CDM

Construction Design and Management

(Health and Safety Design Management)

Guidance Notes

Occupational Safety & Health Council

Environment, Transport and Works Bureau

Hong Kong Housing Authority

Table of Contents

Chapter 1 Introduction

Background

In January 2001, the Construction Industry Review Committee (CIRC) appointed by the Chief Executive of the Hong Kong Special Administrative Region stressed that site safety was a shared responsibility of the regulator, employers and employees. It also suggested that to achieve better safety performance in the whole project life cycle, hazards identification and mitigation should start from the early design stage and be carried through subsequent phases of project development, implementation, maintenance and demolition.

The CIRC considered that the model under UK's Construction (Design and Management) Regulations (CDM Regulations) might provide a basis for achieving the above objectives. The UK model emphasized that stakeholders including clients, designers and contractors should contribute towards the avoidance, reduction and management of health and safety risks during all stages of a project.

The Essence of CDM

This new paradigm of construction safety management is referred to as 'Construction Design and Management' (CDM) in this Guidance Notes. The main objective of CDM system is to achieve:

i) Identification of potential health and safety hazards, and cost-effective mitigation measures at early stage of a project and continue throughout project delivery;

ii) Early involvement and effective co-operation of all stakeholders through timely provision of relevant and necessary information; and

iii) Clear demarcation of the roles and responsibilities of the parties responsible for coordinating and providing relevant project data on risks at all stages of a project.

The former Works Bureau [now part of the Environment, Transport and Works Bureau (ETWB)] and the Housing Authority (HA) have taken the lead to explore the use of the CDM approach by incorporating practicable features of the UK's CDM model for trial implementation in public works and public housing projects. This guidance document is prepared based on the experience gained from the trials with due emphasis placed on the importance of integrating the CDM system with existing project management process in order to ensure balanced considerations be given to all aspects of a project.

Chapter 2 Getting Organized for CDM

2.1 Who is responsible for implementing CDM?

The following parties having specific roles to play in the CDM process are called duty holders. They are:-

(a) Client;

(b) Project Supervisor (usually the lead designer);

(c) Designer (architect/engineer/maintenance surveyor);

(d) Contractor (including principal contractors and sub-contractors);

(e) Contract Supervisor (the client's [or consultant] appointed site representative); and

(f) Maintenance Supervisor (the client's or end user's representative supervising maintenance works).

2.2 Roles and Responsibilities of Duty-holders

The roles and responsibilities of the duty-holders are summarized below:

(a) Client

- Client has the responsibility to check the competence of everyone he appoints, and should allow enough time and resources for all stages of a project;
- Client should appoint a competent Project Supervisor and ensure that his job is done properly; appoint a competent principal contractor; check if there is a pre-tender health and safety plan before tendering;
- Client must ensure that the Project Supervisor has sought all the health and safety information likely to be needed. This information becomes the *health and safety file* and the client should take reasonable steps to ensure the information is made available for inspection by any person for further planning and maintenance of the project ; and
- Client should set up health and safety goals, possibly with performance indicators and establish a performance monitoring system.

(b) Project Supervisor

The Project Supervisor is responsible for advising and assisting the client with his duties; co-ordinating design work; managing communications between client, designers and contractors; liaising with the contractors about ongoing design matters; ensuring that the *health and safety file* is created, updated and properly managed.

The Project Supervisor should be a suitably experienced professional of sufficient seniority commensurate with the complexity of the project. Normally this person would be the senior architect/ engineer/maintenance surveyor managing the project. If the project is managed by consultants, a competent Project Supervisor should best be provided by the lead consultant.

For design-and-build projects, the contractor should be required to appoint a Project Supervisor to prepare and update the *health and safety file* during the design and constructions stages.

(c) Designers

Designers can be the architects/engineers/maintenance surveyors who contribute to or have responsibility for the design and/or drawing up of the specifications of any part of the project works. For the purpose of this document, the architects/engineers/maintenance surveyors are collectively called the 'designers' in subsequent chapters. In design-and-build projects, the contractor should appoint a competent professional to undertake the duties of the designers.

The role of a designer is to identify and minimize hazards which may give rise to risks; reduce risks due to design and inform relevant parties of the remaining risks; cooperate with the Project Supervisor and other designers; provide information for incorporation into the *health and safety file*.

Health and safety is a shared responsibility. Although designers play a vital part in control and management of health and safety hazards, management of risks during the construction stage is still the contractors' responsibility. Therefore, designers are not expected to eliminate all the risks that will arise during construction and subsequent maintenance and operation stage, but are required to address the risks where it is reasonably practicable to do so within the constraints at the time of preparation of the design.

(d) Contractor

The principal contractor should plan, manage and monitor the construction phase in liaison with other contractors; prepare, develop and implement a construction health and safety plan; ensure that suitable welfare facilities are provided throughout the construction phase; check the competence of their appointees; and liaise with the Contract Supervisor about ongoing design matters etc. A person conversant with the details of the works should be appointed by the principal contractor for liaising in CDM matters.

(e) Contract Supervisor and Maintenance Supervisor

Both will have to assure their own competence, cooperate with others, report obvious risks, and provide any information required for the *health and safety file*. These people should have professional background in construction.

Whilst individual departments for the CDM implementation may differ in other organizations and the nature of projects may also vary, the roles of duty holders may therefore need to be adjusted to suit individual circumstances. Nevertheless, it is more important that a considerate culture throughout the process of project design, development and maintenance be nurtured by means of the CDM spirit and concept.

2.3 Example

The following example is given to illustrate the relationship between the various duty holders of a project:

The Architectural Services Department (ArchSD) receives an assignment from the Hospital Authority for the construction of a new hospital and the design work is assigned to a specialist design consultant. Under such circumstances, the Hospital Authority will be the end-user, ArchSD will be the client acting on behalf of the Hospital Authority, and the project manager of the Department will be the Project Supervisor and responsible for the appointment of designers. But this is not the only possible mode. For other situations, the lead consultants may be responsible for the appointment of the Project Supervisor and the designer from their own office. The role of the Contract Supervisor is best, but not necessarily, to be taken up by the project architect/consultant responsible for the contract administration for the project. There is no hard and fast rule. Departments should consider how best to perform each role.

2.4 CDM Implementation Level

For projects where the works may be divided into different identifiable locations or portions, and are covered by different consultancies, for practicable consideration the CDM process may be implemented based on those 'natural' boundaries of responsibilities.

Chapter 3 The Deliverables

3.1 Documents

The most important deliverable of the CDM process is the *health and safety file*, which is a folder containing the relevant health and safety information necessary for effective control and management of risks throughout the life of a project. The file comprises the following documents organized in such a manner so as to facilitate control and traceability of the information flow:

(a) Summary of Health and Safety Concerns

The document records major potential concerns or hazards identified by stakeholders, including clients, end-users, maintenance parties etc., at the preliminary design stage. The designer's initial responses and any strategic decisions taken or actions required, together with the appropriate action parties should be set out in the document. The document also provides an important basis to facilitate subsequent risk assessment and identification of cost-effective control measures. A sample proforma is attached at **Appendix A.**

(b) Hazard and Impact Summary

The document contains a detailed summary of significant hazards and impacts expected to be encountered during construction and maintenance of the project. The document should set out corresponding risk control measures and key decisions that have been considered by the designers during the detailed design stage in addressing the hazards and impacts. Residual risks unable to be dealt with by the design should also be highlighted. A sample proforma is attached at **Appendix B.**

(c) Pre-tender Health and Safety Plan

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 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 coverage of a *Pre-tender Health and Safety Plan* is attached at **Appendix C.**

(d) Health and Safety Information on Operation and Maintenance

Upon completion of the construction works, the Contract Supervisor should ensure that all the health and safety information relevant to the operation and maintenance of the project are provided by the contractor. Such information includes details on special construction features (e.g. prestressed systems), as-built drawings, plant operation manuals, escape routes, special hidden features and special materials affecting the health and safety of subsequent demolition works, etc. This may be called the *"Health and Safety Information on Operation and Maintenance"* which forms part of the *health and safety file*.

The Maintenance Supervisor is responsible for subsequent review and updating of the *health and safety file*, after taking over the project for operation and maintenance.

Documents (a), (b) and (c) above are not contractual documents. Also, document (c) should be issued with the tender documents for tenderers' reference, but not forming part of the contract. The inclusion of the Pre-tender Health and Safety Plan in the tender documents shall not relieve the Contractor from his contractual obligations or legal liabilities.

3.2 Possession of the Health and Safety File

The client should ensure the Project Supervisor prepare and update the *health and safety file* from the preliminary design to construction stage with input from the designers, Contract Supervisor and contractors. After the construction stage, the Maintenance Supervisor takes over the *health and safety file* from the Project Supervisor and continue with its upkeep. The Maintenance Supervisor shall ensure that all referenced information in the health and safety file are readily accessible.

The flow of information between various documents from preliminary design stage to project completion and subsequent operation and maintenance, as well as the parties responsible for providing the information in each stage is shown in Figure 1.

3.3 Availability of the Health and Safety File

The Project Supervisor should make available the *health and safety file* to the client, designers, Contract Supervisor and Maintenance Supervisor for use. The *health and safety file* may also be made available for inspection by the contractor upon request, although he should already have all the relevant health and safety information that he needs from the *pre-tender health and safety plan*.

3.4 Other Related Health and Safety Documents

(a) Outline Health and Safety Plan

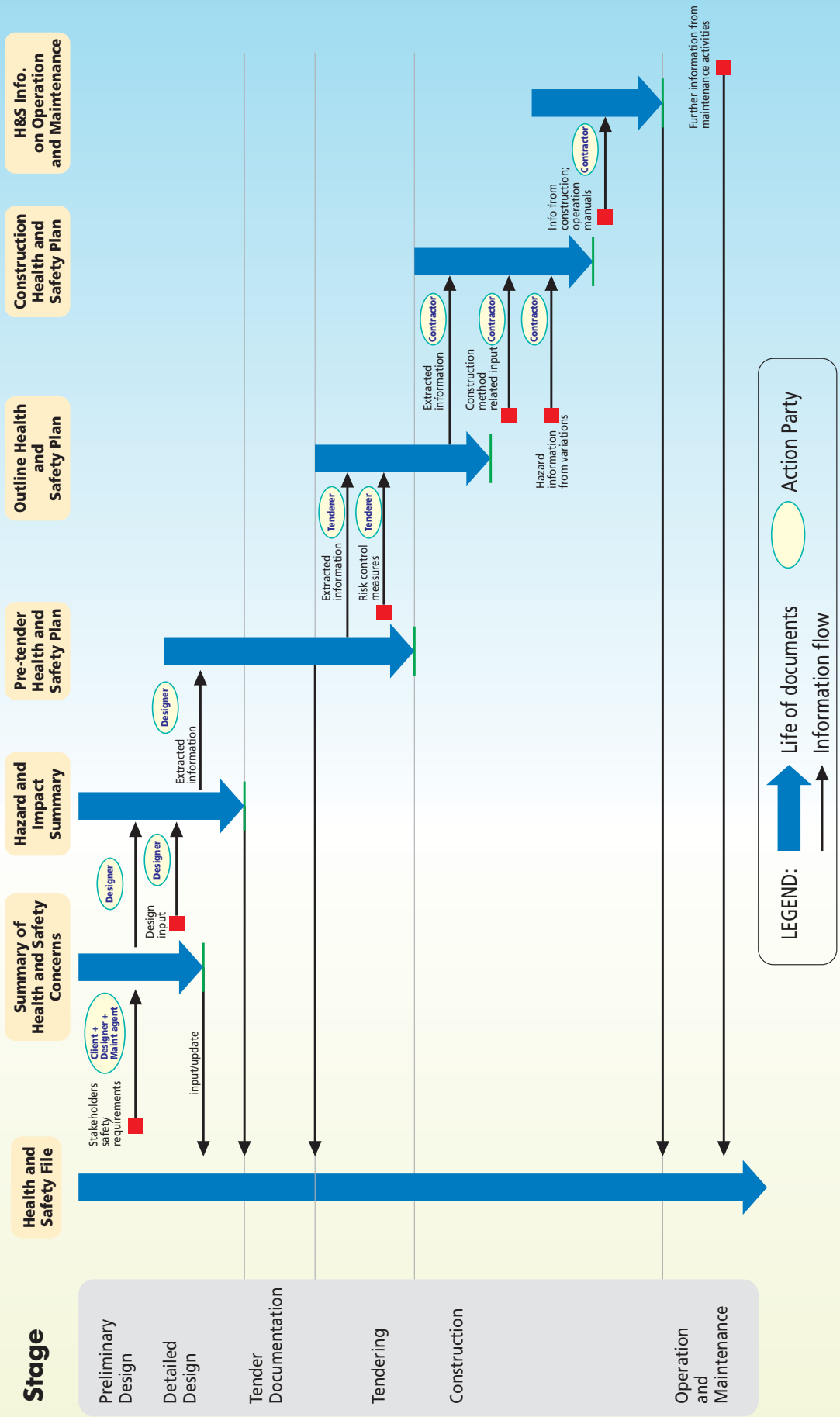
The tenderer is required to prepare and submit for tender evaluation an *Outline Health and Safety Plan* together with his tender to address the risks identified in the *Pre-tender Health and Safety Plan*. The submission should also cover solutions to risks arising specifically from the tenderer's proposed method of construction.

(b) Construction Health and Safety Plan

After contract award, the contractor should prepare and submit a *Construction Health and Safety Plan* covering the "14 elements" of a "safety management system for construction works" (see details in the Construction Site Safety Manual issued by the former Works Bureau), taking into account the content of the Outline Health and Safety Plan and the specific construction methods adopted and the relevant contractual requirements.

3.5 Requirements for Design and Build Contracts

The above CDM documentation process is generally applicable to conventional architect/engineer designed projects. For design-and-build projects, the Employer's Requirements should be prepared based on the findings of any preliminary assessment of the potential hazards or issues of concerns about the project. Although the *Pre-Tender Health and Safety Plan* is not applicable to design-and-build projects, the project office/consultant should draw the tenderers' attention in the tender documents to any major hazards or concerns that have been identified but not obvious to a competent designer or contractor. It should be stated that such information is for reference only. After contract award, the contractor should appoint a competent Project Supervisor to coordinate the preparation of the *Summary of Health and Safety Concerns*, and the *Hazard and Impact Summary*. The contractor should also draw up the *Construction Health and Safety Plan* covering ALL significant risks arising from the design and construction stages and have it checked by the Design Checker (appointed by the contractor) before submitting the document to the supervising officer of the contract for agreement.


Stage
Preliminary Design
Detailed Design
Tender Documentation
Tendering
Construction
Operation and Maintenance
Health and Safety File
Summary of Health and Safety Concerns
Hazard and Impact Summary
Pre-tender Health and Safety Plan
Outline Health and Safety Plan
Construction Health and Safety Plan
H&S Info. on Operation and Maintenance
Client + Designer + Maint agent
Stakeholders safety requirements
input/update
Designer
Design input
Designer
Extracted information
Designer
Tenderer
Extracted information
Tenderer
Risk control measures
Contractor
Extracted information
Contractor
Construction method related input
Contractor
Hazard information from variations
Contractor
Info from construction; operation manuals
Further information from maintenance activities
LEGEND:
Life of documents
Information flow
Action Party

Chapter 4 Administration of the CDM Process

The CDM process aims to improve the health and safety of construction projects by taking a structured approach to how the health and safety of the construction and subsequent operation are designed and managed. Hence, the CDM process should dovetail with the project management process. In this Chapter, we describe in greater detail how the CDM process operates, taking into account the public works programme procedures and other management processes.

4.1 Operation of the CDM Process

The main objective of CDM is to encourage and facilitate systematic consideration and management of safety and health issues from preliminary design to project completion and subsequent stages. At each stage, the relevant CDM procedures should be carried out. Hazard identification is the first step, followed by prevention and protection (i.e. avoid, reduce and control) as described in Sections 5.3 and 5.4. Also, it is best to establish an iterative process for consideration of safety and health issues as the design progresses and when more details are available.

Details of each of these stages and their relevant CDM process are described below. The description should be treated as a reference model, and sensible adjustments should be made where necessary to suit specific project requirements. Although experience may be drawn from previous similar projects to simplify the issue-identification process, the process is indispensable as each project is unique. Major clients/ stakeholders should always be consulted.

4.2 Preliminary Design Stage

For public works projects, after a construction project item is upgraded to Category B status under the Public Works Programme (PWP) authorization system, the project office is authorized to proceed with the design. Before the design work commences, the project office (or the consultants) should appoint a person, normally the lead architect/engineer/designer of the project to assume the role of the Project Supervisor to oversee the CDM process.

At preliminary design stage, the project office has greater freedom of choices and fewer constraints when dealing with potential health and safety hazards. To ensure that sufficient consideration is given to health and safety design issues at this stage, discussion or brainstorming meetings should be conducted. The meetings should be chaired by the Project Supervisor as far as possible, and attended by stakeholders

including the clients, end users, project managers, planners, architects, engineers, designers, maintenance surveyors, safety practitioners (e.g. Departmental Safety and Environmental Advisor) and other relevant parties, in order to facilitate productive discussion and cross-fertilization of ideas, comments and concerns relating to health and safety design issues . Some examples of issues to be addressed at the preliminary design stage are given in **Appendix D.**

All the significant comments and concerns raised by stakeholders together with the corresponding responses should be recorded in the *'Summary of Health and Safety Concerns' (the Summary)*.

The Project Supervisor should then review the *Summary*, taking into account the comments and concerns received. Where the hazards and impacts identified are significant, alternative design options should be considered as far as possible to address them. The *Summary*, including the designers' decisions and responses to the comments or concerns raised, should be reviewed and endorsed by the project review committee, before proceeding to detailed design (see ETWB TCW No. 19/2003 "Review of Preliminary Design before Proceeding with Detailed Design" for further details on the roles of the review committee). Conflicting requirements among the various stakeholders which cannot be resolved expediently at the review meeting(s) can be referred to other forums such as value management workshops as considered appropriate by the chairman of the review committee.

The Project Supervisor must ensure that the *Summary* is included in the *health and safety file* after the endorsement by the review committee. The endorsed *Summary* should then be circulated to all relevant parties for information and reference.

4.3 Detailed Design Stage

After the issue of the *Summary*, the design team should proceed with the detailed design. At this stage, a comprehensive consideration on possible hazards and impacts, together with a risk assessment should be carried out by the designers. This is the most crucial part of the CDM process.

Therefore, it is incumbent upon the Project Supervisor to oversee the risk assessment at the detailed design stage. He should ensure that hazards and impacts associated with the project are identified sufficiently by the designers. In addition, risk control measures are established as far as possible, and the stakeholders such as

clients, end-users and maintenance surveyors etc. are communicated to and fully aware of the safety and health issues affecting the project. When devising risk mitigation measures, the hierarchy of risk control, i.e. avoidance, minimization and control should be followed.

4.3.1 Risk assessment structure

To ensure that project hazards and impacts are properly identified and addressed at the detailed design stage under the CDM process, the Project Supervisor should establish a structure of risk assessment. As a general rule, a designer is required to conduct the risk assessment for his own design, ensuring that all foreseeable hazards and impacts during the construction and maintenance phases are covered. If the design involves input from more than one discipline, then each relevant designer should carry out the risk assessment for his own discipline.

The Project Supervisor should also ensure that any major comments and concerns listed in the *Summary* regarding a particular discipline are passed on to the appropriate designers for consideration and follow-up actions.

4.3.2 Risk assessment programme

After setting up the risk assessment structure, the Project Supervisor should establish a risk assessment programme to ensure that the risk assessment process is completed before the completion of the detailed design and preparation of the *Pre-tender Health and Safety Plan*. This programme should form part of the design programme and be monitored by the Project Supervisor through design progress meetings where appropriate.

To ensure that sufficient consideration is given at design stage to the hazards and impacts affecting construction and maintenance, it is recommended that the risk assessment be carried out at the beginning of the detailed design stage. Subsequently, it should be reviewed and updated regularly, until the design is finalized.

4.3.3 Documentation

At the end of the detailed design stage, the Project Supervisor should ensure that all the significant hazards and impacts identified are properly documented in the *Hazard and Impact Summary*.

The detailed design together with *Hazard and Impact Summary* should also be circulated to the relevant stakeholders, including the clients, end

users, maintenance engineers/surveyors, and other relevant parties for comments and agreement prior to finalization. After that, the Project Supervisor should review and endorse the *Hazard and Impact Summary* for inclusion in the *health and safety file*, as one of the CDM documents.

4.4 Tender Preparation Stage

A *Pre-tender Health and Safety Plan* should be completed before invitation for tenders. The information contained in the *Pre-tender Health and Safety Plan* must be clear and concise. It should contain sufficient details on significant hazards and impacts for a tender to produce accurate pricing plans and assess the health and safety risks that need to be addressed during construction. Therefore, any unusual or unresolved hazards and impacts requiring the tenderer's particular attention should be highlighted in the *Pre-tender Health and Safety Plan*.

The Project Supervisor should also ensure that a copy of the *Pre-tender Health and Safety Plan* is issued with the tender documents and included in the *health and safety file* after the tender has been issued. Tenderers are expected to submit his *outline health and safety plan* with their tender submissions.

4.5 Construction Stage

After the contract award, the contractor should prepare a *Construction Health and Safety Plan*, detailing his plans for managing the health and safety of the construction site. The *Construction Health and Safety Plan* should be prepared based on available information including that contained in the *Pre-tender Health and Safety Plan* and the *Outline Health and Safety Plan*, and other health and safety issues arising from the contractor's proposed construction methods.

A competent Contract Supervisor should be appointed to supervise the works of the contractor. During the construction stage, the Contract Supervisor must ensure that all significant information relevant to the subsequent operation, maintenance and demolition of the project is collected in a systematic manner and submitted to the Project Supervisor for inclusion in the *health and safety file*. Such information should include details of any hidden features (e.g. high-tension cables, pre-streessed elements, safety harnesses anchorage for cleaning or maintenance, toxic materials, especially those that would become toxic during removal, and fire prevention or emergency escape routes, etc.), together with the associated risk

control measures that may influence the operation and maintenance of the completed project.

Furthermore, the Contract Supervisor should ensure that all major design alterations ordered by the client or the designers during the construction period should take into account the resulting risk and impact on subsequent operation and maintenance of the project.

The Contract Supervisor should also ensure that the contractor provides the Project Supervisor for inclusion into (or making reference to) in the *health and safety file* the information relating to the construction stage (see also Paragraph 3.1(d) above), including:

- Records of "as built" drawings and major plans used and produced throughout the construction process;
- General details of the construction methods and materials used;
- Details of the major plant and equipment for use in maintenance;
- Maintenance procedures, facilities and special requirements for the structure, plant and equipment; and
- Details on the location and nature of utility services, including emergency and fire-fighting systems.

In addition, the Contract Supervisor may request the end users or maintenance engineers/surveyor (where known) to draw up a list of particular information that they would like the Contractor to provide for inclusion in the *health and safety file*. Such a list should be given to the contractor in advance, preferably no less than three months before substantial completion of the works.

4.6 Operation and Maintenance Stage

Upon completion of the construction stage, the Project Supervisor should pass the *health and safety file* to the client who will review the sufficiency of its contents particularly those that the contractor is required to provide, before taking over the project for occupation (or operation) and maintenance. If the client is not the end user of the premises, the end users should receive the *health and safety file* from the client. Where necessary, the client may request the Project Supervisor, Contract Supervisor, designers to help review the sufficiency of the information provided by the contractor.

Upon receiving the *health and safety file*, the client or the end user as appropriate should appoint a competent person to be the Maintenance Supervisor responsible for supervising the maintenance works and continue updating the *health and safety file*. If the maintenance works involve more than one discipline, the Maintenance Supervisor should coordinate the input from relevant parties of various disciplines for updating of the *health and safety file*.

To ensure that the information in the *health and safety file* is kept up to date, the Maintenance Supervisor should request the key players involved in operation and maintenance to notify him of any problems that they have encountered. If necessary, the Maintenance Supervisor may request the maintenance contractors to carry out appropriate modifications or improvements to resolve the problem. However, any major modifications or improvements carried out should be documented and relevant details should be included in the *health and safety file*.

4.7 Interfacing with the Systematic Risk Management System in Public Works Programme

The Environmental, Transport and Works Bureau Technical Circular (Works) No. 6 /2005 "Implementation of Systematic Risk Assessment in Public Works Programme" sets out the methodology of 'systematic risk assessment' (SRA) which should be adopted for a public works project with the cost estimate exceeding $200M. The system requires a systematic documentation and management of a wide range of risks (such as political, economic, administrative, land issues etc.) affecting the project delivery. In the 'User Manual' of the mentioned Technical Circular, the project team is also required to consider health and safety hazards. A sample entry under SRA for dealing with construction and maintenance risks in the CDM process is given in **Appendix E.**

4.8 Relation of CDM with Prescriptive Safety Requirements

There are statutory requirements related to prescriptive safety measures for certain dangerous processes or work activities, such as those under the Factories and Industrial Undertakings Ordinance and its Regulations, or the Builders' Lifts and Tower Working Platforms (Safety) Ordinance etc. Examples include abrasive wheels, gas welding and cutting, woodworking machinery, shoring for excavations, bamboo scaffoldings, etc. The duty of the designer under CDM should focus on eliminating such hazardous work activities or processes, or to reduce the risks posed to the workers, through safety considerations in the design.

Chapter 5 Hazard Identification and Risk Control

5.1 Identification of Hazards

The first and essential step in the CDM process is to identify health and safety hazards. There are two categories to consider during the design stage:

(a) hazards that are likely to be within the recognition of a competent contractor, but which might be reduced by designers' initiative; and

(b) hazards that are likely to be outside the recognition of a competent contractor.

Therefore, it is important to:

- identify and eliminate hazards from an early stage;
- identify inter-disciplinary issues where more than one design element might interface; and
- consider all the detailed activities in the construction works and the risks that might arise from their interaction.

Brainstorming sessions held at the start of a project can frequently identify major issues that require further consideration as the design progresses. Hazard checklists may be useful as an aid, but are no substitute for experience and judgment, as each project is unique and has to be considered in the light of the circumstances.

5.2 Risk Assessment

Risk assessment is a tool to assist architects/engineers/designers to assess and manage hazards according to the perceived risk level. Before deciding on the appropriate measures for an identified risk, it is necessary to consider the consequence of a risk, and the likelihood of occurrence. This is the art of risk assessment.

There are many ways of carrying out risk assessments, ranging from crudely qualitative methods to relatively sophisticated quantitative approaches. To some degree all risk assessment methods are subjective and arbitrary but can be useful, provided that the method used is appropriate for the purpose and its limitations are recognized and understood. A precise estimate of risk is not usually required, as this would be too time consuming in practice and lack of data often makes quantitative analysis impossible. A simple method of risk assessment is given in **Appendix F** for reference.

5.3 Attitude to Risks

Risks cannot be avoided, but should be managed according to the following principles of prevention and protection:

- Designing to avoid foreseeable risks (i.e. eliminating hazards, if possible, by adjusting designs);
- Combating the risks at source (i.e. reducing risks from remaining hazards); and
- Giving priority to measures which will protect all persons affected by the works rather than the individual (e.g. walkways with handrails would be preferable to safety harnesses).

Applying these principles in making design decisions should avoid or reduce risks in subsequent construction and maintenance stages. Even though contractors may be able to control risks to a degree during construction, or that the risks are manageable during the maintenance stage, designers should always aim to eliminate, reduce or manage risks at the design stage as far as possible.

Making design decisions also entails achieving an appropriate balance between the impact from the outcome of a risk materializing and the cost arising from sacrificing the design objectives (e.g. clients' functional requirements, aesthetics, environment, programme and cost etc.). Therefore, a design needs not be dominated by the requirement to avoid all risks at all cost, although consideration of risk must be a significant influence in the decision-making process.

5.4 Risk Control Measures

The most effective risk control measures are communal rather than personal. This can be seen in the hierarchy of risk control measures given below (in descending order of effectiveness). When preparing a risk management strategy for a particular hazard, designers should ensure that the measures chosen are as high up on this hierarchy as possible:

- Elimination of the hazard;
- Substitution of a less hazardous design feature;
- Safety provision, such as :

- Enclosure — isolation, barriers, guarding or segregation, all of which are designed to separate people from the hazard;
- Reduced exposure — changes that reduce the time individuals are exposed to a hazard, or reduce the number of people exposed;
- Safe systems of work, together with suitable training and supervision;
- Written procedures, and provision of information, instruction, warnings, signs and/or labels; and
- Use of personal protective equipment (PPE).

If, after incorporation of further control measures, the residual risk rating is still significant, the designer should include appropriate information in the *Pre-tender health and Safety Plan* to alert the contractor of these risks.

Appendices

Appendix A Proforma for "Summary of Health and Safety Concerns"

A. Project Profile

B. Site Environment

C. Site Constraints

D. Record of Consultation/Brainstorming Sessions

1. Date of consultation/brainstorming session: _____

	Attendance	Post/Department	Contact details	Special Role
a.				Chairman/Facilitator
b.				
c.				
d.				
e.				
f.				
g.				
h.				Note-taker

2. 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**
a.				
b.				
c.				
d.				
e.				
f.				
g.				
h.				
i.				
j.				
k.				
l.				
m.				
n.				

Record prepared by _____

(Name of Officer)

Post _____ Date _____

Countersigned by _____

(Name of Project Supervisor)

Post _____ Date _____

Notes

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

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

Appendix B Proforma for "Hazard and Impact Summary"

A. Project Profile

B. Site Environment

C. Site Constraints

D. Hazards and Impacts

	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
1.							
2.							
3.							
4.							
5.							

	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
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15							

Note + : *Risk Assessment Rating is given in Appendix F, item (c)*

Record prepared by _____

(Name of Officer)

Post _____ Date _____

Countersigned by _____

(Name of Project Supervisor)

Post _____ Date _____

Appendix C Coverage of a "Pre-tender Health and Safety Plan"

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

Nature of Project

(a) Client's name;

(b) Location;

(c) Nature / description of construction work to be carried out;

(d) Timescale / Programme for completion of the construction work;

Existing Environment

(e) Surrounding land use and related restrictions, e.g. existence of premises such as schools, court buildings, shops, etc. adjacent to the proposed construction site, planning restrictions which may affect safety and health. e.g. for noise, air quality, etc.;

(f) Existing services, e.g. underground and overhead lines;

(g) Existing traffic systems and restrictions, e.g. access for fire fighting equipment, times of delivery, ease of delivery, parking, loading and unloading operations;

(h) Existing structures, e.g. any special health and safety problems that may be caused by materials in existing structures being demolished, refurbished, altered or added to, any fragile materials which require special safety precautions, instability problems;

(i) Ground conditions, e.g. contamination, overall instability, possible subsidence, old mine workings, underground obstructions, disused tunnels, ground anchors, soil nails;

(j) Proximity to railway lines, tram lines, or live traffic with possible restrictions on the operation of cranes etc.;

Existing Drawings

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

The Design

(l) The risks identified by designers that have **not** been eliminated during the design stage. There residual risks will need to be addressed by the tenderers in their *Outline Health and Safety Plan* and considered further by the contractor in the *Construction Health and Safety Plan* after the contract award;

(m) The principles of the structure design and any precautions or sequences of assembly that need to be followed during construction, e.g. temporary support requirements during periods when the structure may be unstable;

Construction Materials (if applicable)

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

Site-wide Elements

(o) Positioning of site access and egress points (e.g. for deliveries and emergencies);

(p) Location of temporary site accommodation;

(q) Location of unloading, layout and storage areas;

(r) Traffic / pedestrian routes, headroom restrictions;

(s) Existing welfare facilities if contractors are allowed use of them;

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

(t) Consideration on safety and health issues arising where the project is to be located in premises occupied or partly occupied by the client or end-user; provide details of operations which will continue as part of the client's or end-user's undertaking, e.g. office work on the floors below that which is being refurbished, factory processes, etc.;

(u) Restrictions on access, e.g. one particular site entrance may be the only access available for the contractor to use;

(v) Other restrictions e.g. on noise levels, use of percussive machines which cause excessive vibrations etc.;

Site Rules

(w) Specific site rules which the client or designers may wish to specify relating to the construction and maintenance of the project;

Continual Liaison

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

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

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

. . . . . .

General Notes:

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

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

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

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

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

Appendix D Examples of Issues to be Addressed at Preliminary Design Stage

1. General Issues

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

2. Other Issues for Specific Types of Works

Further examples on the issues that should be addressed at preliminary design stage for particular types of works are given in the checklist in Appendix A of EWTB TCW No. 19/2003.

Appendix E Sample entries into the 'Risk Register' under ETWB Technical Circular No. 6/2005

Risk ID	001-1
Risk	**Health and Safety on construction site**
Consequences	Should consider how health and safety hazards may affect the completion of the project (such as in terms of time and cost to the project)
Assessment - Likelihood	Depends on the nature of the construction – tunnelling would be different from erecting a one storey building.
Assessment - Consequence	
Assessment - Risk Rating	
Assessment - Is it Understood	Depends on project team's assessment. Most safety and health risks are understood, and provided that means are in place to control them, they are acceptable
Assessment- Is it Acceptable	
Treatment strategy	By means of operating the CDM process
Treatment options	May refer to CDM documentations
Treatment - Associated Documents	
Treatment - Owner	Probably the Project Supervisor
Treatment - Residual Risk	Probably only those risks that are expected to be irresolvable even by the contractor in his construction health and safety plan need recorded here, and be assessed.
Treatment - Likelihood	To be decided by the project team
Treatment - Consequence	
Treatment - Risk Rating	

Appendix F Risk Assessment Method

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

(a) Consequence

Normally three ratings of severity should be adequate:

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

(b) Likelihood

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

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

(c) Risk Assessment Rating

	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.

Notes

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