HSE CONTRACT RESEARCH REPORT No. 71/1995

CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 1994
BRIEF FOR A DESIGNERS’ HANDBOOK

C Joseh and A Delves

Ove Arup and Partners
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The Health and Safety Commission recognised that there was an urgent need for guidance handbooks to help designers discharge their responsibilities under the Construction (Design and Management) Regulations.

This document is the brief for authors of such designer’s handbooks. It strongly recommends that the handbooks are organised under the following headings: introduction; the size of the problem; the CDM regulations; the principles of the approach; information and guidance on pervasive issues; tests of designers competence; integrating CDM into the design process; systems and work sections; worked examples; presentation; and selected sources of guidance.

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THE BRIEF FOR A DESIGNERS' HANDBOOK

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PREFACE
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 1

INTRODUCTION

The Construction (Design and Management) ("CDM") Regulations 1994 require designers to assess potential hazards in the works they are designing.

The majority of design professionals currently lack the experience effectively to discharge the duties that the new Regulations impose upon them.

The Health and Safety Commission (HSC) recognised that there was an urgent need for guidance handbooks to be provided for designers.

As a result, the Health and Safety Executive (HSE) approved a grant to the Construction Industry Council (CIC) to devise a brief for the authors of such design handbooks.

This document, produced by Ove Arup and Partners, is the brief for authors, produced under an appointment to the CIC as agents for the HSE. It reflects the valuable comments and criticisms received during the field trials at the ICE and RICS in March 1994. It is based on the 7/2/94 draft of the CDM Regulations and the Approved Code of Practice.

The Brief for a Designers' Handbook

The following pages set out the organizational framework that you, the authors, are invited to follow.

**Bold Text** are the headings under which you, the authors, are strongly recommended to provide text and illustrations. These are fundamental.

Plain Text are general guidance to you, the authors. In particular, you are requested to reproduce the tables that appear in plain text in Section 8.

*Italic Text* are examples of the subject matter that should be presented under certain headings, simply as an illustration of the definitive text and illustrations.

The section on presentation and Appendix 1 give guidance on acceptable means of laying out the pages.
THE BRIEF FOR A DESIGNERS' HANDBOOK

THE BRIEF
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 1

INTRODUCTION

Place this document in the context of the level of guidance being given.

The aim of this handbook and others in the series is to help designers meet their obligations under
the CDM Regulations.

The objective of the Regulations is to improve health and safety on construction sites. This
includes new construction, maintenance, alteration and demolition.

The handbooks take as their starting point the fact that design follows a natural and often iterative
sequence.

Different sectors of the construction industry may use different terms, but in essence the process is always the same, moving from concept to detail, from the general to the particular.

At each stage of the design the handbook shows how a review of health and safety could be carried out. The assessment of hazards is ordered to fit the design process.

The method of assessment begins by 'sifting' standard construction situations from non-standard ones, so as to enable designers to assess standard situations more quickly. It cannot be overemphasized that even standard designs contain hazards. The assessment method is designed to flush these out. More unusual designs are subjected to a more rigorous analysis.

This handbook is organised under 11 headings:

* **Introduction**

This places the document in context and explains its organisation.

* **The size of the problem**

This tells designers the numbers of people killed and injured each year in construction. It compares construction with other industries. It compares different sectors of construction, including demolition. It addresses the magnitude of the threat to health posed by construction activities.

* **The CDM Regulations**

This describes the aims of the Regulations and the hierarchy of health and safety publications. It explains the legal duties and guidance relating to those duties.

It explains the roles and duties of function holders under the Regulations, and distinguishes between civil and criminal liabilities.

It describes the purpose, contents and format of the health and safety plan and the health and safety file.
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 1

INTRODUCTION (Continued)

* The Principles of the Approach

This deals with hazard identification and risk assessment. It introduces the principles of prevention and protection.

It distinguishes between issues that are common to all construction sites ("pervasive issues") and those that are specific to some aspect of an individual design ("particular issues").

* Information and Guidance on Pervasive Issues

This deals with welfare, health hazards, site layout, access and egress, fire and other emergency procedures.

* Tests of Designers' Competence

This provides simple questions that designers could ask themselves at all stages of the design process, to identify areas where lack of knowledge may lead to a site hazard.

* Integrating CDM into the Design Process

This section is based on the premise that design should follow an orderly process moving from the concept to detail, from the general to the particular. If the application of CDM follows this process, it is not likely to become a burden on designers.

It relates CDM tasks to the customary design tasks for each stage of the design process. It leads you through the steps you need to follow to fulfil your designers' CDM responsibilities.

It shows you, the designer, how to contribute to the health and safety plan at each stage of the design process.

* Systems and Works Sections

This section is based on the premise that designers think in terms of systems and contractors think in terms of work sections. This section shows the relationship between the two and how this can be used:

- To make it easy for the designers to organise and write the design section of the health and safety plan.
- To make it easy for contractors to understand it.

* Worked Examples

This section shows how the health and safety plan is developed during the design process and can assist the designers.
INTRODUCTION (Continued)

* Presentation

This section provides guidance on acceptable means of laying out the pages.

* Selected Sources of Guidance

This section directs the readers towards some organizations that can provide practical guidance.
Definitions (Take Final definitions from CDM Regs).

Construction Work - The carrying out of any building, civil engineering or engineering construction work and includes any of the following:

a. the construction, alteration, conversion, fitting out, commissioning, renovation, repair, upkeep, redecoration or other maintenance (including cleaning which involves the use of water or an abrasive at high pressure or the use of substances classified as corrosive or toxic for the purposes of regulation 7 of the Chemicals (Hazard Information and Packaging) Regulations 1993), de-commissioning, demolition or dismantling of a structure;

b. the preparation for an intended structure, including site clearance, exploration, investigation (but not site survey) and excavation, and laying or installing the foundations of the structure;

c. the assembly of prefabricated elements to form a structure or the disassembly of prefabricated elements which, immediately before such disassembly, formed a structure;

d. the removal of a structure or part of a structure or of any product or waste resulting from demolition or dismantling of a structure or from disassembly of prefabricated elements which, immediately before such disassembly, formed a structure;

e. the installation, commissioning, maintenance, repair or removal of mechanical, electrical, gas, compressed air, hydraulic, telecommunications, computer or similar services which are normally fixed within or to a structure;

but does not include the exploration for or extraction of mineral resources or activities preparatory thereto carried out at a place where such exploration or extraction is carried out.
INTRODUCTION (Continued)

Structure: Any building, steel or reinforced concrete structure (not being a building), railway line or siding, tramway line, dock, harbour, inland navigation, tunnel, shaft, bridge, viaduct, waterworks, reservoir, pipe or pipe-line (whatever, in either case, it contains or is intended to contain), cable, aqueduct, sewer, sewage works, gasholder, road, airfield, sea defence works, river works, drainage works, earthworks, lagoon, dam, wall, caisson, mast, tower, pylon, underground tank, earth retaining structure or structure designed to preserve or alter any natural feature, and any other structure similar to any of the foregoing.

Any formwork, falsework, scaffold or other structure designed or used to provide support or means of access during construction work.

Any fixed plant in respect of work which is installation, commissioning, de-commissioning or dismantling and where any such work involves a risk of falling more than 2 metres.

Designer: Any person who carries on a trade, business or other undertaking in connection with which he:

a. prepares a design, or;

b. arranges for any person under his control (including, where he is an employer, any employee of his) to prepare a design:

relating to a structure or part of a structure.

Contractor: Any person who carries on a trade, business or other undertaking (whether for profit or not) in connection with which he:

a. undertakes to or does carry out or manage construction work;

b. arranges for any person at work under his control (including, where he is an employer, any employee of his) to carry out or manage construction work.

Hazard: Potential to cause harm
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 1

INTRODUCTION (Continued)

Risk - Likelihood that harm will occur, combined with the severity of the harm

Pervasive - Common to virtually all construction sites:
  - Site and neighbourhood
  - Access
  - Welfare
  - Health hazards from materials and processes
  - Fire
  - Activities made hazardous by their circumstances
  - Demolition
  - Groundworks

Element - An element of design can mean any or all of the following:
  - A physical entity, such as a pilecap or cladding panel or window
  - A work section, such as site preparation or roofing
  - A sub-contract of a traditional main contract, such as a concrete frame or landscaping
  - A work package of a management contract, such as a secondary steelwork or raised floors or toilet fit-out

Environment - The environment of a design can mean any or all of the following:
  - A Nation
  - A Region
  - A Town
  - Terrain
  - Soil
  - Adjacency
  - Seismicity
  - Location Within a Building
  - Location Outside a Building
  - Temperature
  - Humidity
  - Wind
  - Rain
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 2

The Size of the Problem

Provide the following data

1. A comparison of the death/injury rates for construction, manufacturing and agriculture. See HSE annual reports for this data.

2. A typical year in construction. An example is given on the following page.

3. A comparison between building/civil/maintenance/demolition. HSE's "Blackspot Construction" is a good starting point for this. See also HSE's "Deadly Maintenance".

Do not be negative. Use the data to emphasize the magnitude of the challenge that faces designers and the good that they can do.

Explain the terms "major injury" and "over 3 days injury". Emphasize the health risks as well as the injury risks.
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 3

The CDM Regulations

Aims

Describe the aims of the Regulations

Hierarchy of Documentation

Explain clearly the status of the different documents. One suggested way of setting out the information is shown on the next page.

Roles and Duties

Explain these, emphasizing that designers often have duties when others do not:

- Client
- Agent
- Developer
- Planning supervisor
- Designer
- Principal contractor
- Contractor

Civil/Criminal

Explain clearly what breaches of the Regulations are criminal, what are civil, and what the penalties are. Make reference to the Health and Safety at Work etc Act 1974.

Health and Safety Plan - Purpose/Format/Contents

See following pages

Health and Safety File - Purpose/Format/Contents

See following pages
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 3

The Hierarchy of Documentation

*Health and Safety at Work etc. Act 1974*

*Construction (Design and Management) Regulations 1994*

*Approved Code of Practice "Managing Construction for Health and Safety"*

**Guidance handbooks**

1. Clients/Planning Supervisors
2. Designers - [This is the document you are writing]
3. Contractors

*Industry-based guidance from BEC, BRE, BSI, CIC, CITB, CIRIA, Trade Associations etc.*

*Guidance from government/national bodies such as HSE, RoSPA, etc.*

*Manufacturers' data*

**Note**  
The CDM Regulations implement EC Directive 92/57/EEC. They also reflect a long term aim of the HSE to improve health and safety on construction sites.

Annotate this chart to make it clear which documents are mandatory and which are advisory and which are HSC/HSE endorsed.

**Roles and Duties**

Describe here, in bullet point form, the roles and duties of the function holders identified in the Regulations.

**Civil and Criminal Liabilities**

Describe here, in bullet point form, what these are.
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 3

HEALTH AND SAFETY PLAN AND FILE

Provide a diagram, with time as the horizontal axis, that illustrates how the plan and the file develop in time and how their development relates to the design and construction processes and to the life cycle of the structure. Emphasize the 2 stages of the plan, the pre-tender stage and the construction stage. This is procedural guidance (see Section 10).

Health and safety plan

This is education (see Section 10).

The pre-tender health and safety plan is a document which the planning supervisor ensures is prepared. It requires input from designers and the client and summarizes for the principal contractor (PC):

1. Basic project data
2. Constraints on the activities of the contractors
3. Hazards and risks identified by the designers and others
4. Assumptions made by the designers (for example: Construction Sequences)
5. Other relevant information, not given elsewhere in the tender documents

The pre-tender health and safety plan should be relevant in the context of the project and it should not impose detailed methods of work on the contractor. Information about risks should be included to the extent necessary to enable reliable performance by a competent contractor. Information which will assist potential principal contractors in judging what range of competences would be required for a contractor to undertake the work safely could also usefully be included. The designer may assume that the contractor will be competent in the management of risks typical of the type of project under consideration. The broad design assumptions should be stated within the pre-tender health and safety plan.

Information should also be included when the designer judges that work is likely to be made unexpectedly and significantly hazardous by the circumstances in which it will be done. Any special requirements for the purposes of construction and any assumptions or special requirements for maintenance of the structure should also be made clear.

The principal contractor is responsible for further development of the construction stage health and safety plan as follows:

- PC sets out the rules and arrangements for managing health and safety.
- PC takes account of and may include the assessments prepared by contractors under the Management of Health and Safety at Work Regulations 1992 and other legislation.
- PC specifies responsibilities for health and safety.
- PC details how risks to health and safety are to be controlled and monitored.
PC outlines arrangements for training, communications and consultation on health and safety.

See ACOP for more details.

The health and safety plan is a 'live' document that grows during the project. It can be written in stages that reflect the issues that concern the designers and then the contractors.

During the design process, the design section of the plan may be organised by design stage, under 3 headings: Design, Construction and Procurement. This is explained more fully on the next page.
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 3

ORGANIZATION OF THE DESIGN SECTION OF THE HEALTH AND SAFETY PLAN

This is procedural guidance (see Section 10).

Record In The Plan At The End Of The Feasibility Stage:

Client
Design Team (including Planning Supervisor)
Location
Site/Environment/Access/Utilities/Statutory Constraints & Obligations

Size/Scope
Overall Timescale
Budget
Principal Hazards

Record In The Plan At The End Of The Concept Stage

In Design Section  -  Brief technical descriptions of major systems and their associated hazards (one sub-section per system)

In Construction Section  -  Overall assumed sequence and major constraints

Record In The Plan At The End Of The Scheme Stage

In Design Section  -  Brief technical descriptions of major sub-systems and their hazards (organised by work sections)

In Construction Section  -  Assumptions about construction methods plus hazards
                         -  Assumptions about access and site layout

In Procurement Section  -  Special skills/experience needed

Record In The Plan At The End Of The Detailed Design Stage

In Design Section  -  Hazardous materials and processes

In Construction Section  -  Assumed detailed sequences if critical to design, plus hazards
HEALTH AND SAFETY FILE

This is education (see Section 10).

The health and safety file is a document produced by the planning supervisor, with input from the client and the design team and the principal contractor and contractors. It is a reference document held by the client to ensure that future maintenance, repair, alteration and demolition are carried out safely on an informed basis as follows:

- record drawings and plans used and produced throughout the construction process along with the design criteria; these should include structural principles, load paths and instabilities at intermediate stages of erection or demolition;

- general details of the construction methods and materials used;

- details of the maintenance facilities of the structure;

- maintenance procedures and requirements for the structure (e.g. cleaning windows, gutters etc.);

- manuals produced by specialist contractors and suppliers which outline operating and maintenance procedures and schedules for plant and equipment installed as part of the structure;

- details of the location and nature of utilities and services, including emergency and fire-fighting systems.
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 4

THE PRINCIPLES OF THE APPROACH

HAZARD IDENTIFICATION

Write this section based upon the following checklists

1. PHYSICAL INJURY, HARM TO HEALTH AND CATASTROPHIC EVENTS

This checklist is fundamental for authors.

Physical Injury

A1 Contact with moving machinery
A2 Struck by moving (including falling) object
A3 Struck by moving vehicle
A4 Strike against something fixed or stationary
A5 Injured whilst handling, lifting or carrying
A6 Slip, trip or fall on same level
A7 Fall from a height
A8 Trapped by something collapsing/overturning
A9 Drowning or asphyxiation
A10 Contact with electricity or electrical discharge
A11 Other injuries

Harm to Health

B1 Exposure to or contact with a harmful substance (including dust)
B2 Occupational asthma
B3 Occupational deafness and vibration white finger
B4 Dermatitis
B5 Work Related Upper Limb Disorders (WRULD)
B6 Poisoning
B7 Other infections
B8 Other diseases
B9 Radiation

Catastrophic Events

C1 Exposure to fire
C2 Exposure to an explosion (chemical)
C3 Exposure to an explosion (pressure system)
C4 Exposure to flooding and the like

With acknowledgement to Malcolm Tucker, John Laing
THE BRIEF FOR A DESIGNERS' HANDBOOK SECTION 4

THE PRINCIPLES OF THE APPROACH

HAZARD IDENTIFICATION (Continued)

2. HAZARDS CAN BE:

Obvious - working at height
Not obvious - plastering and glazing
The result of unshared assumptions
The result of small changes
Because of circumstances
Because of the juxtaposition of activities

3. COMMON HAZARDS THAT MAY BE SO FAMILIAR AS NOT TO BE OBVIOUS

Roofs with no safe means of access
Unprotected roof edges
Fragile roofs and rooflights
Unshored trenches
Sharp edges (e.g. brick ties)
Heavy weights (e.g. 190mm blocks)
Live overhead/underground services
Live building services
Toxic substances
Working in confined spaces
Working adjacent to sparks or fumes
Access
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 4

RISK ASSESSMENT

There are a variety of methods of risk assessment, ranging from the crudely qualitative to the (relatively) sophisticated quantitative. Any method chosen will, to some degree, be subjective and arbitrary but, nevertheless, can prove useful provided it is appropriate for its purpose and its limitations are recognised.

The purpose of risk assessment in this instance is to indicate to designers the potential effect of their design on the health and safety of others. As a consequence, designers will be able to judge the weight they should give the health and safety factor and so whether, on balance, the design can be left unchanged or should be altered to reduce the health and safety risk.

A precise estimate of risk is not required to achieve this purpose, would be too time-consuming in practice and, in any case, lack of data in practice makes it impossible.

At its simplest then, the risk arising from a hazard depends on:

* the likely severity of harm caused if the hazard manifested itself in an accident or ill health

* the likelihood that the harm will occur.

Risk is assessed by combining these two elements.

However, the contribution of the separate elements first needs to be decided.

Likelihood that the harm will occur

Since the concern is with what you, the designer, can do to reduce risk, the measures which contractors can take on their own behalf, such as temporary edge protection, personal protective equipment and so on, should not be your first solution to a problem.

You, the designer, will need to analyse the likely method(s) of construction and/or maintenance etc. to be able to make a judgement as to likelihood that harm will occur. You need to consider whether hazard and worker will coincide: how many workers, how often, for how long.

Again, only a crude, qualitative judgement can, and need, be made as follows:

'High' - certain or near certain to occur
'Medium' - reasonably likely to occur
'Low' - very seldom or never occurs

Assessment

For example, take the hazard 'falls from height' from, say, the unprotected edge of a 3 metre high roof onto which access will be required to carry out maintenance work. The severity element is 'high'. If the maintenance involves one worker going onto the roof once every five years then the likelihood element might be judged 'low'; one worker once a day, 'medium'; ten workers once a day, 'high'.

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RISK ASSESSMENT (Continued)

Take the hazard 'being struck by mobile plant' on a construction site. The severity element is 'high'. The likelihood element depends on the amount of plant, the size and layout of the site so on a house building site would probably be 'low' to 'medium'; on a civil engineering site involving earth moving, 'medium' to 'high'; on carriageway repairs, 'high'.

Take the use of 'hazardous substances' in painting. The severity hazard associated with a water-based paint is probably 'low'; with an isocyanate paint 'high'. The likelihood element, with brush application, 'low' to 'medium'; with spray application 'high'.

The product of the elements will give some measure of the assessed risk which, in turn, can be seen as exerting a pressure on designers to alter the design. Clearly, a 'high' x 'high' risk exerts a very high degree of pressure, 'low' x 'low' virtually none. Designers can choose to ignore the pressure for alteration whatever the assessed risk but they should be prepared to justify their choice in the light of the particular risk assessment.

Reduction of risk through design and specification

When designing to reduce risk, designers should apply the principles of prevention and protection i.e. the preferred approach is to prevent the hazard arising and thus AVOID the risk, otherwise minimise the risk through the hierarchy of, first COMBAT THE RISK AT SOURCE, then CONTROL THE RISK, giving priority to COMMUNAL PROTECTION over PERSONAL PROTECTION.

So far as is reasonably practicable

This expression occurs frequently in the CDM Regulations, particularly in connection with designers' duties.

The Court of Appeal's interpretation of this phrase is: "Reasonably practicable is a narrower term than physically possible, and implies that a computation must be made in which the quantum of risk is place in one scale, and the sacrifice, whether in money, time or trouble, involved in the measures necessary to avert the risk, is placed in the other; and that, if it be shown that there is a gross disproportion between them, the risk being insignificant in relation to the sacrifice, the person upon whom the duty is laid discharges the burden of providing that compliance was not reasonably practicable. This computation falls to be made at a point of time anterior to the happening of the incident complained of."
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 4

PREVENTION AND PROTECTION

The main principles of prevention and protection are:

1. Avoid risk completely (design it out if you can).
2. Combat risk at source (reduce if you cannot remove it).
3. Give priority to those measures that protect the whole workforce (scaffolding is preferred to abseiling).
4. Protect individuals as a last resort (train people to abseil if there is no alternative).

Remember: the principal contractor is responsible for managing hazards on site. As a designer part of your CDM responsibility is to identify to the PS, and thus to the PC, those hazards that you have not been able to eliminate.

THE APPLICATION OF PREVENTION AND PROTECTION BY DESIGN STAGE

<table>
<thead>
<tr>
<th>Object/Stage</th>
<th>Feasibility/Scheme</th>
<th>Detailed Design</th>
<th>Production Information/Tender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eliminate</td>
<td>Systems in outline. Check lists related to systems</td>
<td>Check lists. Work section ordered handbook</td>
<td></td>
</tr>
<tr>
<td>Reduce</td>
<td>Systems in outline. Check lists related to systems</td>
<td>Check lists. Work section ordered handbook HSE guidance etc</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Knowledge of client, project, resources, budget, completion date etc</td>
<td>Knowledge of client, good practice, resources, budget, completion date, local circumstances</td>
<td>General conditions; drawings, specifications and bills of quantities</td>
</tr>
<tr>
<td>Pre-tender health and safety plan</td>
<td>Information about e.g. site, adjoining land and premises, access etc.</td>
<td>Information to expand context detail, flagged special issues to be taken into account by tendering contractors</td>
<td>Pre-tender health and safety plan</td>
</tr>
</tbody>
</table>
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 5

INFORMATION AND GUIDANCE ON PERVERSIVE ISSUES

Information and guidance for designers may be provided under the following headings:

Site and neighbourhood

Access/Egress

Welfare

Health hazards from materials and processes

Fire

Activities made hazardous by their circumstances

Demolition

Groundworks
TESTS OF DESIGNERS' COMPETENCE

Provide checklists of questions that the designers should answer in order to establish whether they are in known or unknown territory.

Design

Is the design of this element familiar:

- To you? To your colleagues? To your proposed contractors?
- At this scale?
- In these materials?
- With these components/sub-assemblies?
- In this environment?
- Built at this speed?
- Built under similar contractual arrangements?

For definitions of element and environment see Section 1

If you answered NO to any of these, you have identified a hazard.

Construction

Are you, the designer, familiar with the proposed method of construction required by the design?

Yes

No

Record your assumptions in the plan

Note in the plan the basis of your assumptions for verification by the contractor. Ensure your client knows you are proceeding with some uncertainty.

Is the available industry familiar with installing this kind of design?

Yes

No

Don't Know

Continue

Can the design be changed?

If Yes - do so and return "Construction".

If No - flag this as a hazard in plan.

Note in the plan the basis of your assumptions for verification by the contractor. Ensure your client knows you are proceeding with some uncertainty.
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 6

Cleaning and Maintenance

Are you, the designer, sure that there is nothing unusual or dangerous about the cleaning and maintenance that will be required?

Yes

Record your assumptions in the file.

No

Ensure your client is aware of this.
Modify design if necessary. Record in file.

Repair and replacement

Are you, the designer, sure that there is nothing unusual or dangerous about carrying out the repairs that may be needed?

Yes

Record your assumptions in the file.

No

Ensure your client is aware of this.
Modify design if necessary. Record in file.
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 7

INTEGRATING CDM INTO THE DESIGN PROCESS

INTRODUCTION

This section covers each stage in the process of designing and procuring a structure.

To discharge your duties under CDM, you as a designer should review your design in an orderly way at each stage of the process. You should also document these reviews in a way that enables the planning supervisor to ensure a health and safety plan that assists the principal contractor is prepared.

This handbook recognises that design of all projects passes through a number of identifiable stages, independent of contractual arrangements:

* Feasibility
* Concept
* Scheme
* Detailed Design
* Procurement

Different sectors of construction may use different terms, but the approach is still valid.

As design progresses, the issues facing designers move from the general to the particular. Health and safety considerations are no different to the other design issues in this respect. CDM reinforces the need for health and safety to be considered in an orderly and well-documented way during the design process. It should not be forgotten that design is not always a linear process. It is frequently iterative, which may make it necessary for designers to re-visit earlier decisions and assumptions. This emphasises the need for the design process to be well managed and well documented.

Each page covers one stage in the process. Each section describes, in general terms:

* The purposes of design work and decisions to be reached
* CDM issues and actions
* How to identify and record what goes in the health and safety plan
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 7

FEASIBILITY STAGE

Purpose of Work and Decisions to be Reached

To provide the client with an appraisal and recommendation in order that he/she may determine the form in which the project is to proceed, ensuring that it is feasible functionally, technically and financially.

CDM Issues and Action

• Ensure that client is aware of CDM duties.
• Co-operate with planning supervisor (if there is one) and other designers.
• Identify major site hazards.
• Identify information requirements (e.g. what you, the designer, need from the client).
• If the work is for an existing structure, consider protection of its users.
• Contribute to the health and safety plan.
• Contribute to the health and safety file.

Record In the Health and Safety Plan At the End of the Feasibility Stage

Client
Design Team
Location
Site/Environment/Access/Utilities/Statutory Constraints and Obligations
Size/Scope
Overall Timescale
Budget
Principal Hazards
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 7

CONCEPT STAGE

Purpose of Work and Decisions to be Reached

To determine general approach to layout, design and construction in order to obtain authoritative approval of the client on the outline proposals and accompanying report.

CDM Issues and Actions

• Co-operate with planning supervisor, (if there is one) and other designers.
• Ascertain and record client's policy for repair and maintenance.
• Identify, remove, minimise pervasive hazards.
• Identify, remove, minimise site-wide hazards.
• Identify, remove, minimise major system *hazards.
• Develop assumed construction methods and sequences.
• Identify health and safety implications of procurement strategy.
• Identify and record basic assumptions inherent in concept design.
• Contribute to health and safety plan.
• Contribute to health and safety file.

Record In The Plan At the End of the Concept Stage

In Design Section - Brief technical descriptions of major systems *and their associated significant hazards (one sub-section per system) Major design assumptions.

In Construction Section - Overall assumed sequence and major constraints

In Procurement Section - Basis of procurement strategy Special skills/experience needed

*Note - For the meaning of system see Section 8.
THE BRIEF FOR A DESIGNERS’ HANDBOOK - SECTION 7

SCHEME DESIGN STAGE

Purpose of Work and Decisions to be Reached

- Complete the brief-taking
- Decide on particular proposals, including planning arrangement, appearance, construction method, outline specification, cost
- Obtain approvals

CDM Issues and Actions

- Co-operate with planning supervisor, (if there is one) and other designers.
- Identify, remove, minimise major sub-system or work section, hazards.
- Develop further the assumed construction methods and sequences.
- Review materials, buildability and maintainability.
- Identify and record assumptions inherent in the scheme design.
- Contribute to the health and safety plan.
- Contribute to the health and safety file.

Record In The Plan At The End Of The Scheme Stage

In Design Section - Brief technical descriptions of major sub-systems and their significant hazards (organised by work sections)

In Construction Section - Assumptions about construction methods plus hazards
- Assumptions about access and site layout

In Procurement Section - Special skills/experience needed
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 7

DETAILED DESIGN STAGE

Purpose of Work and Decisions to be Reached

To obtain final decisions on matters related to design, specification, construction and cost.

CDM Issues and Actions

- Co-operate with planning supervisor, (if there is one) and other designers.
- Identify, remove, minimise hazards associated with details, materials, processes (e.g. access, fixing, loading/unloading, fumes, weights, dust, noise).
- Identify assumed detailed sequences and methods of critical to design.
- Identify flow of information in contractor-designed items.
- Contribute to the health and safety plan.
- Contribute to the health and safety file.

Record In The Plan At The End Of The Detailed Design

In Design Section - Hazardous materials and processes

In Construction Section - Assumed detailed sequences if critical to design, plus hazards

In Procurement Section - Flow of detailed information in contractor designed elements
Who tells what to whom and when
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 7

PROCUREMENT STAGE

Purpose of Work and Decisions to be Reached

Appointment of principal contractor (and other contractors).

CDM Issues and Actions

• Assist as requested, the PS in assembling a pre-qualification questionnaire for would-be tenderers.

• Identify those hazards, documented in the plan, for which tenderers should provide an explanation of how they intend to manage them.

• Comment upon health and safety aspects of the returned tenders as requested.
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 8

SYSTEMS AND WORK SECTIONS

Explain to the readers how the CAWS and CESSM3 work sections can be combined into systems (for building work) and elements (for civil work).

List the two sets of work sections.

THE COMMON ARRANGEMENT OF BUILDING WORK SECTIONS (CAWS)

A  Preliminaries/general conditions
B  Complete buildings
C  Demolition/alteration/renovation
D  Groundworks
E  In situ concrete/large precast concrete
F  Masonry
G  Structural/carcassing metal/timber
H  Cladding/covering
J  Waterproofing
K  Linings/sheathing/dry partitioning
L  Windows/doors/stairs
M  Surface finishes
N  Furniture/equipment
P  Building fabric sundries
Q  Paving/planting/fencing/site furniture
R  Disposal systems
S  Piped supply systems
T  Mechanical heating/cooling/refrigeration systems
U  Ventilation/air conditioning systems
V  Electrical supply/power/lighting systems
W  Communications/security/control systems
X  Transport systems
Y  Services reference specification
Z  Building fabric reference specification
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 8

SYSTEMS AND WORK SECTIONS (Continued)

THE CIVIL ENGINEERING WORK CLASSIFICATION (CESSM3)

Work Sections

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>General items</td>
</tr>
<tr>
<td>B</td>
<td>Ground investigation</td>
</tr>
<tr>
<td>C</td>
<td>Geotechnical and other specialist processes</td>
</tr>
<tr>
<td>D</td>
<td>Demolition and site clearance</td>
</tr>
<tr>
<td>E</td>
<td>Earthworks</td>
</tr>
<tr>
<td>F</td>
<td>In situ concrete</td>
</tr>
<tr>
<td>G</td>
<td>Concrete ancillaries</td>
</tr>
<tr>
<td>H</td>
<td>Precast concrete</td>
</tr>
<tr>
<td>I</td>
<td>Pipework - pipes</td>
</tr>
<tr>
<td>J</td>
<td>Pipework - fittings and valves</td>
</tr>
<tr>
<td>K</td>
<td>Pipework - manholes and pipework ancillaries</td>
</tr>
<tr>
<td>L</td>
<td>Pipework - supports and protection, ancillaries to laying and excavation</td>
</tr>
<tr>
<td>M</td>
<td>Structural metalwork</td>
</tr>
<tr>
<td>N</td>
<td>Miscellaneous metalwork</td>
</tr>
<tr>
<td>O</td>
<td>Timber</td>
</tr>
<tr>
<td>P</td>
<td>Piles</td>
</tr>
<tr>
<td>Q</td>
<td>Piling ancillaries</td>
</tr>
<tr>
<td>R</td>
<td>Roads and pavings</td>
</tr>
<tr>
<td>S</td>
<td>Rail track</td>
</tr>
<tr>
<td>T</td>
<td>Tunnels</td>
</tr>
<tr>
<td>U</td>
<td>Brickwork, blockwork and masonry</td>
</tr>
<tr>
<td>V</td>
<td>Painting</td>
</tr>
<tr>
<td>W</td>
<td>Waterproofing</td>
</tr>
<tr>
<td>X</td>
<td>Miscellaneous work</td>
</tr>
<tr>
<td>Y</td>
<td>Sewer and water main renovation and ancillary works</td>
</tr>
<tr>
<td>Z</td>
<td>Simple building works incidental to civil engineering works</td>
</tr>
</tbody>
</table>

Combine the two sets into a building system set and a civil element set.
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 8

SYSTEMS AND WORK SECTIONS (Continued)

Grouping the building work sections into systems

This page groups the common arrangement of work sections into eight systems.

This is done as an aid to organizing the information that the plan contains. It is similar to "The Logic of the Sequence of the Level 1 Headings" in "The Common Arrangement of Work Sections for Building Works", published by the Building Project Information Committee.

Systems

1. **Whole Building**
   A Preliminaries and general conditions
   B Complete buildings

2. **Demolition/Alteration/Renovation**
   C Demolition/alteration/renovation

3. **Groundworks**
   D Groundworks

4. **Structural Systems**
   C Demolition/alteration/renovation
   E In situ concrete/large precast concrete
   F Masonry
   G Structural/carressing metal/timber

5. **External Envelope**
   C Demolition/alteration/renovation
   F Masonry
   H Cladding/covering
   J Waterproofing
   L Windows/doors/stairs
   P Building fabric sundries
   Z Building fabric reference specification

6. **Internal Finishes and Fittings**
   K Linings/sheathing/dry partitioning
   L Windows/doors/stairs
   M Surface finishes
   N Furniture and equipment

7. **External Works**
   Q Paving/planting/fencing/site furniture

8. **Building Services**
   Y Services reference specification

8.1 **Plumbing**
   R Disposal systems
   S Piped supply systems

8.2 **HVAC**
   T Mechanical heating/cooling/refrigeration systems
   U Ventilation/air conditioning systems

8.3 **Electrical**
   V Electrical supply/power/lighting systems
   W Communication/security/control systems

8.4 **Transportation**
   X Transportation systems
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 8

SYSTEMS AND WORK SECTIONS (Continued)

Grouping the Civil Engineering Work Sections into Elements

This is done as an aid to organising the information that the plan contains.

Basis - Civil Engineering: CESMM3 Work Classification

<table>
<thead>
<tr>
<th>Elements</th>
<th>Work sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. General Items/Preliminaries</td>
<td>A</td>
</tr>
<tr>
<td>2. Demolition and Site Clearance</td>
<td>D</td>
</tr>
<tr>
<td>4. Concrete Structures</td>
<td>F, G, H</td>
</tr>
<tr>
<td>5. Steelwork Structures</td>
<td>M, N</td>
</tr>
<tr>
<td>6. Other Structures</td>
<td>O</td>
</tr>
<tr>
<td>7. Surfacing</td>
<td>R</td>
</tr>
<tr>
<td>8. Particular Facilities</td>
<td></td>
</tr>
<tr>
<td>8.1 Railways (S) tunnels (T)</td>
<td>S, T</td>
</tr>
<tr>
<td>8.2 Highways</td>
<td>R</td>
</tr>
<tr>
<td>8.3 Sewers</td>
<td>Y</td>
</tr>
<tr>
<td>8.4 Marine works</td>
<td></td>
</tr>
<tr>
<td>8.5 Small buildings</td>
<td>Z</td>
</tr>
<tr>
<td>8.6 Pipework</td>
<td>I, J, K, L</td>
</tr>
<tr>
<td>9. Mechanical, Electrical, HVAC</td>
<td></td>
</tr>
<tr>
<td>10. Finishes</td>
<td>V, W, X</td>
</tr>
<tr>
<td>11. Maintenance</td>
<td></td>
</tr>
</tbody>
</table>
WORKED EXAMPLES

Health and safety plan

Provide two examples, one building and one civil, that illustrate the development of the plan through the design stages, from feasibility to detailed design. At the end of each, the information they contain can be organised in the manner given in ACOP, and may be further arranged by work section wherever possible.

The A3 fold-out sheets that follow are examples that the CIC Task Force found useful. You may reproduce them, amend them, or provide your own examples.
PRESENTATION

It is essential that the designers can easily distinguish between:

- Education on the CDM Regs
- Guidance on procedures for discharging their duties
- Steps designers can take which may be beyond the requirements of CDM but which may assist other duty holders, especially the client, in fulfilling their duties
- Examples

It is strongly recommended that colour is used to make these distinctions clear.

Keep it simple and clear and concise.

Use diagrams and charts only when they will make a real improvement to communication.

Make extensive use of examples throughout the text.

Appendix 1 provides more detailed guidance on effective handbook presentation and includes examples of page layout that the CIC Task Force found acceptable.
THE BRIEF FOR A DESIGNERS' HANDBOOK - SECTION 11

SELECTED SOURCES OF PUBLISHED GUIDANCE

Provide addresses, telephone and fax numbers for the following organisations, plus any others that publish practical guidance for designers.

HSE
BEC
BRE
BSI
CIRIA
RoSPA
CITB
Trade Associations

Appendix 2 contains examples of more detailed elemental guidance.
APPENDIX 1

This describes means of effective handbook presentation and includes examples of page layout that the CIC Task Force found acceptable.
BRIEF FOR A DESIGNERS' HANDBOOK

EXAMPLES OF PRESENTATION

Loose leaf binders

When handbooks are prepared as loose leaf binders for periodic updating the following framework is relevant, (most of the information is also relevant to the presentation of bound publications).


Dividers: Should be at least 250g/m² and should have laminated tabs (with lamination extending onto the divider page)

Paper: Should be at least 100g/m² and should be suitably strong (see BS 5641)

Subdivision: Documents subdivisions should be described as follows:

- **Volumes** - numbered One, Two, Three etc.
- **Sections** - separated by dividers and lettered A, B, C - Z, AA, AB, AC - AZ, BA, BB, BC etc. There should be a title to each section.
- **Paragraphs** - decimally numbered 1.0, 1.1, 1.2 - 1.99, 2.0, 2.2 etc. Do not use two decimal points e.g. 2.1.12. (numbered paragraphs may include 2 or 3 actual paragraphs on the same subject)
- **Pages** - numbered page A2, page A2, page A3 etc. within each section.

Page identification: It is important that pages in a loose leaf binder are clearly identified they should all show the following:

- **Name of the publication**
- **Volume number**
- **Section letter and title**
- **Page number** - If pages are inserted between sequentially numbered page (see 'updating' below) they should be numbered page A1a, page A1b, page A1c etc.
- **Date of issue** - this is vital information in loose leaf publications (page to be replaced - details of the page to be replaced may be included if it is thought that readers will find it helpful e.g. when checking whether the advice followed previously was up to date at that time) (it may be helpful to put 'continued' or 'continued from...' when paragraphs run over from one page to another)

Covers: Front covers should show the following information:

- **Title** (which should include reference to the CDM Regulations either in the main title of in a subtitle)
- **Authorship** (or organisation responsible for the contents)
- **Classification**, at least one of the recognised classifications for construction industry publications i.e. CAWS, CI/SfB and UDC.

Back covers should show the following information:

- **Address and phone number** of the organisation responsible for the contents
- **Details of publisher and printer**
- **ISBN number**

(details of other relevant publications from the same organisation may be shown on the back cover)
Spine: Should read from left to right when the publication is lying face up. It should show:
Title
Responsible organisation
(the classification may also be shown on the spine)

Contents: An up-to-date contents page is essential. It should be reprinted and sent out with each new issue of insert pages. There should be a separate contents page in each volume showing the contents of all volumes (the contents of the volume containing the page can be distinguished by a bolder type face). Contents pages should show:
Section dividers including their titles
Current page numbers and dates of issue
Main headings written in full
(details of all replaced pages and dates of issue may be shown if it is thought readers may need to know when particular advice was current)

Headings: There should not be more than three levels of headings (and preferably only two). The heading levels should be clearly distinguished by type size and/or colour.

Typography: Legibility will be improved if the following are avoided:
Small typefaces - (minimum for main text 8 point but preferably 10 point - captions to illustrations can be 6 point)
Long lines - of more than 75 characters per line
Upper case - when used on its own, upper case should be restricted to text of one or two lines only as a block of upper case text is harder to read.

Illustrations: Use illustrations (and annotations) in preference to text where they can explain a point. They help to locate text in the readers memory and encourage use of the document. However unhelpful illustrations should not be used simply to break up the text. Photographs and isometric views (30° x 30°) are preferred to plans sections and elevations.

Updating: Establish an updating policy (and budget) when planning the publication. The frequency of updating and the method of distribution and the method of charging (subscription or separate charge for each release) need to be established. It is generally better to replace whole sections in order to avoid insertion of odd sheets that disrupt the page numbering sequence.
15 Scheme Design

generic arrangement for all design disciplines

15.1 Purpose of work and decisions to be reached

- Complete the brief taking
- Decide on particular proposals, including: appearance, construction method, outline specification and cost.
- Obtain approvals

15.2 Design tasks

- Final development of the brief
- Develop general arrangements
- Define systems plus associated construction methods
- Prepare cost plan
- Undertake buildability assessments
- Plan site logistics
- Plan methods for maintenance and repair
- Prepare resource analysis for key trades
- Prepare procurement programme
- Prepare construction programme for systems
- Update project master programme

15.3 CDM Tasks

- Review Health and Safety issues found in Concept/Outline Design (14).
- Identify Health and Safety issues arising from design parameters and assumptions
- Define Health and Safety strategy.
- Prepare programme for detailed design stage.
- Identify, remove, minimize and document hazards.

15.3.1 Example: Choice of specific piling system

Choice of foundation system
Need to use piles was decided at Feasibility/Master plan stage (13)
Extent of building area and service runs to be piled was decided at Concept/Outline design stage (14)
At this stage select bored piles. investigate sound reduction - enter on record form

Relevant hazards associated with piling
All systems:
- access and clearances for equipment
- protection of works
Bored piles:
- disposal of spoil - vehicle movements and possibility of contamination
- entrapment of underreaming operatives and inspecting staff
Driven piles:
- noise and vibration
Hazard check list - scheme design

The check list below highlights site risks that need to be considered as the scheme design is developed. Hazards that are not highlighted on the list may be a risk to be dealt with at scheme design stage in particular projects.

<table>
<thead>
<tr>
<th>HAZARDS-Risks</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>shown bold</td>
<td></td>
</tr>
</tbody>
</table>

**HEALTH**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing</td>
<td>Avoid noisy processes, such as hammer driven piling, concrete breaking etc or substitute quieter alternatives</td>
</tr>
<tr>
<td>Muscular/skeletal</td>
<td>Manual handling risks can be reduced by planning for mechanical lifting and lighter components (eg masonry units, cast iron baths, lintols)</td>
</tr>
<tr>
<td>Microbiological</td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td></td>
</tr>
<tr>
<td>Skin contact</td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td></td>
</tr>
<tr>
<td>Toxic chemical</td>
<td>Contact with contaminated soil and ground water can be avoided by locating and designing structures to avoid excavation in areas of contamination or below highest water table level. Consider protection of workers in industrial environments.</td>
</tr>
<tr>
<td>Vision</td>
<td></td>
</tr>
<tr>
<td>Other health hazard</td>
<td></td>
</tr>
</tbody>
</table>

**SAFETY**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphyxiation</td>
<td>Deep excavations (over 2m) may be filled with carbon monoxide and other gases and should be avoided (or possible need for fresh air supply should be recorded in the safety plan)</td>
</tr>
<tr>
<td>Drowning</td>
<td>Consider draining or fencing off areas of water and routing vehicles and pedestrians away from water. Provide for rescue boat and life saving equipment where structure is over or close to water</td>
</tr>
<tr>
<td>Electricity</td>
<td>Avoid ground work near routes of underground cables</td>
</tr>
<tr>
<td>Entrapment</td>
<td>Avoid excavations in poor ground, route services to avoid deep excavations, avoid excavations adjacent to existing structures (or specify precise precautions)</td>
</tr>
<tr>
<td>Falling</td>
<td>Minimise risks of work at height by: providing working decks, fabricating assemblies (such as dormer windows) at ground level, providing permanent guarding at roof edges and for rooflights</td>
</tr>
<tr>
<td>Fire</td>
<td></td>
</tr>
<tr>
<td>Machinery</td>
<td></td>
</tr>
<tr>
<td>Moving/falling object</td>
<td></td>
</tr>
<tr>
<td>Vehicles</td>
<td>Provide space for suitable vehicle access in and out of the site and around the site, avoid blind corners and main pedestrian routes</td>
</tr>
<tr>
<td>Other safety hazard</td>
<td></td>
</tr>
</tbody>
</table>
15 Scheme Design

generic arrangement for all design disciplines

Aim

This stage is the opportunity to re-examine the risks found at 'Outline design stage' and to look at how a more developed scheme will be built. The aim is to identify risks so that they can be eliminated, reduced or managed. Risks that cannot be eliminated should be noted in the safety plan for consideration at detailed design stage.

Reminders

Purpose of scheme design
• Complete the brief taking
• Decide on particular proposals, including, planning arrangement, appearance, construction method, outline specification and cost
• Obtain approvals

Design tasks
• Final development of the brief
• Develop general arrangements

• Define systems plus associated construction methods
• Prepare cost plan
• Undertake buildability assessments
• Plan site logistics
• Plan methods for maintenance and repairs
• Prepare resource analysis for key trades
• Prepare procurement programme
• Prepare construction programme for systems
• Update project master programme

CDM Actions

1 Review Health and Safety on site issues found at outline/concept stage
A new set of decisions is being made - some will affect the conclusions on H & S taken earlier, for example:
• The safest position for temporary site access from a road may no longer be feasible
• A pitched roof may be required for cost and performance reasons but the perimeter cradle track system for window cleaning will have to be reconsidered

2 Identify decisions taken at this stage that affect Health and Safety on site
Consider H & S issues arising from new design parameters, from assumptions about procurement, construction and maintenance and from design decisions. For example:
• It may be decided to sublet the design of the roof structure. Safety issues related to the roof will need to be brought into the Health and safety plan and file
• An existing building may now be retained and a method of cleaning the masonry will have to be chosen
• A new position for connection to the public sewer may require deeper excavation in made ground that could be affected by carbon monoxide and other gases.

3 Define Health and Safety strategy
Is it enough to ensure that only competent contractors will be involved with the construction or should some aspects of the work be treated as being beyond the safety frontier (and therefore requiring method statements defining preventative and precautionary measures)?
See examples overleaf

4 Remove identified risks - or record methods of minimizing and managing risks that cannot be removed
A record form (Page XX) should be completed for the Health and Safety plan and file
• Avoid building on (and fence off) area of site below power lines - enter on record form
• Arrange with specialist firm for tree felling and lopping to be completed before contractor takes possession of site - enter on record form
Example of procedures for civil engineering project-scheme design stage

The project is a bridge joining two farms above a main line railway and a small river that is subject to flooding. The options of a tunnel or a single span bridge have been ruled out at the concept design stage.

1 Identify the issues arising from the design
   • site - Access roads, moving vehicles, working areas and storage, temporary crossings, restrictions, alternative crossings.
   • Construction sequence and methods.
   • Finalise buildability assessments.
   • Review safety frontier - Do the works present special problems?
     Answer is YES because of proximity of railway and high water table.
2 Identify principal work sections in relation to main hazards
3 Carry out assessment of risks involved for each work section activity
4 Input into Health and Safety plan the strategy for each work section.

SECTION ACROSS CUTTING

SECTION THROUGH BRIDGE

PLAN

river
rail tracks
15 Scheme Design - generic arrangement for all design disciplines

Purpose of work and decisions to be reached - complete the brief taking - decide on particular proposals, including planning arrangements, appearance, construction method, outline specification and cost - obtain approvals

Design tasks and CDM tasks

EXEMPLARY TASKS

Examples of Issues
- Removal of contaminated soil:
  - use driven not bored piles;
  - use podium to avoid basement;
  - pump drainage to avoid excavation
- Building near water:
  - drain water off during construction;
  - fence off water;
  - leave generous access margin
- Wide span structure:
  - build at ground level then raise as an assembly
  - provide deck on scaffolding below during construction

Examples of Hazards
- Falls:
  - not enough space around building to use appropriate access equipment;
  - no guarding of rooflights
- Collapse:
  - avoid excavation next to existing structures;
  - avoid unbraced masonry gables on exposed sites;
  - allow ample time in programme for curing of in-situ floors and lintels
- Manual handling:
  - no suitable route for plant to position pre-glazed window units
  - precast padstones specified for steel beams where there is no access for lifting gear
- Dust:
  - cleaning existing stonework (will require dust free method or protection)
- Noise:
  - site adjacent to hospice (existing structure could be retained as noise barrier)
  - concrete slab to be removed (use low noise method or retain slab)
  - nailing decking while building is in use (use self-drive screws)

Contents
Examples of Issues to be considered at scheme design stage

1 Stability
The framework for the cladding requires the bracing by the staircase before it is stable.

*action:* Note in Health and Safety plan and file that staircase and frame that supports the cladding must be erected simultaneously (or temporary bracing must be provided).

2 Vehicles and manual handling of materials
Access into the site is restricted, open areas at the rear are inaccessible there is no suitable position for a hoist.

*action:* Amend scheme to delay construction of projecting wing at side and provide wide openings at ground level to allow dumper to pass through building. Note amendment and reasons in Health and Safety plan.

3 Falls carrying out maintenance
Standard ceiling lighting has been proposed for whole floor area, even though part of the area is double height. There is a risk of falls during lamp replacement and cleaning.

*action:* As luminaire lowering gear is too costly, provide permanent wheeled access tower and allow for storage adjacent to double height space. Note decision in Health and Safety file.
APPENDIX 2

This contains examples of the more detailed elemental guidance that the CIC is commissioning. The first example is a brief essay on the hazards of piling, by Allan Delves of Ove Arup and Partners. The second is a distillation and re-presentation of the same guidance, by Sylvester Bone of The Camden Consultancy.
Example of Guidance by Work Section

Piling

**Introduction**

Piling is a hazardous operation made worse by the often difficult circumstances under which the work is undertaken. The hazards and risks which need to be avoided, reduced or controlled will depend on the type of piling system chosen during the design development and the circumstances under which the system is employed. For example, irrespective of the type or system of piling adopted the operations can be made potentially more hazardous by working on restricted sites, on contaminated land, or near railway tracks.

There are many different types of piles and piling systems available to the designer once the fundamental choice has been made to adopt a piled solution. Piles are usually employed either as individual vertical load bearing piles or placed adjacent to one another to form retaining walls to resist horizontal loads. Piling systems divide into two distinct categories;

- driven piles
- cast-in-place piles

Driven piles are generally characterised by the use of large cranes handling long lengths of piles, the employment of temporary supports and the use of piling hammers. Cast-in-place may involve the initial placing of an open ended driven casing but most cast-in-place piles are now of the bored or diaphragm wall type. Cast-in-place piles are characterised by large machines working adjacent to the pile location. An individual machine usually requires the services of a range of ancillary craneage and other plant to carry away excavated material and for the supply of reinforcement and concrete.

By way of example, typical hazardous piling operations include working on restricted sites, piles over water, large under-reamed piles and bored piles in contaminated land.

HSE statistics indicate that fatalities and injuries associated with piling generally fall into the following causations:

- Falls - ladders, bosuns chairs
- Traps - plant and ground collapse
- Strikes - plant, machinery and objects

The following guidance on detailed hazard information and measures to counter these is divided into two main headings; 1. Circumstances and 2. Operations. Operations is further sub-divided into; general piling operations and particular types of piling. Finally, examples are given which demonstrate designers' choice and the need for risk assessment.

1. **Circumstances**

The level of severity of hazards and risks associated with piling operations are directly related to the circumstances in which the operation takes place. The following are the circumstances and hazards that it may be necessary to consider as a part of the design development.
Public areas

Avoid piling operations in public areas if possible; noise, dust, fumes and access problems are hazards. Provisions should be made to keep the public well away from operations. Choice of a quiet type of piling is advised together with adequate hoarding to the site.

Adjacent buildings and users

Noise, dust and fumes are hazards to be avoided. Unlike passing public, adjacent building users can be in residence for long periods and therefore exposure may be greater to the hazards.

Restricted site/confined spaces

Restricted sites make the crowding of plant and machinery a major hazard. Rates of production and programme time may need to be adjusted to allow the safe working of plant in close proximity. Sufficient space should be planned into the site layout to allow for access, egress, storage and rigging and de-rigging machines.

Access and egress

Provisions should be incorporated into the design to allow for the safe movement of vehicles, piling machinery and equipment to and from the site. Temporary roads should be adequately constructed.

Services - Overhead and Underground

Contact with overhead power lines is a cause of many accidents and injuries in the piling industry. Avoid a system of piling that risks this contact. If this is not possible, ensure that provision for "goalposts" and warning barriers is included in the contract documentation.

Buried cables and pipes present a hazard. Ensure that adequate surveys have been carried out in the early stages of design.

Work over or near water

Falling from height into water is the obvious hazard and systems that avoid working directly over water should be used. If not possible, then adequate precautions should be incorporated into the design to provide protection against drowning.

Work adjacent to railway lines

The railway is a hazard. Certain piling systems are more appropriate for working close to railway lines.

Contaminated Land

Contaminated land presents an additional hazard as hazardous substances may come into contact with workers, for example, the risings from auger piling. If working on the contaminated land cannot be avoided, then choice of a driven pile may be a simple solution, provided noise is considered the lesser hazard.
2. **Operations**

2.1 **General Piling Operations**

**Site preparation**

A level platform with good firm access is required to carry out piling operations safely. Provision for this should be included in the contract documentation.

**Cranage**

Many accidents involve cranes, particularly if they are working in close proximity. A well planned operation will ensure that the site is not overcrowded and cranes have sufficient working space. This reflects directly on rate of production and programme limitations.

**Slinging and lifting**

All piling operations involve some degree of slinging and lifting. Attention at the early stages of design to avoid movement of heavy loads across open spaces where others are working is necessary by giving thought to crane locations, particularly tower cranes.

**Access to rigs and piles**

Limited access to the piling rigs on unsuitable ground can lead to accidents. Ensure that the site layout allows for clear, uninterrupted access to all areas of work for dump trucks, concrete trucks, lorries etc.

**Cutting, burning and welding**

These operations usually accompany most piling operations to some degree, in particular sheet piling. Provision of adequate working space and ventilation are important to ensure healthy and safe operation.

**Welfare**

Ensure that adequate space for accommodation, messing, drying and washing facilities are planned into the proposed site layout.

2.2 **Particular types of piling**

**Driven piling**

This category of piling involves driving of pre-cast concrete, timber or steel piles. Obvious hazards include the noise generated by the hammer and the handling of long lengths of pile and temporary works support by crane. Planning of the site layout is essential to allow adequate space for crane operation and access for delivery of piles to within reach of the cranes. Local Authority Regulations usually restrict the noise from driven piling operations. Falls from height is a common hazard in driven piling due to access to the top of the pile. Improvements in the safety of sheet pile operations have been significant in recent years, both for handling piles and provision of temporary support.
Cast-in-place piling

Bored piles; Tripod

This type of piling is more labour intensive than most other forms so the hazards and risks can be greater. It is essential a good platform is provided and surveys undertaken to detect underground services.

Bored piles; Rotary

This type of piling traditionally involves diameters from about 450mm to 2500mm so the amount of material brought to the surface and its disposal need careful planning. At the upper size range, entry into the borehole by workers becomes a temptation and is a major hazard. Piles should be protected to prevent falls.

Bored piles; Continuous Flight Auger

This is the quietest form of piling but it does involve the simultaneous operation of excavation and concreting and this combine operation is a hazard in requiring different trades at once.

Bored piles; Diaphragm Wall

The major hazard of this type of piling is the existence of bentonite and the use of heavy cranes and loads. Excavations full of bentonite should be protected to prevent falls. Overflow of bentonite should be contained and workers should be protected from the health hazards of the additives to bentonite. The existence of collection pipes over the site leads to the hazard of tripping. The handling of reinforcement cages is a major hazard which requires room for assembly and lifting into place.

Bores piles; Under-reamed

These types of piles require special mention because of the need to enter them sometimes to:

- confirm the design
- check workmanship
- check soil conditions

Where pile entry is necessary the following hazards should be avoided.

- unsuitable entry cage
- inadequate rescue arrangements
- absence of fresh air supply
- absence of gas detector
- vibrations

Example of designers' choice and the need for risk assessment

1. A project required the placement of a concrete slab over contaminated land, a group of piles was required to support the concrete slab. The site was located in an inner city location where noise restrictions were imposed by the Local Authority.

Augered piles is the solution as far as the noise restriction is concerned but not as far as the contaminated land is concerned due to the arisings from the boring requiring handling by workers and the risk of exposure to a toxic hazard. Driven piles appear the obvious solution however this involves noise which it is difficult to manage and control.
The solution to the designers’ choice of piling system can only be derived by undertaking a simple but effective risk assessment taking into account a comparison of the consequences of the different methods in the light of the particular circumstances.

2. A project includes the construction of a deep basement on a restricted confined inner city site. The designers' choice at feasibility stage recommended the provision of a watertight curtain wall to be part of the permanent works. At concept design the various solutions were examined. These being Steel sheet piling, Diaphragm wall or Secant bored piles. Steel sheet piles were excluded due to the noise restrictions imposed by the Local Authority. The choice between Diaphragm wall and Secant piles was decided by consideration of the space requirements for safe working for each scheme. A risk assessment on each scheme was carried out which identified that the safer method was the Secant piling.

The diaphragm wall scheme was eliminated on the grounds of space required for the handling of large reinforcement cages and the danger of restricting movement of plant around the site due to the existence of bentonite pipes and the bentonite recycling plant set-up. These hazards were weighed against the hazards of increased activity of plant servicing the Secant pile operation.
WORK SECTION XX PILING

What does this section cover?

Many types of piling e.g.
- individual vertically loaded piles;
- rows of closely spaced piles forming retaining walls;
- driven piles;
- bored piles;
- mini piles (formed by a small rig that can be used within a building);
- underreamed piles (with enlarged bases for more end bearing);
- barrettes (big rectangular piles made by a grab working through bentonite).

Is anything missed out?

More specialised types of ground treatment such as ground anchors and soil stabilisation by vibroflotation could come under this section - but are not covered in this guide, neither is pitched sheet piling (steel sheet piling erected above ground between end gates as a retaining structure).

What are the hazards?

Safety hazards are:
- Accidents involving vehicles, machinery and large components;
- Falls from working at high level on piling rigs;
- Falls into borings and other excavations;
- Entrapment when inspecting or working on borings and from ground collapse;
- Drowning - if the works are over water;
- Asphyxiation - from gasses at the bottom of boreholes;
- Electrocution - from overhead or underground cables;
- Accidents caused on adjacent land or railway;
- Accidents associated with cutting and welding;
- Tripping over bentonite pipes and reinforcement.

Health hazards are:
- Musculo-skeletal - Moving machinery, unjamming it and rigging it;
- Hearing loss - driving piles and clearing augers can be noisy;
- Poisoning - from substances in contaminated land and from bentonite additives;
- Respiratory - debris removal and traffic create dust.

What are the main risks?

Collision, falls and musculo-skeletal injuries when dealing with vehicles and machinery particularly if restricted access and other conditions on site increase the risk.
Are there other risks to watch for?

Yes - other risks become main risk if:
- piling is in contaminated ground (poisoning)
- large underreamed piles are used (entrapment while inspecting bases of bores over 750mm diameter)
- driven piles are used on enclosed site (hearing loss)
- piling involves working over water (drowning)
- there is an adjacent railway (railway accident)
- underground or overhead services cross the site (electrocution).

What's the evidence for safety risks?

HSE records of figures for piling crews in the five years (1986-90) 5 fatalities. Total vehicle accidents and accidents with machinery in construction were 104 fatalities.

The Federation of Piling Specialists' has an active Safety Committee that considers hazards that have resulted in accidents.

Is there evidence of health risks?

No figures specifically related to piling operations but musculo skeletal damage is responsible for sickness and there have been a few cases of illness due to contact with the substances used in bentonite additives.

Can the risks be avoided?

No - Piling always involves some risk. Specific risks can be avoided by choosing a piling method which does not involve that risk (but other methods may create different risks).

What are the best ways for a designer to reduce the risks?

1. Insist on thorough surveys of soil conditions and overhead and underground services.

2. Consult with piling specialists at feasibility stage (or outline stage at the latest) on type of piles, space required and working arrangements.

3. Ensure that a competent contractor is appointed and that a method statement is prepared for inclusion in the health and safety plan.

4. Provide the conditions for safe working. i.e.
   - A level working platform;
   - Firm, unobstructed vehicle access;
   - No conflict with simultaneous site operations.

5. Ensure that site is securely fenced before the start of piling operations.
Are there other ways?

Yes - For some site conditions and piling operations there are techniques that reduce risks, for example:
Driven piles do not require spoil to be excavated and removed from the site (important on contaminated or dusty sites and where traffic movement needs to be restricted); Driven piles need not always be sunk with noisy hammers, pneumatic jacks can sometimes be used.

What about welfare?

As piling may be the first operation on site and sometimes well in advance of other operations method statements should include changing, toilet and washing facilities as well as first aid provision.

Best advice available:

From the Federation of Piling Specialists
The publication of a 'generic risk assessment' is being prepared and should be ready for publication in 2-3 months.

From the Construction Industry Training Board
Safety of piling sites (Booklet prepared with the FPS)
Be alive to safety, Stay alive to safety (Videos).

From British Standards
BS 2830 Suspended safety chairs and cradles for use in the construction industry
BS 5228 Code of practice for noise control on construction and open sites
BS 5573 Code of practice for safe precautions in the construction of large diameter boreholes for piling and other purposes
BS 7121 Code of practice for the use of cranes.

From the Construction Industry Research and Information Association
Review of problems associated with construction of cast-in-place concrete piles (reprinted 1985)
The use and influence of bentonite in bored pile construction (reprinted 1991)
Survey of problems associated with the installation of displacement piles (1980)
Noise and vibration from piling operations (1980)
Methane and associated hazards in construction (1992)

Is there any specific legislation?

No - But legislation including the Construction (Lifting Operations) Regulations, Noise at Work Regulations and COSHH Regulations (for bentonite additives) applies.
**Example 1: Slab over contaminated land**

Option A Driven piles -
- inherently more noisy -
- difficult to provide
  adequate enclosure to
  reduce noise in
  neighbourhood - operatives
  need ear protection

Option B Augerad piles -
- excavation and disposal
  of contaminated soil
- creates risks for operatives
  who will need protective suits -
  difficult to ensure safe disposal of soil.

Choice: seriousness of risk: A = medium B = high, exposure to hazard: A = high B = high
therefore choose A and provide sound enclosure

**Example 2: Deep basement for inner city site**

Option A Steel sheet piling -
- noisy to install (local authority
  will not accept

Option B Diaphragm wall - requires extra
- space to handle spoil and large
  reinforcement cages. risk of accidents from
  spread of Bentonite tubes over the site.

Option C Secant piles - requires extra
- plant to auger out and fill the piles

Choice: seriousness of risk (between B and C because LA will not accept A) B = high
C = high, exposure to hazard B = high C = medium, therefore choose C (Bentonite plant and tubes tipped the
balance)
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