessment Scoring System (PASS)</li> <li>• Implement audit system and KPI tracker(includes LC and subcontractor engagement)</li> <li>• Uncouple subcontractor roles</li> <li>• Earlier Lead Contractor and Contractor involvement</li> <li>• Adoption of a point of work assessment (dynamic risk assessment) aide memoire via a mobile or tablet App.</li> <li>• Encourage work engagement and near miss reporting with lessons learnt.</li> </ul>
	<b>Operation &amp; Maintenance</b>	<ul style="list-style-type: none"> <li>• More clarity needed for Maintenance Supervisor*</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct review session</li> <li>• Revise Building / Asset Manager Role</li> </ul>

Strata		Key Issues	Proposed Solutions
Insights on Existing Practices	<b>Current Training</b>	<ul style="list-style-type: none"> <li>• DfS awareness needs to be enhanced including risks of temporary works</li> <li>• More training needed for MiC, DfMA, steelworks</li> <li>• Intensive training and upskilling on adopting simpler methods and processes than just paperwork</li> <li>• Clients and Designers appear to be not embracing and incorporating H&amp;S within their BIM (Digital Engineering)</li> </ul>	<ul style="list-style-type: none"> <li>• Improve applicability of the safety design to the projects (local adoption cases)</li> <li>• Increase training hours, professional development, and case sharing</li> <li>• In line with the above the importance of worker engagement and near miss reporting with lessons learnt sharing.</li> <li>• Training on the adoption of a point of work assessment (dynamic risk assessment) aide memoire via a mobile or tablet App.</li> <li>• Clients and Designers awareness training on BIM (Digital Engineering) and on the benefits of incorporating H&amp;S</li> <li>• Adoption of technology-enabled training for frontline workers and supervisors</li> </ul>
	<b>Existing DfS Guidance</b>	<ul style="list-style-type: none"> <li>• Lack of organizational structure</li> <li>• Lack of clarity in demarcation of roles &amp; responsibilities</li> <li>• DfS has not been as prioritised as programme/cost in business decisions</li> <li>• Improve the workflow and time taken in the approval process</li> </ul>	<ul style="list-style-type: none"> <li>• Add steering group on safety review</li> <li>• Review roles &amp; responsibilities with RACCI chart</li> <li>• Provide monetary incentives and require strong support from top management</li> <li>• Review project lifecycle and approval processes</li> </ul>

RAACI\* – Chart clarifying who is *Responsible*, *Accountable*, to provide *Advise*, to be *Consulted* and *Informed* through the project lifecycle stages

# 03

## **DFS MANAGEMENT SYSTEM & STAKEHOLDER ENGAGEMENTS**

# 3 DFS MANAGEMENT SYSTEM & STAKEHOLDER ENGAGEMENTS

## 3.1 Development of DfS Management System and Reference Materials

### 3.1.1 Framework of Design for Safety

Based on transferrable international best practices identified in the Literature Review Report, and insights gathered from the surveys, there are several **key recommendations for enhancing Design for Safety in the local context**, which include:

- To refine project life cycle guidance to promote earlier risk management
- To add clarity to duty holders' roles and responsibilities
- To improve local applicability
- To integrate Health and Safety into business decision-making

In this regard, a Design for Safety framework has been developed with objectives of cultivating safety best practices and strengthening the safety culture in Hong Kong under **four "CORE" guiding principles**, as shown in Figure 2:

- **Communication and Coordination** – Enhanced communication and coordination between all duty holders across the project lifecycle
- **Ownership and Leadership** – Encouragement for industries to adopt greater ownership of safety and health outcomes
- **Risk Prevention and Management** – Risk reduction at the source by requiring all duty holders to remove, minimise, and communicate the risk they create
- **Evaluation and Training** – Conduct iterative project and training to ensure project resources are equipped with necessary requirements and review lessons learned throughout the project

Figure 2 Four CORE guiding principles



### 3.1.2 Roles and Responsibilities of Duty Holders

Table 3 Roles and responsibilities of duty holders

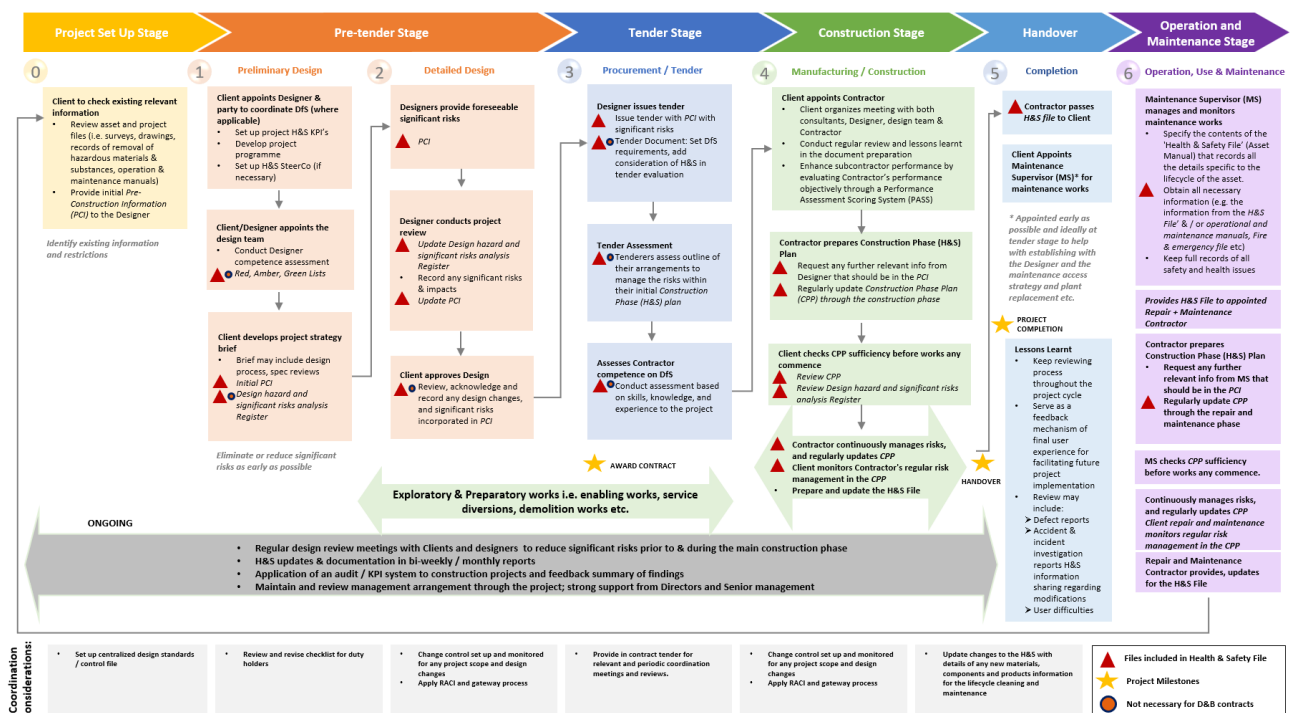
Duty Holder	Definition
<b>Client</b>	<ul style="list-style-type: none"> <li>• An individual/(s), a company, or organisation, for whom a construction project is carried out for, who is –               <ul style="list-style-type: none"> <li>○ financing the project, and</li> <li>○ is able to influence many major decisions involved in the project.</li> </ul> </li> <li>• Clients only have duties when the project is associated with a business or other undertaking (whether profit or not).</li> <li>• This can include, for example, developers, local authorities, school governors, insurance companies and project originators on Private Consortium projects, as well as the owners of a residential unit.</li> </ul>
<b>Designer</b>	<ul style="list-style-type: none"> <li>• An organisation or individual who plans or alters a design or specifies a particular method of work or material.</li> <li>• This would include architects, architectural technologists, civil and structural engineers, mechanical and electrical engineers, quantity surveyors, interior designers, temporary work engineers, building surveyors, independent checking engineers, technicians or anyone who specifies or alters a design for permanent or temporary structures and works.</li> </ul>
<b>Contractor</b>	<ul style="list-style-type: none"> <li>• An individual or a company that carry out actual construction work.</li> <li>• It is noted that a maintenance contractor can be classified under the Contractor role during the Maintenance Stage.</li> <li>• It is noted that this role should be used purely during the asset / building lifecycle stage.</li> </ul>
<b>Maintenance Supervisor</b>	<ul style="list-style-type: none"> <li>• The Maintenance Supervisor (e.g. Facilities Manager, Asset Building Supervisor) is in charge of overseeing operating and the upkeep of a building, including cleaning, maintenance, alterations, refurbishment and demolition during Maintenance Stage.</li> </ul>
<b>Functional roles to coordinate DfS</b>	<p><b>Designer (lead/coordinating role)</b></p> <ul style="list-style-type: none"> <li>• There should be a functional role of Designer (lead/coordinating role) to coordinate the DfS during the design stage and construction stage appointed by Client to coordinate with designers/contractors.</li> <li>• This functional role can also be taken up by a Client Representative, Architect, Authorised Person or Project Manager.</li> <li>• The Client can decide to appoint a coordinator or team with a functional role of DfS if there is a lack of DfS capability of Designer (lead/coordinating role) when the Client does not have the in-house capability and resource of a competent person to advise the Health &amp; Safety.</li> </ul> <p><b>Main contractor</b></p> <ul style="list-style-type: none"> <li>• The Client can decide to appoint a Main Contractor when the project engage more than one Contractor or a coordinator or team with functional role of DfS if there is lack of DfS capability of Main Contractor to monitor the DfS during the construction stage.</li> <li>• The objectives include to manage, monitor and coordinate with other Contractors and/or subcontractors they employ.</li> <li>• If there is only one Contractor where they directly employ every trade and profession directly as an employee, the Client can evaluate the necessity of appointing this role directly.</li> </ul>

### 3.1.3 Application of DfS under Different Project Stages

The application of the 'CORE' DfS guiding principles throughout the project lifecycle is illustrated in Figure 3 Design for Safety Management System. The continuous integration of these guiding principles helps to ensure that the health and safety objectives can be achieved throughout the entire project through

- 1) promotion of early and regular communication and coordination and coordination between all duty holders,
- 2) clear demarcation of roles and responsibilities to promote greater ownership of safety and health outcomes,
- 3) early detection of risk or hazards and proactive elimination at the source, and
- 4) regular review sessions and training courses to ensure that project resources are equipped with necessary requirements

Figure 3 Design for Safety Management System



Note: The above process is for typical normal project lifecycle. As for Design and Built (D&B) Contracts, the appointed D&B Contractor will be taking up design as well as construction works. Therefore, the flow sequence of Design for Safety Management System and recommended files/documents to be included will be adjusted to suit, e.g. there may be no tendering stage and tender assessment once D&B contract is awarded. However, if specialist contractor required to be involved, perhaps the equivalent assessment and evaluation will be conducted internally by the D&B contractor. Some of the documents that may not be necessary required have been identified for D&B contracts.

### 3.1.4 Reference Materials

To facilitate support the DfS Management System, Reference Materials have been prepared to support the implementation of DfS by different duty holders across the project life cycle, including but not limited to the following templates and guidelines:

- Project Brief of Construction Project
- Pre-Construction Information (PCI)
- Red, Amber, Green (RAG) Lists
- Design Hazard and Significant Risks Analysis Register

- As-Built Drawings
- Construction Phase Plan (CPP)
- Health & Safety File (Asset or Building Manual)
- Fire and Emergency File
- A Centralised Knowledge Hub for Design for Safety
- Key Performance Indicators (KPIs) for Design for Safety
- Promotion of Early Involvement of Construction Experts in the Initial Conversation
- Tender Stage Framework
- Digital Visualisation (i.e. BIM, Visual Reality, etc.) and Tools

## 3.2 Stakeholder Engagement

### 3.2.1 Objectives

The overall objectives of the stakeholder engagement workshops are to gather insights that help to evaluate gaps identified in the earlier stages of the Consultancy (including the Literature Review Report and Survey), further explore key points raised by the Task force and CIC and develop the Design for Safety (DfS) Management System tailored to the local Hong Kong Construction Industry.

### 3.2.2 Methodology

The proposed stakeholder engagement approach included discussion within **five focus group discussion workshops** based on the stakeholder groups proposed by Arcadis (with CIC and Taskforce comments and approval) with groups of 4 – 27 participants in each workshop. As of 6 May 2022, **65 confirmed attendees from 34 organisations** have registered and attended in the workshops.

The stakeholder engagement workshops were structured into four main parts to address gaps and validate major elements of the proposed DfS system, as outlined below:

- 1) **Project Flow for Each Duty Holder** – To validate the DfS process flow with each key stakeholder throughout the construction life cycle
- 2) **Application of ‘CORE’ Guiding Principles** – To refine how the CORE Guiding Principles can be applied under the DfS System, including the framework, Health & Safety files, technological applications, and potential training programmes
- 3) **Key Roles & Responsibilities** – To discuss the roles outlined for key duty holders to achieve a holistic understanding of their responsibilities and interdependencies
- 4) **Feedback on Reference Materials** – To assess the applicability of the key Health & Safety Files embedded throughout the project life cycle

### 3.2.3 Key Comments

After completion of the workshops, Arcadis has collected stakeholders’ feedback, compared their insights and reviewed transferrable best practices (raised in the discussion) and their applicability to Hong Kong’s construction industry. The following key recommendations made by stakeholders have been incorporated into the development of Design for Safety management system –

*Table 4 Key comments received from stakeholder and Arcadis responses*

No.	Key comments	Arcadis response
1	Additional guidelines to promote DfS in the Pre-Tender Stage (or earlier), including a DfS review meeting, senior	In the Pre-tender stage, Client will develop a project strategy brief to include design process, DfS review meetings, etc. At this stage, the relevant information will also be included into the

No.	Key comments	Arcadis response
	management/client support, and earlier contractor engagement	initial Pre-Construction Information (PCI) and Design Risk Register for record.
2	Tender stage framework to include more DfS factors and outline of significant risks	In the tender stage, an additional tender assessment has been added in the DfS process flow with objectives of (1) outlining the tenderers' arrangements to manage risks, and (2) assessing the DfS skills, knowledge and experience to the project.
3	A holistic process feedback mechanism and lessons learnt sharing sessions	The feedback and shared lessons learnt have been included in the DfS process flow.
4	An incentive scheme and additional guidelines to promote a shift in "safety-first" mentality	<p>The incentive programmes are mentioned in the CIC's roadmap of Design for Safety which is not within the scope of this consultancy. Arcadis has raised this comment to CIC for consideration.</p> <p>In terms of achieving the shift in safety-first mentality, Arcadis has proposed three suggestions including 1) Enhanced focus on workplace health, 2) Promoting the publication of H&amp;S performance, and 3) Training</p>
5	A knowledge portal / hub and promotion of application of technological solutions including VR and digital twins	<p>The knowledge portal/hub is mentioned in the CIC's roadmap of Design for Safety which is not within the scope of this consultancy. Arcadis has raised this comment to CIC for consideration.</p> <p>In terms of the application of technological solutions (e.g. VR and digital twins) have been included into one of the training modules that can facilitate the principle of Safety in Design.</p>
6	A structural assessment report as formal guidelines	<p>Across the project lifecycle, live documents (e.g. PCI, CPP, Health &amp; Safety Files) have been developed for assessing the health and safety state and continuously monitoring the significant risks that being addressed prior to the commencement of construction works. Design changes and reviews are also included in the DfS documents that are easy to be followed and tracked back in any project stages.</p> <p>In the project lifecycle, there are regular review meetings to help identify any site constraints or design change requirement with the designers and Client and agreed upon safety measures.</p>
7	Additional review of the United Kingdom's "CROSS" system and its application to the Hong Kong industry	Arcadis has reviewed the best practices from UK in CDM and appraised the applicability to the local setting of Hong Kong. Some typical good examples of DfS have been incorporated into the training materials.
8	Training may include lessons learnt, case studies, partnership with universities/professional institutions,	The training programme has been designed and developed based on the DfS Management system and Reference Materials by considering



No.	Key comments	Arcadis response
	behaviour training on accountability, and reference to international best practices	the feedbacks from stakeholders including the enhancement of demarcation of roles and responsibilities, shared lessons learnt in local construction accidents and real-life projects and international best practices used in syndicate exercises.
9	Additional review of proposed additional roles of Lead Designer, Lead Contractor, and H&S Advisor/DfS Professional/DfS Consultation, Asset Building Manager/Maintenance Supervisor	During the workshops, Arcadis have received different opinions on this additional role. In the DfS Management system, the functional roles have been proposed, which allow Client to decide whether it is necessary to appoint an independent party (e.g. DfS Consultant/Professional) who is experienced in management of Health & Safety and can support design team to carry the works across different project phases. In the Phase 1 Final Report, a Pre-qualification questionnaire of functional roles have been included for reference.
10	Streamline of redundant paperwork by referencing EPMS system and consideration of integration with CEDD's original system	The development of templates and reference materials aims to improve the identification of health and safety hazards and associated risks early in a project and show how the information being exchanged and delivered among the duty holders. To reduce the number of templates, we could combine everything related to identifying Hazards and risks in the design to one document – i.e. combine the Preliminary Hazard and Significant Risks Analysis / Design Risk Register / Risk Assessment Rating (Risk Rating Matrix) / Hazard and Impact Summary through the project stages.
11	Clarity on the applicability of proposed DfS Management system in D&B projects	The proposed DfS management system is adaptable for all types of project contracts. The DfS system was written to be adaptable and flexible for all types of projects, contracts and procurement routes and across all different sectors of construction industry. However, the flow sequence of Design for Safety Management System and recommended files/documentations to be included will be adjusted to suit, e.g. there may be no tendering stage and tender assessment once D&B contract is awarded. If specialist contractor required to be involved, perhaps the equivalent assessment and evaluation will be conducted internally by the D&B contractor. Hence, some of the documents that may not be necessary required have been identified for D&B contracts. The relevant documents have been marked up in the process flow.



04

**TRAINING PROGRAMME**

# TRAINING PROGRAMME

## 4.1 Objectives

The purpose of DfS is to improve the overall management of health, safety and welfare in the construction industry. Training of the DfS Management system and the requirements has become extremely important process because it helps to empower professionals to realise the importance of good risk management with the necessary tools so that it can adequately identify and deal with potential risks early and appropriately. Typically, the training programme has two distinct target audience.

- **Management personnel** (i.e. who plan, procure, cost, design and specify or arranging for, or instructing, others to do the “designer role”) – The 2-day course aims to –
  - Enable designers to recognise the benefits of good procurement, identifying hazards & significant risks and mitigating or at least treating them early
  - Understand the importance of collaborative working to help identify and manage risks
  - Establish whether the Client’s existing information is sufficient and what steps are needed to ensure good Pre-Construction Information is gathered for tendering and sharing with the Contractor
  - Understand how important it is to design and specify the right components, materials and products and ensure a design change control process followed will help assist cost certainty
  - Realise by providing the right information to the right people through the project lifecycle stages will help prevent accidents and incidents that would delay the project and increase unnecessary costs
- **General construction personnel** (i.e. those who are actively working during construction, operation and maintenance of project cover both Clients and Contractors) – The half-day course aims to –
  - Be able to recognise the purpose and benefits of the Design for Safety Management system and requirements with collaborative working to help identify and manage risks early
  - Understand how important it is to design and specify the right components, materials and products and ensure a design change control process followed will help assist cost certainty
  - Realise by providing the right information to the right people through the project lifecycle stages will help prevent accidents and incidents that would delay the project and increase unnecessary costs
  - Understand what key areas that Clients, Designers, Contractors and Maintenance Supervisor including functional role of coordinating should carry out and provide to ensure workers work safely

## 4.2 Methodology

In the past stakeholder engagement workshops, feedbacks from stakeholders have contributed to identify skill gaps in performing the DfS in their ongoing projects. It was suggested by stakeholders that training courses should be considered important to ensure that project resources are equipped with necessary requirements. Their key recommendations include the following:

- Specified training modules for different duty holders
- Training modules should cover the safety in behaviour/attitudes
- Shared lessons learnt
- Continuing Professional Development (CPD)

After recognising the current training needs, the project team has helped to develop the training material mainly based on the following key resources:

- Guidance Notes of Design for Safety (DevB)
- Worked Examples of Design for Safety (DevB)
- DfS Final Report and Reference Material developed for the Development of Design for Safety Management System and Training Programmes for the Hong Kong Construction Industry (CIC)

The Arcadis team have obtained and utilised some training material used on UK accredited seminars and courses delivered via IIRSM, APS and CIOB covering Design Risk Management, Building Safety, Principal Designer, Fundamentals of CDM 15 and CDM15 for Clients.

While the contents particularly of the two-day DfS Designers course will be capturing relevant and important examples and information such as **data**, **methodology** and **templates** from previously released industry research papers and the latest industry reports and guidance such as those listed below, which is not exhaustive –

- Accident & incident data from HK DEVB, Workplace Safety & Health (WSH) / Ministry of Manpower (MoM) SGB & HSE UK <https://www.hse.gov.uk/statistics/>.
- Strategy brief, survey schedule, gateways and programme working with HSE's CONIAN KPWC, BIM4 WK Groups, RIBA, CIOB & IIRSM Seminars.
- Integrated gateways: planning out health & safety risk prepared by Glasgow Caledonian University for the HSE 2004 <https://www.hse.gov.uk/research/rrpdf/rr263.pdf>.
- RIBA Plan of Work covering various strategies. <https://www.architecture.com/knowledge-and-resources/resources-landing-page/riba-plan-of-work>.
- ICE Guidance for design risk management <https://myice.ice.org.uk/getattachment/knowledge-and-resources/best-practice/design-risk-management/DRM-Guidance-Version-2-March-2020.pdf.aspx>.
- Case study extracts from live or recent projects in UK and Hong Kong.

### 4.3 Training Programme & Syllabus

There are two types of courses for the proposed training programme: 1) a two-day full course for management personnel, who will perform as designer role, and 2) a half-day course for general construction personnel. The key content as shown in Table 5:

*Table 5 Topics included in the training programme*

No.	Required content as per tender document	Relevant topics included in the training programme
1	Principles and intent for implementing Design for Safety	<ul style="list-style-type: none"> <li>• DfS Requirements in Context – Project Life Cycle Stages</li> </ul>
2	Design hazards and their significant risks	<ul style="list-style-type: none"> <li>• Design &amp; Construction Health &amp; Safety Lessons learnt from Major Accidents/Incidents &amp; Statistics in HK also Singapore &amp; UK</li> <li>• Identifying Hazard &amp; Risks &amp; Key Topics</li> </ul>
3	Design risk analysis and management	<ul style="list-style-type: none"> <li>• Principles of Prevention – ERIC – IERCI &amp; ALARP etc.</li> <li>• DfS Design Risk Management</li> <li>• Working at Height (WAH) with extracts of UK HSE film</li> <li>• Digital Design Engineering</li> </ul>
4	Technique for design hazards and risks identification in respect of the construction lifecycle and elimination and / or reduction	<ul style="list-style-type: none"> <li>• DfS Case Studies</li> <li>• Syndicate Exercises</li> </ul>

No.	Required content as per tender document	Relevant topics included in the training programme
5	Ways to conduct effective Design for Safety reviews	<ul style="list-style-type: none"> <li>• Client Strategy Brief</li> <li>• Pre-Construction Information</li> <li>• DfS Case Studies</li> <li>• Syndicate Exercises</li> </ul>
6	Application of the Design for Safety Management System	<ul style="list-style-type: none"> <li>• DfS Requirements in Context – Project Life Cycle Stages</li> </ul>
7	Reference material on the Design for Safety Management System	<ul style="list-style-type: none"> <li>• Client Strategy Brief</li> <li>• Pre-Construction Information</li> </ul>
8	Roles and responsibilities of different key duty holders, in particular the designer, in the management system framework, and expectation on them	<ul style="list-style-type: none"> <li>• DfS Roles &amp; Responsibilities</li> <li>• DfS Competence Skills, Knowledge and Experience</li> </ul>

## Syllabus for 16-hour DfS Designers Course for Management Personnel

### Day 1

Kick-off Ceremony for the CIC DfS Course

- Welcome | Opening | Keynote Speeches for the DfS Course

Part I: DfS Introduction, Requirements, Roles and Responsibilities

- Introduction, Aims & Objectives
- Design & Construction Health & Safety Lessons learnt from Major Accidents/Incidents & Statistics in HK also Singapore & UK
- DfS Requirements in Context – Project Life Cycle Stages
- DfS Roles & Responsibilities
- DfS Competence Skills, Knowledge and Experience

Part II: Client Strategy Brief, Pre-Construction Information, Hazards and Risks

- Client Strategy Brief
- Pre-Construction Information (PCI)
- Identifying Hazard & Risks & Key Topics
- Review of today – Day One

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### Day 2

Part III: Principles of Prevention and Design Risk Management (DRM)

- Principles of Prevention – ERIC – IERCI & ALARP etc.
- DfS Design Risk Management
- Working at Height (WAH)

Part IV: Case Studies, Syndicate Exercises, Digital Design & Engineering

- DfS Case Studies
- Syndicate Exercises
- Digital Design Engineering

Part V: Course Summary and Assessment

- Q&A, Assessment and Summary & Closing

## Syllabus for 4-hour DfS Awareness Course for General Construction Personnel

### Day 1 (AM)

Kick-off Ceremony for the CIC DfS Course

- Welcome | Opening | Keynote Speeches for the DfS Course

Master Class for General Construction Personnel

- Introduction, Aims & Objectives
- Design & Construction Health & Safety Lessons learnt from Major Accidents/Incidents & Statistics in HK also Singapore & UK
- DfS Requirements in Context – Project Life Cycle Stages
- DfS Roles & Responsibilities
- DfS Competence Skills, Knowledge and Experience

Course Assessment

- Course assessment, Q&A, Summary & End of Close

## 4.4 Masterclass Trial and Feedback

Both versions of the course were trialed in the form of a Masterclass at the HKIC, facilitated by Arcadis in April 2023. During the courses, the trainer guided the participants to go through the details of identifying hazards and associated significant risks, methods and techniques of control, mitigation, reduction and treatment to communicating, consulting, cooperating, coordinating and capturing relevant information, etc.

In addition to the sharing of relevant information and case studies, interactive exercises were incorporated throughout the course to enhance learning — these took the form of small group discussions or presentations on assigned topics. The CIC also invited external guest speakers to share their experience to enrich the content of the course.

The total number of registered participants in this DfS Masterclass reached 72, including 29 for the General Construction Personnel Course and 43 for the Management Personnel Course. They held various relevant roles, including Client, Designer, Contractor, or Maintenance Supervisor, across the public and private sectors of the Hong Kong construction industry.

Questions and comments were collected throughout the course and has been considered in the refinement of the training program and materials where applicable.

*Table 6 Feedbacks and comments on the Masterclass of DfS*

	Course Content and Structure	Course Delivery and Logistics
<b>Areas of Satisfaction</b>	<ul style="list-style-type: none"><li>• Rich and broad coverage of DfS content</li><li>• Clear definition and explanation of DfS concept</li><li>• Well-organised course structure</li><li>• Good coverage of topics on the subject</li><li>• Useful references from guest speakers' presentations (e.g.,</li></ul>	<ul style="list-style-type: none"><li>• Concise and clear teaching methodology</li><li>• Overall comfort of the lecture venue</li><li>• Photo taking sessions after distribution of certificates</li><li>• Provision of food and beverage</li></ul>

	Course Content and Structure	Course Delivery and Logistics
	<p>temporary works management)</p> <ul style="list-style-type: none"> <li>• Clear demarcation of roles and responsibilities (e.g., safety is not solely the Main Contractor's responsibility but the whole project team including Client and Designer)</li> <li>• Well-organised methodology on course assessment</li> <li>• Useful sharing of case studies and videos for illustration</li> </ul>	
<b>Areas of Improvement</b>	<ul style="list-style-type: none"> <li>• More case studies related to the Hong Kong construction industry</li> </ul>	<ul style="list-style-type: none"> <li>• More guidance to be provided by the trainer to help participants discuss the case studies and present their ideas in front of the class</li> <li>• Time management during the course</li> <li>• Small font size in handouts</li> <li>• Distribution of certificates during the class is not necessary</li> </ul>

# 05

## **CONCLUSION & KEY ACHIEVEMENTS**



## CONCLUSION

### 5.1 Summary of Deliverables

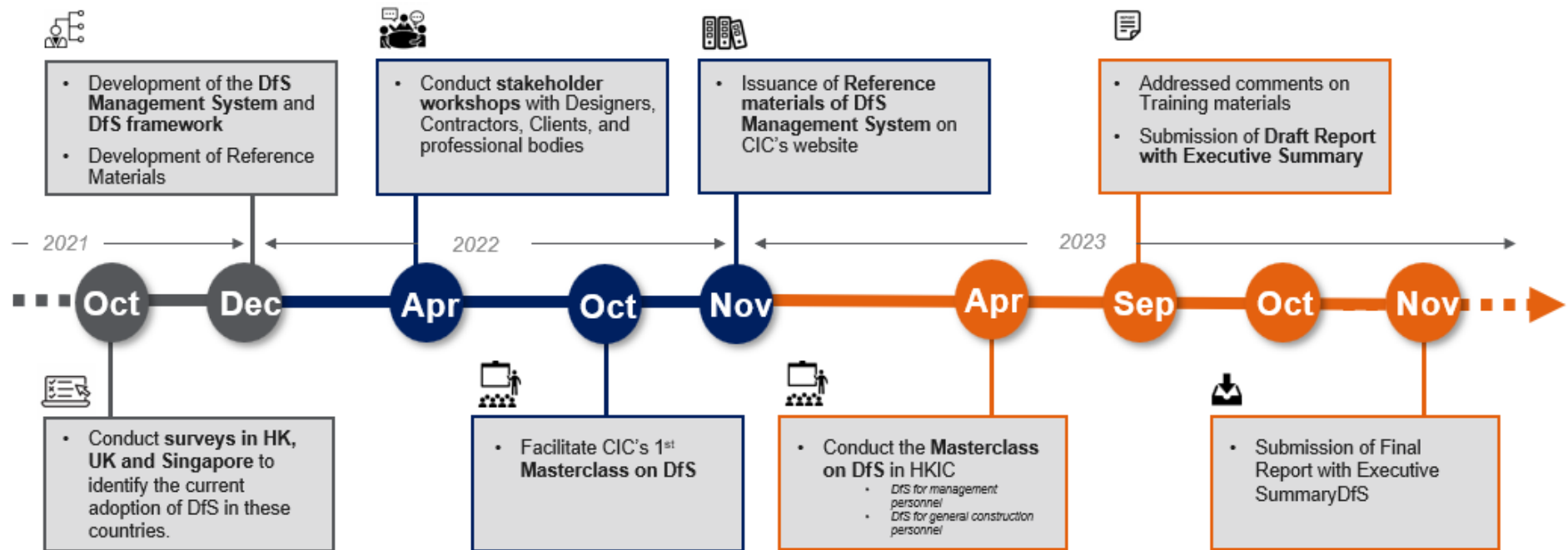
Table 7 Summary of Deliverables (As of November 2023)

No.	Description of Deliverables	Submission Date
1	Inception Report	30 June 2021 – 1 <sup>st</sup> Draft 2 July 2021 – 2 <sup>nd</sup> Draft 13 July 2021 – Update of deliverable dates 27 August 2021 – Refined version
2	Literature Review Report	17 August 2021 – 1 <sup>st</sup> Draft 21 September 2021 – Refined version
3	Survey Report	14 December 2021 – 1 <sup>st</sup> Draft 9 February 2022 – Refined version
4	Phase 1 Draft Report with a separate draft reference material	14 December 2021 – 1 <sup>st</sup> Draft 9 February 2022 – Refined version
5	Consultation Report	23 May 2022
6	Phase 1 Final Report with a separate reference material	13 June 2022 – 1 <sup>st</sup> Draft 30 November 2022 – 2 <sup>nd</sup> Draft 7 December 2022 – Refined version
7	Phase 1 Reference Materials (Chinese version)	1 February 2023
8	Phase 2 Draft Report with a separate draft detailed training plan with course content/materials and PowerPoint material	21 December 2022 – 1 <sup>st</sup> Draft 8 February 2023 – Refined version
9	Phase 2 Final Report with a separate detailed training plan with course content/materials and PowerPoint materials	31 May 2023 – 1 <sup>st</sup> Draft 20 June 2023 – Refined version
10	Draft Report with an Executive Summary	20 September 2023 – 1 <sup>st</sup> Draft 16 November 2023 – Refined version
11	Final Report with an Executive Summary	22 November 2023

### 5.2 Key Achievements

Throughout this consultancy service, we have achieved several key milestones, demonstrating significant progress and impact on the promotion of Design for Safety in Hong Kong. Key milestones have been highlighted in the Figure 4 below:

Figure 4 Key Milestones in the Consultancy



1. **Engaged over 30 professional bodies and 65 industrial stakeholders:** The project successfully collaborated with a significant number of key stakeholders relevant to the domain. This achievement indicates a wide reach and strong stakeholder engagement, ensuring diverse perspectives and expertise were considered throughout the project.
2. **Received over 500 survey responses from three selected countries:** As part of the project, a comprehensive survey was conducted in Hong Kong, the United Kingdom, and Singapore. The survey was designed to gather valuable insights and data from relevant stakeholders, including professionals and industry experts. It aimed to assess the current landscape and identify areas of improvement regarding safety in design.
3. **Developed a DfS Management System with Reference Materials:** Based on the findings and extensive research from literature review, survey and stakeholder consultations, a robust Design for Safety management system was developed and refined. This system provided a structured approach to integrating safety considerations into the design process. It included Four CORE principles of DfS framework, roles and responsibilities of duty holders, and DfS process flow to enhance safety measures throughout the project lifecycle. Alongside the DfS management system, a collection of reference materials was curated. These materials served as a comprehensive knowledge base, providing in-depth information, case studies, and practical examples to support professionals in implementing safety measures effectively.
4. **Conducted two sessions of Masterclass on Design for Safety:** To disseminate knowledge and promote best practices, the consultancy project organised and facilitated two sessions of Masterclass on Design for Safety, held both in October-November 2022 and April 2023. These interactive sessions were facilitated by subject matter experts and aimed to train professionals on the principles, methodologies, and implementation strategies related to safety in design. The masterclass sessions provided a platform for participants to enhance their skills and gain practical insights.
5. **Developed Draft Report and Final Report with Executive Summary:** The Draft Report submitted in September 2023 represents includes a comprehensive analysis of the research, findings, and recommendations gathered throughout the project and it serves as a working document that allows for review and feedback from stakeholders, ensuring that their input is considered before finalising the report. The Final Report is the culmination of the consultancy project which has incorporated the revisions, additions, and improvements made based on the feedback received during the review process. The Report presents a comprehensive overview of the project's objectives, methodology, data collection and findings, and syllabus of Masterclass on DfS. It provides a detailed account of the project's outcomes and achievements and serves as a reference document for stakeholders and future initiatives.

Overall, the consultancy project achieved significant milestones by engaging numerous professional bodies, conducting a comprehensive survey, developing a Design for Safety management system, curating reference materials, and delivering impactful masterclass sessions. These achievements collectively contributed to promoting safety awareness and fostering a culture of safety in design within the Hong Kong construction industry.

### 5.3 Next Steps

Going forward, CIC should encourage the construction industry to select pilot projects to incorporate DfS according to the published Reference Material. Any feedback or suggestion during the implementation of DfS for these pilot projects should be captured by CIC as this will help to further enhance the content of the Reference Material or training materials for next revision with the aim to improve Hong Kong's DfS practice in the construction industry and to ultimately enhance awareness and reduce incidents in Hong Kong.

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