

CDM2007 – Construction work sector guidance for designers

Third edition

Taking account of CDM2007 and its ACoP L144 (2007)

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Summary

The Construction (Design and Management) Regulations 2007 (CDM2007) apply to construction work undertaken in the UK and for all projects for which designers have duties under CDM. This guide helps any person or organisation acting as a designer to meet their obligations with respect to construction hazards in an effective manner. Advice on considering “in-use” hazards (a duty introduced into the 2007 Regulations which was not included in the 1994 Regulations), is provided in CIRIA Publication C663 – *CDM2007 – Workplace “in-use” guidance for designers*.

Each of the legal duties is explained and advice given on how they may be effectively discharged. This new edition takes account of the ACoP publication L144 (2007). In addition to giving advice on a designer’s duties, the guide explains how the work may be carried out in an effective, proportionate manner and guidance is given on the difficult issues which arise in practice. The issue of “who is a designer for the purposes of CDM” is also addressed.

The guide starts by explaining to designers the need for action and what is required of them by CDM; this includes details of the different types of accident and health issues involved in construction. The major part of the content consists of the examination of health and safety issues arising in the 39 different sectors considered. For each section, hazards are identified and discussed, examples of risk mitigation are given and references provided to related issues in other sections and to other publications that may assist. Finally, guidance is given about documenting information and sources of further information of a general nature.

CDM2007 – Construction work sector guidance for designers

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Foreword

The Health & Safety Executive (HSE) is pleased to see industry preparing supporting guidance for designers. CIRIA has a reputation for preparing useful “good practice” guidance, and it is noted that the existing CDM guidance for designers is being updated both as guidance for designers as they consider hazards and risks arising during construction (this guide), and during the use of a structure as a workplace (a new companion guide).

It is hoped that designers will use this guidance to raise their awareness of the issues they have to address; designers need to be aware of the hazards and risks which affect those involved in all aspects of construction, including maintenance.

CDM2007 is designed to bring the consideration of the actual potential hazards and risks on each project to the forefront of a designer’s work and this guide should assist designers in carrying out their duties by seeking to eliminate hazards, minimise the risks which remain and communicate residual risks to others. This activity must be at the core of a designer’s work whether on a small house extension or an Olympic stadium.

Health & Safety Executive

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About this guide

THE CDM REGULATIONS

The Construction (Design and Management) Regulations 2007 (known as CDM2007 in this guide) affect construction work in the UK. The Regulations place duties upon all designers and this guide is designed to assist in fulfilling those duties with respect to construction work.

CDM2007 builds upon earlier health and safety legislation by imposing a framework of duties so that all the parties to a construction project must consider health and safety. The Regulations have an Approved Code of Practice L144 (known as the ACoP) titled *Managing Health and Safety in Construction: Construction (Design and Management) Regulations 2007*, which has legal status and must be referred to alongside CDM2007.

Guidance has been prepared by industry working groups and may be freely accessed through www.citb-constructionskills.co.uk/CDM.

This guide addresses construction hazards; there is a companion CIRIA guide C663 (CDM2007 – Workplace “in-use” guidance for designers) which addresses workplace “in-use” hazards, ie risks to those who work in or are affected by structures in use, as now required by CDM2007.

READERSHIP

Construction work sector guidance for designers is written for those wishing to develop a full understanding of the designer function with respect to relevant construction hazards under CDM. It focuses upon the management of hazard and risk but also provides information about designers' CDM duties in general. The term designer is a defined term under CDM2007 and has a broad meaning, going beyond the traditional meaning to include anyone who makes input to design decisions. This is discussed in the guidance. It should also be noted that during the stages of a project, different designers will be active; initially consultants may be making conceptual decisions and working up schemes, but later trade contractors will be designing their work and the main contractor will be designing site systems including lifting arrangements. It is the job of the CDM coordinator to coordinate these inputs.

Each designer will have his or her own area of decision-making, which will affect risks on site, both during construction and during subsequent activities, including cleaning and other maintenance work, alteration and demolition. Designers need to concentrate on the decisions that they can influence while being aware of the concerns of other designers, which may be affected by their actions.

A general understanding of CDM2007 and its ACoP L144 is assumed. For further information see the section “Sources of further information”. In particular, when considering workplace “in-use” risks (ie those risks which

remain after construction and affect those using the structure), designers may refer to the CIRIA publication C663: *CDM2007 – workplace “in-use” guidance for designers*.

KEY POINTS

It must be understood that anyone who acts as a designer as defined by CDM2007 (including a client who imposes specific requirements) has duties as a designer under CDM.

All those who contribute to design decisions affecting construction must consider the hazards and risks involved. This requires an understanding of construction work, including subsequent activities (maintenance including cleaning, alteration and demolition) and of the types of accidents and health issues that are involved.

This report provides a wealth of accessible information about health and safety issues in a wide range of construction activity. The consideration of these matters must be an integral part of the design decision process. Each designer has a part to play, working as a member of the design team who must make decisions related to health and safety in a coordinated manner, led by the CDM coordinator.

The object of CDM is to *embed health and safety management into projects*. All designers have a role to play and must communicate with others to provide information about health and safety for contractors to take into account, as they plan and execute work on site.

A designer’s duties under CDM require considerable common sense and openness in order to relate to the other duty-holders in a constructive manner. *Duties must be carried out in a manner that is proportional to the type of project and the likely level of risk.*

Information prepared by designers for the purposes of CDM must:

- ❑ focus on health and safety information that competent people would not reasonably anticipate
- ❑ be specific to the project
- ❑ reflect the level of risk and complexity
- ❑ be concise.

Particular care is needed to prepare ***concise, focused documentation that is relevant to the project in hand***. In this way it will be of immediate use to the people who need to use it. To achieve this, the use of lengthy standardised or off-the-shelf catch-all documents ***must be avoided***. The aim is to produce relevant information that is proportionate to the project and its risks, and hence useful and cost-effective.

HOW TO USE THIS GUIDE

The guide has been structured so that it can be read from cover to cover or consulted by those who simply need to dip in for specific information. It is divided into sections that focus on construction work sectors and, for each project, only the relevant sectors need be consulted. The guidance is designed to provoke thought and to improve understanding and knowledge; it cannot provide complete information for every circumstance. As with all checklist guidance, the user must ask “is there anything else, for this particular project?”

Chapter 1 – Introduction

This chapter introduces the duties of a designer under CDM and suggests how the guidance may be used in managing hazard and risk. It provides information about over-arching issues, the planning and sequencing of construction, common causes of accidents and the major health hazards in construction.

Chapter 2 – Construction work sector guidance

A wide range of construction activities are examined, by sector. For each sector, major hazards are identified and discussed, risk mitigation measures are proposed and reference to further guidance is provided.

Chapter 3 – Providing information

Advice is given about the need for decisions to be documented, including the statutory duty to provide health and safety information to others.

Chapter 4 – Sources of further information

Appendices:

- A Checklist of hazard management**
- B Checklist of information to be provided**
- C Examples of hazard elimination and risk reduction on projects.**

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The book was updated in 2003 to align with the amendments to the CDM Regulations in 2000 and the revised ACoP published in 2001. The contractor for this work was Alan Gilbertson of Gilbertson Consultants Limited and CIRIA's research manager was David Storey.

The book was updated again by Alan Gilbertson in 2007 to align with the rewritten CDM Regulations and their ACoP.

2007 Project Steering Group

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I

Introduction

I.1

THE PURPOSE, SCOPE AND LIMITATIONS OF THIS GUIDANCE

This guidance has been produced to assist designers to comply with Regulation 11 of the Construction (Design and Management) Regulations 2007, (CDM2007). This Regulation requires designers to ensure that any design prepared for the purposes of “construction work” during construction, maintenance, repair or demolition includes adequate regard to the avoidance of hazards and the reduction of risk during construction. This guidance touches on duties other than those under Regulation 11, to set the duties in context. The scope of a designer’s responsibility under CDM2007 is examined fully in the Approved Code of Practice (ACoP) L144, which all practicing designers should be familiar with – see in particular paragraphs 110–145.

The duty to consider risks to users of completed structures is dealt with in a companion CIRIA publication C663 entitled *CDM2007 – Workplace “in-use” guidance for designers*.

The purpose of this guidance is to help designers to manage health and safety risks during construction work, arising from their designs, while meeting their statutory duty, in the following ways.

- 1 It provides information on the major hazards associated with each of the specific construction work areas.
- 2 It gives key considerations, prompts and examples to encourage designers to think about the peculiarities of their own specific projects and to identify and prioritise project-related hazards, with respect to the stages of design.
- 3 Once the health and safety hazards have been identified, it provides signposts to the types of responses that designers can make to alter their design to avoid, reduce or control the hazards.
- 4 It gives cross-references to other sectors of construction work addressed by the report, which may be related in terms of health and safety, and to external texts from which more detailed information may be obtained.

The guidance has been drafted for designers who are active in design practice in any construction discipline and need rapid access to the key considerations connected with a particular construction work sector. Within each sector, what the designer can achieve is influenced by the design stage and previous decisions that have been made, either by the designer or by others.

The scope of this report is restricted to 39 construction work sectors, chosen following industry consultation and intended to represent those areas of construction work considered to contain the most significant and common hazards and risks to the health and safety of construction workers and others (eg members of the public and building occupiers). However, these construction work sectors by no means address all hazards in construction. Every designer has to think through the design options to identify all the hazards that can reasonably be foreseen and then act accordingly to avoid or reduce them.

A number of the hazards mentioned specifically in the work sectors, or those that designers may further identify, may be outside a particular designer's scope of control or may be issues that a contractor would deal with. However, they are included so that designers may be as fully informed as possible about the range of potential hazards. Those not familiar with site practices might find *Health and Safety in construction*, HSG150, a useful introduction to the main health and safety hazards in construction work.

The designer's duties relate to considering construction hazards that can reasonably be identified and to providing information so that contractors and others can be made aware of them. Designers are not required to outline methods of dealing with hazards but should explain any particular construction assumptions that have been made as part of the design.

Readers need to appreciate that the guidance in this document is not intended to repeat information available elsewhere, but to include reference to it, so it is not intended that this handbook can be read entirely in isolation.

1.2 DEFINITIONS

1.2.1 Designer

CDM2007 defines the term “designer” with much wider meaning than that common in construction usage. See Section 1.4.2 for an explanation of the term designer.

1.2.2 Construction work

CDM2007 likewise defines (Reg 2) the term “construction work” with much wider meaning than that common in construction usage, including maintenance, cleaning and decoration. Designers are expected to consider hazards to those who maintain, repair, clean, refurbish, adapt and eventually remove or demolish all or part of a structure, as well as those who construct it.

1.2.3 Stages of a project

The terms “concept stage”, “scheme stage” and “detail stage” have been used in this guide to subdivide the design process. It should be noted that much design (in its widest sense) is done after the appointment of contractors. The designer's response to any hazards identified will vary according to the stage of design development. There is more flexibility to avoid hazards at the start of the design process during concept stage, than during the detail stage when control measures may be more appropriate for dealing with any remaining hazards.

1.3 THE CONTINUING NEED FOR ACTION TO IMPROVE HEALTH AND SAFETY IN CONSTRUCTION

The chances of being killed during a working lifetime on construction sites are currently around 1 in 650 and the chances of being disabled by serious illness or injury is much greater than for workers in other industries. In addition, members of the general public are also injured and killed by construction work. Figures from the Health and Safety Executive indicate that on average (2003/4 to 2005/6) 66 workers are killed on sites each year.

An analysis of this figure by types of accident is given in Table 1.1. Although the total number and mix of fatalities varies each year, the nature of accidents has remained broadly the same.

Table 1.1 Analysis of figures by type of accident

Percentage of total	Type of accident
46%	Falls from a height
15%	Struck by falling/flying object, eg during machine lifting of materials
6%	Contact with electricity or an electrical discharge
15%	Struck by a moving vehicle
9%	Trapped by something collapsing or overturning
2%	Contact with moving machinery or material being machined
7%	Other causes

There is also a large incidence of health problems amongst construction workers and Table 1.2 gives estimates for numbers suffering ill-health as a result of certain hazards. These numbers dwarf the figures for injuries and on-the-job fatalities and in many cases, the effects may not be felt until years of exposure has taken place.

Table 1.2 Estimates of numbers of construction workers suffering ill-health

Hazard (possible resulting disease or condition)	Annual estimates	
	Lower limit	Upper limit
Asbestos (mesothelioma, asbestosis, lung cancer)	200 (deaths)	250 (deaths)
Musculoskeletal injury (back disorders, work-related upper limb disorders, lower limb disorders)	55 000	70 000
Respiratory disease (bronchitis, emphysema, asthma, pneumoconiosis, sinusitis, influenza)	3500	23 000
Skin disease	3100	10 500
Noise (deafness and ear conditions)	1000	5800
Vibration conditions	200	400

From the figures in these tables, it is clear that great improvements can be made. To do so, contributions need to be made by clients, designers and contractors. In particular designers need access to guidance that will help them identify the hazards arising from their design and then to avoid, reduce or control these hazards through the design process.

I.4

THE DESIGNER'S DUTIES UNDER CDM2007

I.4.1

The importance of design in managing health and safety in construction.

CDM2007 places the designer at the centre of health and safety, jointly with the contractor, because the work to be done is of the designer's choosing. The ACoP states:

“Designers are in a unique position to reduce the risks that arise during construction work, and have a key role to play in CDM... Designers' earliest decisions can fundamentally affect health and safety... [Designers] need to consider the health and safety of those who will maintain, repair, clean,

refurbish and eventually demolish all or part of a structure... Designers have to weigh many factors as they prepare their designs. Health and safety considerations have to be weighed alongside other considerations, including cost, fitness for purpose, aesthetics, buildability, maintainability and environmental impact...”. (ex paragraphs 109–111 and 124).

All designers need to be familiar with CDM2007 and the ACoP, or they will not be able to undertake the legally enforceable duties placed upon them by CDM.

1.4.2 Who are designers?

It is important to appreciate who is classed as a designer. As well as the design team appointed by a client (or a design and build contractor), the ACoP (paragraphs 115–118) makes it clear that in CDM the term designer has a broad meaning, including:

- architects, civil and structural engineers, building surveyors, landscape architects, other consultants, manufacturers and design practices (of whatever discipline) contributing to, or having overall responsibility for, any part of the design, for example drainage engineers designing the drainage for a new development
- anyone who specifies or alters a design, or who specifies the use of a particular method of work or material, such as a design manager, quantity surveyor who insists on specific material or a client who stipulates a particular layout for a new building
- building service designers, engineering practices or others designing plant which forms part of the permanent structure (including lifts, heating, ventilation and electrical systems), for example a specialist provider of permanent fire extinguishing installations
- those purchasing materials where the choice has been left open, for example those purchasing building blocks and so deciding the weights that bricklayers must handle
- contractors carrying out design work as part of their contribution to a project, such as an engineering contractor providing design, procurement and construction management services
- temporary works engineers, including those designing auxiliary structures, such as formwork, formwork, falsework, façade retention schemes, scaffolding, and sheet piling
- interior designers, including shop-fitters who also develop the design
- heritage organisations who specify how work is to be done in detail, for example providing detailed requirements to stabilise existing structures
- those determining how buildings and structures are altered, eg during refurbishment, where this has the potential for partial or complete collapse.

Local authority or government officials may provide advice relating to designs and relevant statutory requirements, eg the Building Regulations, but this does not make them designers. This is because these are legal requirements where the designer has no choice in respect of compliance. Any such requirements should be treated as “design constraints” in the usual way. However, if the statutory bodies require that particular features which are not statutory requirements are included or excluded (eg stipulating the use of hazardous substances for cleaning or the absence of edge protection on flat

roofs), then they are designers and must ensure that they comply with CDM2007.

Manufacturers supplying standardised products that can be used in any project are not designers under CDM2007, although they may have duties under supply legislation. The person who selects the product is a designer and must take account of health and safety issues arising from its use. If a product is purpose-made for a project, the person who prepares the specification is a designer under CDM2007, and so is the manufacturer who develops the detailed design.

Nearly all participants in a project could be designers, whether it be a client specifying a type of construction, or a subcontractor deciding how to work and designing a method of lifting and slinging.

The guidance provided in this report is for ALL designers. Note that designers are required to work as a team, assisted by the CDM coordinator. Decisions that are not in the control of one designer, due to the contractual framework, will be in the control of another designer. Each project will be different and it is therefore not appropriate for CDM2007 to set out exactly how the various designers on a project will interact. As the design progresses, designers will need to take account of decisions already made and information provided by others. They need to raise questions where necessary and make further decisions using their own expertise. Examples of areas of design that require careful coordination include:

- all interfaces between elements, particularly where there is a degree of interaction
- interfaces between permanent works and temporary works
- works that will be left in a temporary condition while other work continues.

1.4.3

Designers' duties

Designers' duties under CDM are contained in Regulations 11 and 18 and amplified in the ACoP paragraphs 109–145. All designers should read this guidance and become familiar with it.

Website <www.citb-constructionskills.co.uk/CDM> also gives guidance.

Designers must:

- ensure that their clients are aware of their duties under CDM and that (for notifiable projects) the correct steps have been taken (appointment of CDM coordinator, notification of HSE)
- ensure that they are competent and adequately resourced to address the H&S issues in their design work
- seek to eliminate hazards and reduce risks in their design
- cooperate and coordinate their work with the CDM coordinator and other designers
- provide information about significant residual risks, both before construction as pre-construction information and for the future in the health and safety file.

1.4.4 Information from clients

Designers should note that a client is required (Reg 10) to provide the CDM coordinator/designers with information that he could reasonably be expected to obtain, which will be relevant to the management of hazards and risks. This requirement may assist in persuading a reluctant client to commission surveys (in conjunction with an explanation of the benefits such work will bring to the project).

1.4.5 Designers' management of hazards and risks

CDM2007 requires (Regulation 11) that the designer shall, so far as is reasonably practicable, avoid foreseeable risks to people by eliminating hazards which give rise to risks and reducing risks from any remaining hazards, giving priority to collective measures (ie separating people from the hazard rather than providing PPE).

The duty is explained further in ACoP paragraphs 124–128:

“Designers have to weigh many factors as they prepare their designs. Health and safety considerations have to be weighed alongside other considerations, including cost, fitness for purpose, aesthetics, buildability, maintainability and environmental impact. CDM2007 allows designers to take due account of other relevant design considerations. The Regulations do not prescribe design outcomes, but they do require designers to weigh the various factors and reach reasoned, professional decisions.

Designers are required to avoid foreseeable risks “so far as is reasonably practicable, taking account of other relevant design considerations”. The greater the risk, the greater the weight that must be given to eliminating or reducing it. Of course designers are not expected to consider or address risks which cannot be foreseen, and The regulations do not require zero risk designs because this is simply impossible. However, designers must not produce designs that cannot be constructed, maintained, used or demolished in reasonable safety.

Designers should critically assess their design proposals at an early stage, and then throughout the design process, to ensure that health and safety issues are identified, integrated into the overall design process and addressed as they go along. It is pointless to complete the design first, then try to address the risks which the design has introduced. By then, all of the key decisions are likely to have been taken and no one will be willing to make any changes because of the time and cost involved.

The first thing that designers need to do is eliminate hazards (things with a potential to cause harm) from their designs so far as is reasonably practicable, taking account of other design considerations. Examples would be to design out things like fragile roofing materials or products; eliminating rooflights from areas where roof access is needed; positioning plant which needs regular maintenance at ground level so there is no need for work at height or providing permanent safe access for work at height. Eliminating hazards removes the associated risk, and is therefore the best option and should always be the first choice.

It is not always reasonably practicable to eliminate hazards, and where this is the case consideration should be given to incorporating design solutions which reduce the overall risk to an acceptable level. This can be done by reducing the:

- likelihood of harm (injury or adverse health effect)
- potential severity of the harm
- number of people exposed to the harm
- frequency or duration of exposure to harm”.

Limitations to the designers’ duties are specifically covered in the ACoP paragraph 143:

“Under CDM, designers do not have to:

- take into account or provide information about unforeseeable hazards and risks
- design for possible future uses of structures that cannot reasonably be anticipated from their design brief
- specify construction methods, except where the design assumes or requires a particular construction or erection sequence, or where a competent contractor might need such information
- exercise any health and safety management function over contractors or others; or worry about trivial risks”.

1.4.6 Hazard Elimination and Risk Reduction (HERR) by Designers

Designers need to examine ways in which hazards can be avoided or mitigated or, if neither is possible, designed for so that the level of risk is acceptable (given proper controls), applying the principles of prevention and protection. This process follows the requirements of the Regulations: *Hazard Elimination* and then *Risk Reduction* (HERR).

1.4.7 Designers’ contribution to risk control

Risk control measures should preferably be collective rather than personal. In descending order of effectiveness, the hierarchy of risk control involves:

- changes that eliminate a hazard
- substitution of a less hazardous design feature
- 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 risk, or the number of people exposed
- safe systems of work, together with suitable training and supervision
- written procedures, and the provision of information, instruction, warnings, signs and/or labels
- use of personal protective equipment (PPE).

Failure by designers to address a hazard may mean that contractors have to adopt less effective measures such as the use of PPE. *The designers' contribution to risk control therefore lies primarily in the scenario they set for the contractors.* Designers select the risks that contractors must manage and the provision of information about residual risk (although necessary, see below) is of importance only once the key design decisions that affect risk have been made.

1.4.8 Provision of information by designers

Designers have always provided information for construction, and under CDM2007 they need also to provide information for the health and safety file to guide and inform those responsible for future work (cleaning, maintaining, repairing, modifying, adapting and demolishing) on the structure. The ACoP (paragraph 131–133) states:

“Designers must provide information that other project team members are likely to need to identify and manage the remaining risks. **This should be project specific, and concentrate on significant risks which may not be obvious to those who use the design.** For example, providing generic risk information about the prevention of falls is pointless, because competent contractors will already know what needs to be done, but if the design gives rise to a specific and unusual fall risk which may not be obvious to contractors, designers should provide information about this risk.

Designers also need to provide information about aspects of the design that could create significant risks during future construction work or maintenance. If in doubt about the level of information needed, the best way to find out is to ask those who will use it.

Significant risks are not necessarily those that involve the greatest risks, but those, including health risks that are:

- ❑ not likely to be obvious to a competent contractor or other designers; unusual; or
- ❑ likely to be difficult to manage effectively”.

The ACoP (paragraph 134) notes that the information must be “brief, clear, precise and in a 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
- ❑ suggested construction sequences showing how the design could be erected safely, where this is not obvious.

1.4.9

Issues of concern – questions and answers

These are commonly asked questions relating to designers' duties under CDM.

- 1 Q** To what lengths do designers need to go in considering hazard and risk and providing guidance for construction work?
- A** Guidance is given in the ACoP (see Section 1.4.8 above). A competent designer has to be prepared to take a view on what is reasonable in the circumstances, all things being considered, at that time. Properly informed professional judgements need to be made. What will not be acceptable is a failure to consider hazards.
- 2 Q** How does a designer decide whether to mention the need for specific controls?
- A** This will be when:
the client (reasonably) wishes a specific approach to be adopted, or the design requires specific precautions
or
a safe method of work has already been approved by a competent body.
- 3 Q** How does a designer decide which risks need to be pointed out to contractors?
- A** This should be when a significant risk might not be recognised by a competent contractor or is of an unusual nature such that a designer is bound to draw it to the contractors' attention and suggest how it might be handled.
- 4 Q** When considering how far to go in documenting project risks, does the likely type of contracting organisation need to be taken into account?
- A** This is a matter of judgement for designers based on what is known at the time, bearing in mind that they should be able to rely upon the appointment of competent contractors. A designer should identify to the person appointing a contractor if the design requires a contractor to have special skills or competencies beyond the norm for the type of project. Once the contractor has been appointed, the best way forward is to agree with them the information that they need.
- 5 Q** Can information be shown on a number of documents as well as in the pre-construction information and does it need to be duplicated?
- A** Specific concerns should be mentioned in the pre-construction information. If they are important, experience shows that they will be more likely to be acted on if shown on the drawings or referenced from the drawings. Information on drawings is most likely to be seen by the individuals directly engaged in and managing the work on site.

- 6 Q** Are control measures recommended by designers binding upon the contractors?
- A** Not unless it is written into the contract.
- 7 Q** How can a designer decide on levels of risk and balance options?
- A** Decisions must be based on knowledge and experience. Advice from colleagues or experts should be sought if there is uncertainty on a particular point. Contractors may also be able to advise the designer on the relative health and safety merits of different design options. Note that designers should not agonise between options that will present similar levels of risk, but concentrate on those that could substantially reduce it, eg provision of a parapet rather than examining a steel/concrete option.
- 8 Q** Do the health and safety aspirations of a client affect decisions?
- A** If a client wishes to aim for a higher standard of health and safety than would normally be required for basic legal compliance, this may affect decision-making and the site rules in pre-construction information. The client's requirements in this respect should be made plain at an early stage. The basic requirements of CDM will not be affected.
- 9 Q** Does quality assurance (QA) play a role in Hazard Elimination and Risk Reduction (HERR) by designers?
- A** This is a business decision. However, risk management is fundamental to CDM and QA may be an appropriate management tool to monitor whether it is being carried out systematically and to demonstrate that the business is complying with statutory duties and company policies and procedures.
- 10 Q** How do contractors' risk assessments relate to Hazard Elimination and Risk Reduction (HERR) by designers?
- A** Hazard Elimination and Risk Reduction (HERR) is used by designers to identify and assess hazards and to help them make decisions about design options. Contractors use risk assessment to develop a safe system of work that takes account of information in the pre-construction information and all project circumstances.
- 11 Q** If the project is at an early stage (eg bidding for grants, obtaining estimates) or if no CDM coordinator is appointed by the time a designer is making decisions, is a designer relieved of his duties under Regulation 11?
- A** No. Regulation 11 duties are not dependent on the appointment of a CDM coordinator. However, note that a designer should not be making binding H&S related decisions if a CDM coordinator should have been appointed, only "initial design work" is permitted (see Reg 18 and ACoP paragraph 139). The designer has a duty to ensure (Regulation 11 (1)) that the client is aware when he should be appointing a CDM coordinator under CDM; if he fails to act, designers should remind him in writing if there is a risk that design could be seen as progressing beyond "initial design work" and pointing out the benefits of appointing the CDM coordinator. Action in the face of a blatant refusal to appoint when required by CDM2007 is difficult to recommend, being a commercial matter but the law under CDM2007 is clear.

1.4.10

Getting help

The HSE runs a helpline called 'Infoline', tel 0845 345 0055 fax 0845 408 9566 or email hse.infoline@natbrit.com and you can also visit their website <www.hse.gov.uk>.

1.5

HOW TO USE THIS GUIDANCE

The construction work sectors have been organised into five groups (A to E), each of which addresses a major area of construction work. Within each group the sectors are referenced numerically. The arrangement of the groups has been organised to reflect the order of construction where possible.

Each of the 39 construction work sectors is referenced as <Group letter><Work sector number> For example:

Deep basements and shafts is referenced as B2 (Group B, Work sector 2 in this group).

This referencing system is used for the internal cross-references between work sectors, principally in the "Related Issues" section.

In some instances sectors are intended to be read in conjunction with others, eg C1 (General concrete) should be read alongside any of the more specific concrete topics (C2, C3 or C4).

A detailed description of the way in which the sectors are arranged is given in Chapter 2.

1.6

FLOWCHART OF HAZARD ANALYSIS

Designers can follow a logical process to deal with the hazards that have been identified, either as typical generic hazards or as project specific. The outcome of this process will depend on the nature of the hazards and the limits of the project that is being considered. Figure 1.1 illustrates the process as a flowchart, starting with the identification of the hazards and concluding with the significant residual risks.

The three elements of Figure 1.1 are described below.

- 1 The design process is divided into three stages (concept, scheme and detail). Each design stage will address different issues, but typically the nature of issues will move from the general to the particular as the design is refined.
- 2 Once hazards have been identified, the CDM process is split into the three approaches (avoid, reduce, control) and each of these methods of solution is considered in turn. For example, reduction measures may be considered only if a hazard cannot reasonably be avoided.
- 3 The end of the hazard consideration in design process is the consideration of the residual risks that remain in the design. Those that are judged to be significant or unusual in the context of the project need to be identified. Information on these risks may need to be provided to those who need it

in order that appropriate action can be taken by the contractor, for construction, or the client (and others) for future work. This is considered further in Chapter 3.

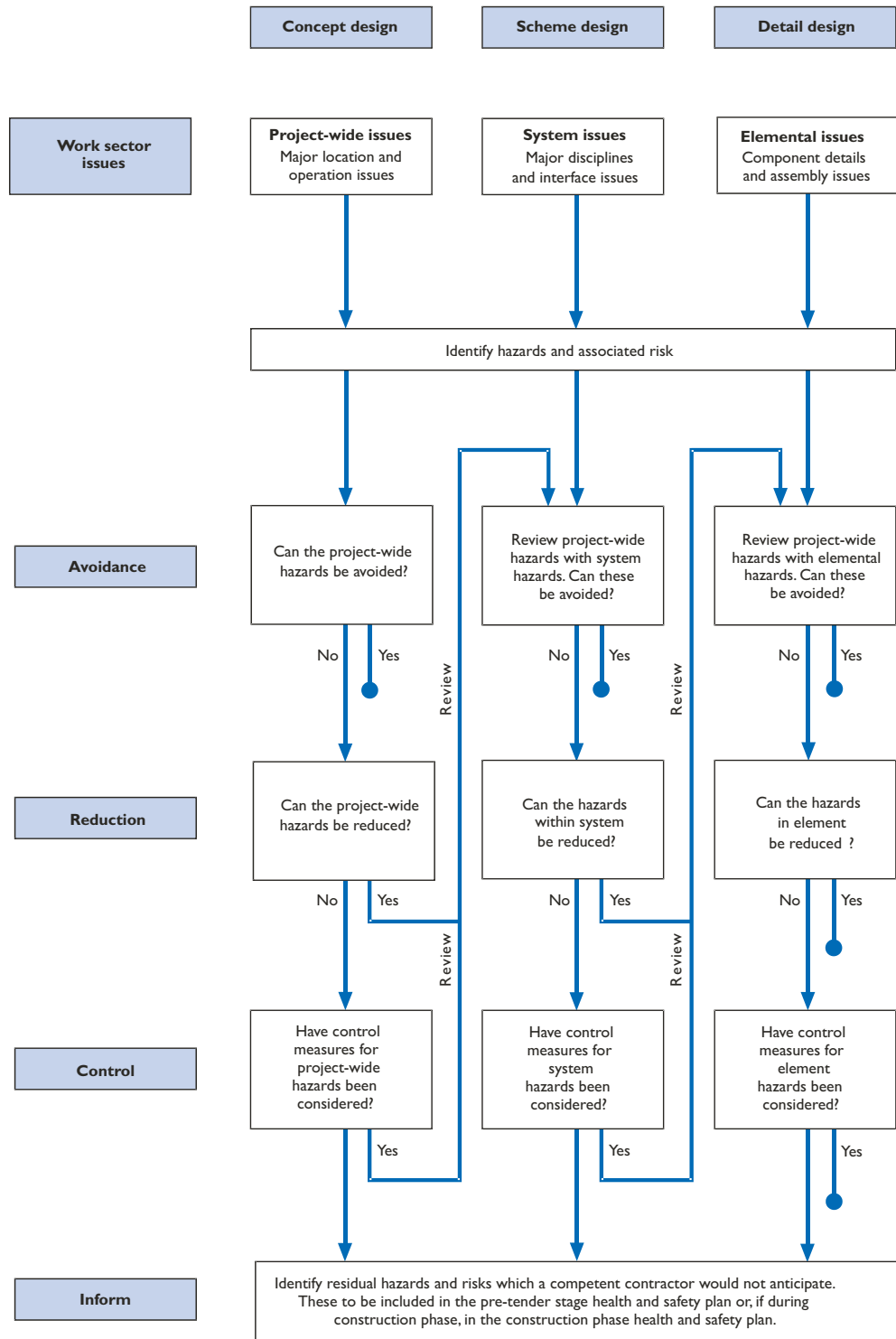


Figure 1.1 Flowchart of hazard analysis

This process of analysing and dealing with hazards is considered in the construction work sectors under the headings of “Hazard Consideration in Design” and “Examples”. The “Hazard Consideration in Design” section within each sector assumes a parallel series of operations to analyse the various risks arising from the intended construction. These then determine the degree of effort designers should apply to eliminating or reducing the hazards and then informing others so that they can control them. This total process is referred to as ERIC (Eliminate, Reduce, Inform, Control).

I.7 **GENERIC ISSUES**

I.7.1 **Introduction**

The identification and consideration of health and safety hazards by construction work sector must be set within the wider context. This section looks at three such issues:

- common types of accident
- major health hazards
- planning and sequencing of construction.

There may be other issues that need to be considered on each particular project and designers should consider them in conjunction with the hazards related to construction work sectors.

I.7.2 **Common types of accident**

The main causes of injury in construction work are set out in Table 1.3. They happen in many different construction work sectors. It is essential for designers to have an appreciation of the part that they can play by eliminating the hazards and reducing the risks involved. Examples of preventative action are also shown in Table 1.3. It is important to understand that there are many designers involved in projects, including people who specify the materials to be used. Each needs to play their part, even though they cannot each address all of the issues.

Table 1.3 Issues relating to types of accident

Risk	Examples of causes	Examples of preventive action
Falls from height	Fall from a flat roof Fall through fragile roof/skylight Fall from ladder	Design in parapet or barrier Do not specify fragile materials Design out the need for ladders during construction, cleaning and maintenance operations eg: <ul style="list-style-type: none"> ● sequence work to allow permanent stairways to be used during construction ● specify/sequence work to provide hard standing for mobile access equipment ● design windows to be cleaned from the inside ● specify materials that don't need routine painting or design in safe access for maintenance ● consider prefabrication so that sub-assemblies can be erected at ground level and then safely lifted into place Design in permanent access equipment eg: <ul style="list-style-type: none"> ● rails for cradles/gantries ● anchorages for fall arrest equipment and rope access equipment
Trench collapse	Poor ground conditions	Ensure that there is adequate information about ground conditions and ground water Seek to avoid deep excavation in poor conditions
Struck by moving vehicle	Poor site layout	Design site to: <ul style="list-style-type: none"> ● provide safe access and egress onto public roads ● ensure there is adequate space for plant and equipment to operate safely
Electric shock or burn	Contact with overhead or underground cables	Provide accurate information on all cables Arrange for service diversions ahead of main works Position structures to minimise risks from: <ul style="list-style-type: none"> ● buried services ● overhead cables
Collapse of structure during erection	Incorrect sequence of assembly leading to temporary instability	Suggest sequence of erection Design in bracing to ensure stability during erection

1.7.3

Major health hazards

Many more construction workers suffer serious health problems due to their work than serious accidents. Many of these health hazards can be avoided at the design stage. Table 1.4 gives some examples.

Table 1.4 Issues relating to types of health hazard

Health problem	Typical causes	Preventative action
Skeletal/muscular disorders	Laying heavy concrete blocks Laying kerb stones Needing to lift in an awkward way eg needing to twist and turn, particularly repeatedly	Specify light blocks (n/e 20 kg) Specify light block kerbs or extruded kerbs/ heavy sections that can only be lifted mechanically Design for ease of access eg avoiding need for awkward postures or twisting in plant rooms
Hand/arm vibration syndrome (HAVS)	Scabbling Hand tunnelling Breaking out pile heads	Specify surface finishes that do not require scabbling Minimise hand tunnelling eg specify size that will accommodate machinery Design piles so that mechanical pile head removal is possible; specify method
Dermatitis	Allergic reaction due to contact with wet cement	Design to use bulk supply pumped into position to minimise skin contact Ensure that good welfare facilities are specified Specify low chrome cement if skin contact is likely
Noise-induced hearing loss	Noisy machinery/ processes	Avoid the need for noisy processes such as mechanical breaking
Asbestosis, mesothelioma	Exposure to asbestos dust	Ensure that site has been surveyed to identify/locate any asbestos
Solvent exposure	Specification of solvent-based adhesives for large surfaces or in confined spaces	Specify adhesives with non-volatile solvents eg water-based

Designers need to be aware of health hazards; guidance is provided in the *Site health handbook*, CIRIA publication C629. This is an area where new information and understanding often becomes available and designers will need to keep up-to-date through CPD activity.

1.7.4

Hazard Identification

A list of hazards is provided below to assist in appreciating risks. A list of this type can never be complete.

falls	polluted, contaminated access
plant movement	struck by mobile plant
collapse	static machinery
services	electrical shock/fire/explosion
impact	impact
health hazards	crushing
collapse of excavation	poor visibility
flooding/fire/explosion	buried/crushed/trapped
services/electrocution	plant and machinery intrusive occurrences
falling from height	ground effects/movements
noise/vibration/dust	inundation
inadequate working space	plant instability
inadequate working platform	working environment
working environment	structural instability
inadequate access	fumes/heat
access to height/depth	irritants
manoeuvring vehicles	crushing
lifting, lowering loads	discarded syringes and sharps
handling	lasers
untidy, unsafe site	asbestos
radiation	

1.7.5

Planning and sequencing of construction

At concept stage, the designers of a project can do a great deal to avoid and reduce significant hazards.

One important factor is the manner in which the site is laid out; is there room for the site establishment including materials storage and can safe delivery be made? These issues will also be affected by the decisions made about the form of construction, eg the amount of on-site work which requires materials to be stored, mixed etc.

Another technique used to achieve safer construction 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 wide understanding of the construction process and of the options that are feasible.

Examples

- Designers can reduce the potential for health problems arising from manual handling by producing a scheme that encourages mechanical lifting during maintenance operations and places a limit on the weights of objects to be handled manually. *These measures will not only improve the long-term health of operatives but should also improve productivity.*

- Designers can reduce the need to work at height when erecting a steel frame by designing the steelwork in 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. The safety of those who do have to work at height can further be enhanced if an adequately strong ground slab is installed before the steel frame so as to provide a stable, flat working surface from which mobile elevating work platforms can be used for bolting up. This is much safer than using ladder access and quicker than scaffolding. In addition, edge protection can be provided for in the design of the permanent works so that it is easy to install; where appropriate, it may be lifted into place as the works are erected. All of these measures have been found to improve productivity and speed on site.

Although designers are not expected (for normal structures) to specify particular construction methods or sequences, they will be expected to have considered possible alternatives when the hazards are being identified. If the assumptions of construction method and sequence become inextricably woven into the design, such that there is only one reasonable choice, then this will have to be made known.

Alternative methods and sequences will need to be considered to ensure that the appropriate choice is made. This will include factors other than health and safety and the final choice will reflect that health and safety is not expected to be pursued at any cost, rather that decisions have to be sensible and reasonable and balanced with other design decisions.

Table 1.5 demonstrates how options may be compared in a simple, effective manner, assisting decision-making.

Table 1.5 Example of the assessment of alternative methods and sequences of construction

Consideration	Option 1 – Assembly <i>in situ</i>	Option 2 – Pre-assembly and lift into place
Health and safety	Operatives working at height, risk of people falling, risk of falling objects, risk of lifting many individual items	Fewer operatives working at height, risks from manipulating large modules, quicker site operation means shorter exposure times
Quality	Variable quality	Better opportunities for quality control
Programme	Assembly <i>in-situ</i> slower than prefabricating	Quicker than assembling <i>in-situ</i> in terms of site work. Pre-assembly can be elsewhere on site or remote. Requires longer lead time
Price	Usually little difference in cost of materials and components. Pre-assembly possibly more expensive in total manpower/double handling, eg needs larger crane, but should be more predictable out-turn price.	
Performance	In this instance, it is judged that there is no material difference in eventual performance of the structure arising from the choice of one construction method or another.	

Note that comparisons will not always be necessary; the ACoP (paragraph 129) states:

“The amount of effort put in to eliminating hazards and reducing risks should depend on the degree of risk. There is little point in spending a lot of money, time and trouble on low risk issues. There is also little to be gained by detailed comparison of construction techniques that present similar risks, for example whether to specify a steel frame or concrete portal building. The focus should be on issues that are known to have the potential to cause significant harm, and where there are known solutions that reduce the risks to everyone exposed”.

2

Construction work sector guidance

2.1

CONSTRUCTION WORK SECTOR GROUPS

The construction work sectors in this report are divided into five groups, relating to main stages of construction work, as follows:

Group A General planning

Group B Excavation and foundations

Group C Primary structure

Group D Building elements and building services

Group E Civil engineering

Within these groups, each of the 39 sectors is presented in a standard format over four pages. Once readers are familiar with the layout and arrangement of the guidance material, it is expected that individual sectors will be referred to on a case-by-case basis and the structure of the guidance has been designed with this in mind. However, it is vital that users have read and understood the introduction to the report and also have access to the list of general reference material contained in Chapter 4 of the report.

2.2

THE CONTENT OF EACH CONSTRUCTION WORK SECTOR

Each of the construction work sectors is arranged over four pages, with a common structure of headings and subdivision of the information presented.

Table 2.1 indicates what each part of the common structure of the construction work sector guidance contains. In order to get maximum benefit from the guidance, readers must know where particular information is contained within each sector.

Manual handling is a hazard potentially applicable to all construction processes. It has not been repeated in each section but must always be borne in mind.

Table 2.1 Description of contents of each work sector

Page	Heading used	Contents
First	Scope	This describes what the work sector covers, either as a formal definition or as examples in bullet point form.
	Exclusions	This describes what is not included in the scope of the work sector; usually items that have been considered too specialist.
	Major hazards	These are hazards that will be most likely to arise when this work sector is included in a construction project; a maximum of six are given to concentrate on the major issues.
Second	Specific hazard Identification	This section gives typical issues that may arise, depending on the nature of the project the designer is undertaking, to add to those identified as major hazards. There are examples of specific questions, headed <i>Possible key considerations</i> . These are included to stimulate lateral thought, as it is impossible for any guidance of this kind to cover all possible eventualities. This list works in conjunction with the prompts.
	Prompts	This gives a list of general issues that may well influence how the key considerations are addressed. The list is NOT exhaustive and each prompt should be considered against each consideration.
	Hazard consideration in design	This section considers the issues that might arise at different stages of the design process (concept, scheme and detail), ranging from strategic questions at concept stage to specific issues at later stages. This section also presents some possible design options, which could allow the designer to avoid or reduce health and safety hazards. The design options are a starting point and must not be considered as a complete list.
Third	Examples of risk mitigation (methods of solution)	This sub-section considers typical issues, showing how these generate different responses, according to whether the hazard can be avoided or only reduced, or whether control measures are required as a last resort.
	Examples of risk mitigation (issues addressed at different stages)	This sub-section presents two typical projects to illustrate how a particular issue can be addressed in different ways as the design progresses from concept to detail stage.
Fourth	Related issues	This section identifies other work sectors within the report that have an impact on, or are affected by, the work sector in question. Work sectors are referenced by their letter and number – see Section 1.5.
	References for further guidance	This gives titles of other published guidance, arranged as primary, secondary and background references. General references that apply to the report as a whole are given in Chapter 4. The classification of a work sector in the Common Arrangement of Work Sectors, Civil Engineering Work Sectors and CI/SfB systems is also given where appropriate.