Construction Industry Council CDM Guidance for Designers CDM Guidance notes: Designers review sheets	General Administration Note # A 003

Please complete this form by ticking the appropriate boxes to indicate your opinions — using the 'scales' shown. <u>Add your contact details below</u>, and any other relevant comments in the spaces provided.

Name ……………………………….. Contact tel No: …………………….. e/mail: …………………………………

A. How useful did you find the various sections of the document? (NOTE: not all items below will apply, please add in sections where necessary)	**Very useful**	**Fairly useful**		**Not at all useful**
	☐	☐	☐	☐
Introduction	☐	☐	☐	☐
Identification of hazards	☐	☐	☐	☐
What designers should do	☐	☐	☐	☐
Proposals for controlling the hazard	☐	☐	☐	☐
Examples	☐	☐	☐	☐
References	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
COMPLETE GUIDANCE SHEET:	☐	☐	☐	☐

B. Was the 'level' of the information suitable for your needs?	**Too high**	**About right**		**Too low**
Comments: (please give an indication of your grade within the firm)	☐	☐	☐	☐

C. What did you think of the technical guidance given?	**Excellent**	**Satisfactory**		**Poor**
Comments:	☐	☐	☐	☐

D. Would you change the information provided, if so how?	**Yes**	**Partly**		**No**
Comments:	☐	☐	☐	☐

E. General comments:

Construction Industry Council CDM Guidance for Designers Using the guidance	General Administration Note **A 004**

1. This series of guidance notes have been drawn up to assist designers in discharging their duties under the Construction (Design and Management) Regulations 1994 [CDM]. While it has been written under discreet section headings, each section should not be read in isolation from other sections, which might be related.

2. For example, erecting a reinforced concrete [rc] structure will involve operatives in fixing reinforcement, erecting shutters and placing, compacting and finishing the concrete. Therefore, the guidance note dealing with designing to reduce hazards with in-situ rc construction is relevant. But erecting a rc structure will, invariably, require working at height and, depending on the design, working in unergonomic positions. Therefore, the guidance dealing with working at height and musculo-skeletal disorders may also contain relevant information. Consequently, the guidance sheet dealing with reinforced concrete construction should be read in conjunction with the other two.

3. In some cases, the information may be contained in more than three sheets.

4. To help designers to decide what information may be relevant for a particular design, Table 1, which links the guidance sheets to the various common construction operations, has been included. While its use is self-explanatory, notes to help the reader have been attached below:

a) ✓ means the sheet is completely relevant;
b) **?** means the sheet may be relevant, either because it contains information related to a process or it contains information related to a hazard.

5. In addition to the topic specific guidance, this document contains a general information series, which is included at the end. These sheets were intended to give designers some background on a number of topics that are outside the mainstream topics, eg, manual handling. It was felt that some knowledge in these areas would help designers to understand better why the some of the advice given in the specific sections is included.

6. Designers will notice that this document does not include a section on the CDM Regulations themselves. This was intentional. The Drafting Committee felt that it would not be a useful addition, because this information is readily available in other publications from the Health and Safety Executive [HSE].

7. These publications are commended to designers, who want to understand how they can discharge their duties under regulation 13 of the CDM regulations.

Abbreviations

8. The text in these guidance notes contains abbreviations. Although, an abbreviation is introduced in the text in parentheses, eg, temporary works equipment [TWE], immediately after the text it will replace, a list of abbreviations, which appear in these notes is given below:

General technical

ACM	Asbestos containing material;
BS	British standard;
CoG	Centre of gravity
dB(A)	Decibels;
HAVs	Hand-arm vibrations syndrome;
MAT	Mobile access tower;
MEWP	Mobile elevating work platform;
MSD	Musculo-skeletal disorder;
MSI	Musculo-skeletal injury;
pc	Precast concrete;
PPE	Personal protective equipment;
rc	Reinforced concrete;
re-bar	Reinforcing bar or reinforcement;
RSA	Rolled steel angle;
RSC	Rolled steel channel;
SAE	Suspended access equipment;
TWE	Temporary works equipment;
UB	Universal beam;
WRULD	Work-related upper limb disorder;

Regulations

CDM	Construction (Design & Management) Regulations 1994;
CHSW	Construction (Health, safety & Welfare) Regulations 1996;
COSHH	Control of Substances Hazardous to Health Regulations 1999;
HSW	Health and Safety at Work etc Act 1974;
LOLER	Lifting Operations & Lifting Equipment Regulations 1998;

Organisations

ACR	Advisory Committee for Roofing;
BCSA	British Constructional Steelwork Association;
CIRIA	Construction Industry Research and Information Association;
HSE	Health and Safety Executive;
SAEMA	Suspended Access Equipment Manufacturers Association;
SCI	Steel Construction Institute;

Construction Industry Council
CDM Guidance for Designers

General Guidance note

The Health and Safety File

G 10.003

INTRODUCTION

Designers are uniquely placed to minimise the risks when further work is carried out on structures they have designed.

1 The CDM Regulations require the preparation of a Health and Safety File, which is handed to the client at the end of a project. This document is meant for designers and contractors, working on future projects, and should provide the health and safety information they need to assess any hazards and risks, to allow them to put in measures to control/manage them.

2 In order to be useful, the Health and Safety File should be as succinct as possible. The provision of huge volumes of information is not recommended, because it will not be read. However, there are core pieces of information, which should be supplied. This sheet provides guidance on what constitutes this core information.

WHAT THE FILE SHOULD CONTAIN

3 The file should contain enough information to allow future hazards to be identified and the risks from these hazards managed. Typically, the File should contain at least the following:

General details

4 This section is very basic and should form an introduction to the file. It should contain:

(a) The address of the premise;
(b) The name of the Building Owner[1];
(c) The names and addresses of -
 (i) The Architect;
 (ii) The Structural/Civil Engineer;
 (iii) The Quantity Surveyor;
 (iv) The Building Services Engineer;
 (v) The Planning Supervisor;
 (vi) The Principal Contractor; and
 (vii) All sub-contractors.

1. Updated every time the building changes ownership.

5 In addition, there should be no confusion about whether the File is up to date, why it was revised and how many pages it contains.

General arrangement drawings

6 Sufficient general arrangement drawings should be provided, to ensure that subsequent designers are able to abstract information about:

(a) Architectural form;
(b) Structural layout [including foundations];
(c) Materials used: type, strength;
(d) Layout of building services, internal and external including:
 (i) Drains;
 (ii) Mechanical plant and ducting;
 (iii) Electrical wiring;
 (iv) Plumbing; and
 (v) Utilities: gas, electric, etc.

Basis of design statements

7 This information is intended to allow subsequent designers to identify and assess any hazards associated with the building form and its finishes, to allow them to design to minimise the hazards. It should, at least, contain the following:

Basis of civil and structural design

8 provided by the Civil/Structural Engineer, to allow subsequent designers to specify processes, which will not release the potential for harm held in the existing structure. This should include information about:

(a) The basic structural form, eg, a pin-jointed steel frame with bracing;
(b) The methods of structural analysis, including the names of any computer programmes used;
(c) How the characteristic loads [occupancy and environmental, eg wind] were derived. List the British or European standards used;
(d) The wind loads: basic wind speed used and a brief resumé of how the building was defined for calculating wind coefficients;
(e) How the structural elements in the structure were designed. List all standards [with their date] that were used;
(f) **Any deviations from the requirements in the listed standards**;
(g) Critical components and how they work, eg, fixing of pre-cast walling;
(h) Requirements for and provisions for future maintenance, eg, repainting steel, resurfacing roads;
(i) How the calculations may be obtained, eg, file reference numbers;
(j) How the building could be demolished or dismantled.

Basis of design for external services

9 provided by the Designer of the services, to help designers to minimise the risks associated with working on or close to existing services. This should provide information about:

(a) The general form of the ground that the services were installed in, including any areas of significant hazard, eg, made ground;

(b) The location of services, referenced from a fixed point on the building;
(c) The average depth of the services and utilities and their maximum depths;
(d) Types of backfill used.

(e) For drainage runs, the following additional information would be useful:
(f) The falls of the drains;
(g) The length, size and unit weight of the pipes;
(h) The location of any drains, which carry highly hazardous waste from, eg, pathology laboratories, petrol interceptors, etc;
(i) A manhole schedule giving diameters, depths and form of access arrangements, eg, mild steel ladders;
(j) Provisions for future maintenance.

Basis of architectural design
10 provided by the Architect, to allow subsequent designers to specify processes, which will not release the potential for harm held in the building fabric. This should, at least, include information about:
(a) Partitions: generally materials and finish [2];
(b) Fixtures and fittings: materials, eg, MDF;
(c) Ceilings: materials and type;
(d) Paint: generally type, location and COSHH data sheets [2];
(e) Roof assemblies: materials and where applicable non-fragile life;
(f) Glazing: type, weight and its location;
(g) Adhesives: general type, location and COSHH data sheets [2];
(h) Provisions for future maintenance, eg, cleaning of glass, gutters, external painting, including assumptions about how it would be carried out;
(i) Provisions for demolition and dismantling;

2. Including any deviations from the generality and their locations.

Basis of design for building services
11 provided by the Designer, to allow subsequent designers to minimise the risks associated with the work required to maintain/supplement existing services. This should include information about the following:
(a) The location of services, referenced from a fixed point on the building;
(b) The average height of the services in an area and their maximum and minimum heights;
(c) The general maximum length, size and unit-weight of service run components;
(d) A schedule of deviations from the generality of (c) and their locations;
(e) Significant hazards associated with pieces of equipment, eg, high voltages, high pressures, high temperatures, and their locations, etc;
(f) Provision for future inspections and maintenance and assumptions about how they would be carried out, eg, from a step-ladder; and
(g) How the services could be dismantled.

Other relevant information
12 *Site specific hazards* which existed when the project was executed should be highlighted in the Health and Safety Plan, for example, this may include:
(a) Site constraints, eg, delivery times, vehicle size restrictions, limitations on working hours, restrictions on generation of dust, etc;
(b) Peculiar local permissions, eg, work close to railways, canals, trunk roads or on listed buildings;
(c) Stability of adjacent structures;

13 *Drawing schedules* listing the working drawings that were issued and the address from which they would be available. The drawings should be as-built drawings.

14 *File revisions*, which should be updated every time work is carried out, which changes either the fabric or the form of the building and its associated services. Superseded parts of existing files should never be left in a state, which could cause confusion about their status.

LENGTH OF THE FILE

15 The File should only contain relevant information. An estimate of how long it should be is given in table 1 below:

Section title [para reference]	**Originator**	**Length*** [pages]
Contents	Planning Supervisor	1
General details	Planning Supervisor	1-2
GA drawings	all	6**
Basis of designs		
Structural [8]	Structural engineer	1-2
Services [9]	Designer	1-2
Architectural [10]	Architect	1
Building services [11]	Services engineers	3-6
Other relevant	Planning Supervisor	1-2
Total excluding drawing schedules		15-22

Table 1: Guidance on length of file
* Suggested
** A3 preferable

Construction Industry Council
CDM Guidance for Designers

Designing to make management of noise in construction easier

Health Guidance Series

H 20.002

INTRODUCTION

1. Designers can play a major part in making it easier to manage noise in construction.

2. Noise is a health hazard, which has a cumulative effect that could, eventually, lead to deafness. Unfortunately, in construction, high noise levels are encountered in many situations, exposing a large number of workers to a potential health hazard.

3. The most effective way of reducing exposure to noise is to design it out of any process. However, it is recognised that with the current state-of-the-art plant and machines, this is not always possible. In these situations, designers should concentrate on not creating conditions in which the effects of noise are exacerbated.

4. This guidance note gives advice about how designers can limit the effects of noise.

HAZARDS ASSOCIATED WITH NOISE

5. Noise has a cumulative effect on a persons hearing. Continuous exposure to noise above certain limits – see table 1, could lead to impaired hearing and, in the worst case, deafness.

WHAT DESIGNERS SHOULD DO

6. Designers should give consideration to measures, which either remove the hazard of noise or lessen its cumulative effects.

7. Although exposure to noise in construction is inevitable with much of the state-of-the-art plant that is available, there are some construction processes, which are no longer necessary. In these cases, designers should not specify work, which requires such processes to be carried out. For example:

a) Scabbling "green" concrete to achieve a bonding surface is not always necessary. Instead, designers should specify:
   i) retarding and washing off the joint interface;
   ii) cast in proprietory joint formers;
b) Saw-cutting joints in concrete should be avoided and cast in crack inducers specified instead;
c) Chasing walls for services should not be necessary:
   i) in new buildings, built-in ducting should be specified;
   ii) in existing buildings, consider overcoating existing plaster if it is sound enough to do so and build ducts in;
d) Build proprietory ties into masonry joints instead of specifying site shot-firing;
e) Avoid site drilling wherever possible, eg: specify cast-in anchors instead of the drill-and-fix type;
f) Site grinding, cutting, etc should be kept to a minimum. For example by:
   i) detailing mesh reinforcement to suit designed bay sizes rather than cut to suit on site;
   ii) specifying non-standard concrete blocks as specials, to be cut off site under controlled conditions;
g) Specify road and slab bases, which do not require the use of noisy rollers, eg, dry-lean concrete;
h) Avoiding vibro-compaction of ground.

8. The health risks associated with exposure to noise can be lessened, by reducing a workers continuous exposure to noise. Table 1 below sets out some continuous exposure limits:

Table 1: Allowable exposure to noise

Noise level dB(A)	Allowable unprotected exposure
90	Up to 6 hours
95	Up to 4 hours
105	Up to 1 hour

Source – The Centre to Protect Workers Rights [www. Osha-slc.gov]

Therefore, when it is reasonably practicable to do so, designers should consider how they could limit a person's exposure to noise or specify quieter processes – see **7.** Other examples include:

a) Designing the position of construction joints, etc, to limit the size of concrete pours to what can be achieved in two hours;
b) Designing for and specifying the quieter methods of driving piles, which are available.

9. In addition, to lessen the risk of increasing the intensity, designers should, if it is possible to do so, limit the number of noisy operations that need to be carried out in enclosed spaces with hard surroundings. Situations in which the intensity can be increased include:

a) Inside of box-girders – grinding welds, using powertools;
b) The inside of concrete structures – usually, but not exclusively, a problem associated with refurbishment work;
c) In sewers, box-culverts and manholes;
d) In cofferdams.

10. Some plant has been designed with noise reduction attachments. Designers should find out about these items and, where it is possible to do so, modify their designs to suit their use, if it is necessary to do so.

NOISE – SOME BACKGROUND INFORMATION

Noise levels

11. Noise is measured in decibels, dB(A). Decibels are measured on a logarithmic scale. So when the decibels go up by a small amount, the level of noise actually goes up a lot. For example, 73 dB(A) is twice as loud as 70 dB(A), ie, 70 dB(A) + 70 dB(A) = 73 dB(A).

12. We talk at 60 dB(A). There is consensus that if you have to shout to talk to someone who is about 2m away, this is an indication that noise is approaching levels at which it becomes a hazard.

13. Noise dies off with distance from the source. For example, noise at 3m from an item of plant is four times greater than the noise at 20m away.

Where noise is encountered

14. On construction sites, most of the machines used are noisy, above action levels. Some examples of noise levels are given, in table 2 below.

15. This means that people working on construction sites, close to one of these operations, is inevitably going to be exposed to the debilitating effects of exposure to noise above action levels.

16. In addition, in certain conditions, when reverberation is possible, the intensity of noise can be increased. Such increases in intensity are normally encountered in environments that are enclosed by "hard" walls and roofs, off which reverberation is possible, eg: brick, concrete, steel.

17. High intensity noise, ie, noise above 100 dB(A) is very damaging, even in very short durations. Therefore, some construction processes, eg, shot-firing using cartridge guns, should be avoided at all costs, because the effects of noise are cumulative.

Table 2: Likely noises levels associated with construction plant and machines [para 14]

Plant or machine	Likely noise level dB(A)**
Asphalt pavers	**<** 85
Concrete drills	> 85
Concrete grinders/cutters	~ 100
Concrete scabblers	100
Pile drivers [traditional methods] [See also SCI Pub P308 table 4.1]	> 100
Pneumatic hammers & breakers	> 100
Sandblasting plant	> 85
Shot-firing gun [cartridge tools]	> 120*
Dumpers	> 85
Excavators [JCBs etc]	< 85
Rollers	> 85
Concrete vibrators	> 85
Normal conversation [for comparison]	~ 60

Source – Noise in Construction [HSE] & OSHA
* Short, very loud [impact] noises do most harm.
** The first action level for noise is 85 dB(A)

USEFUL REFERENCES

Noise in construction [HSE]

Construction Industry Council
CDM Designers' Guides

Designing to make management of hazards in refurbishment work easier

Technical Guidance Note

T 20.005

INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with refurbishment work.

2. Refurbishment figures prominently in HSE statistics as an industry in which accidents happen. Many of these accidents would have been avoided, if the right decisions had been made at the design stage.

3. Refurbishment work often exposes workers to the hazards associated with demolition. In addition, the stability of a structure during refurbishment often depends on the load carrying capacity of existing structural elements, some of which are very old or have had their sections reduced, i.e., weakened, to accommodate the new scheme.

4. Another significant factor is that refurbishment work is often carried out in or close to areas where the public are likely to be, exposing them to the risks associated with refurbishment. Therefore, great care needs to be taken by designers and contractors, to ensure that refurbishment work is carried out safely.

HAZARDS ASSOCIATED WITH REFURBISHMENT

5. The main hazards associated with refurbishment work include:

a) Uncontrolled collapse of the structure or part of the structure during:
   i) Demolition and dismantling, and
   ii) Rebuilding;
b) Exposure to substances harmful to health;
c) Falling from height;
d) Working on confined sites.

WHAT DESIGNERS SHOULD DO

6. Designers can help by eliminating these hazards completely or by designing to ensure that they minimise the chances of the hazard occurring.

Preliminaries

7. In order to assist with this, designers should find what they can about the building or structure to be refurbished, or advise clients that they have a duty to do so. Such information is available from a number of sources - see Table 1 in Technical Guidance Series **T 30.001 Demolition**. In addition, surveys of the existing building should be carried out.

8. The information referred to in **7** should, at least, include information about:

a) *The age of the building:* which should indicate whether a design code existed, when the building was designed. A chronology of design codes for some common structural materials is given below, in table 1. These standards will provide information about design techniques and assumptions and material strengths, which prevailed during their currency.

Table 1: Chronology of design codes and standards

Steel	**BS 449**: 1932, 1948, 1959 & 1967 **BS 5950**: 1985 & 1990
Concrete	**CP 114**:1957 & 1969 **CP 110**: 1970 **BS 8110:** 1985
Masonry	**CP 111**: 1948, 1964, 1970; **BS 5628**: 1978

b) *Building structural form:* This is necessary to allow a full analysis of the existing structure to determine:
   i) Load paths,
   ii) Individual member or frame loadings,
   iii) How the new infrastructure could relate to or may be supported by the existing,
   iv) Whether there is any pre-stressed or post-stressed concrete construction present, and
   v) Whether solid masonry walls are, in fact, solid

   Knowing the construction techniques of an era would help this, because this could affect the design of the refurbishment. This information can be found by reading some of the books referenced at the end.
c) *Building condition:* to allow an assessment of how much of the original load capacity is still available. In addition, this could alert designers to faults like:
   i) Dry-rot in timber;
   ii) Carbonation of concrete;
   iii) Corrosion of steel, etc.

   In addition, this should provide information about construction methods that should not be specified – see **13**.
d) *Materials of its construction*: to assist with -
   i) Deriving the design strength of the existing structure; and
   ii) Decisions about what processes may be applied to the materials, to ensure that these processes do not release harmful by-products – see General Guidance Series **G 030.001 What Designers Should Know**.
e) *Any requirements for testing*: to provide credible assessments for strength and composition.
f) *Building past uses*: which will indicate what substances harmful to health are present - see General Guidance Series **G 30.001** and Health Guidance Series **H 10.001 Hazardous Materials**;
g) *Any site Restrictions*: which could control what can be delivered to site and lifted – see **19** a) or manhandled – see **19** f)ii).

9. For buildings constructed before 1985, an asbestos survey must be carried out.

Designing to avoid uncontrolled collapse during small-scale demolition or dismantling

10. To avoid uncontrolled collapse, designers should ensure that individual members and existing structural systems are not overloaded by:

a) Making sure that the global and component strengths of the existing structure are calculated;
b) Determining what of the existing structure is critical for ensuring stability, to ensure that these components or structural systems are either not removed or removed only after specially designed temporary works are in place;
c) Highlighting these members and systems **unambiguously** on a drawing and informing the contractor about the loads the temporary works will support, eg: when removing load-bearing walls;
d) Informing the contractor about residual strengths in existing members, eg: floors, which could help a contractor to determine how much load can be applied to them – see also 9a) (iii) and 9b) (iii).

Designing to avoid uncontrolled collapse during rebuilding

11. To avoid collapse while rebuilding, designers should ensure that the forces applied during construction do not exceed the capacity of the existing structure, especially:
a) Where stability depends on the interaction between the existing structure and the new components, eg:
  i) Can the existing structure carry the loads applied by any new structure?
  ii) Where roof trusses are being retained, what temporary bracing is required?
  iii) Where temporary works are to be supported on the existing structure, eg: props on existing floors;
  iv) Where construction loads could be significant, and could require careful control during erection, eg: rate of pouring concrete.

12. Wind during construction, eg, voids in facades can have a significant effects, and should be considered.

13. New work carried out close to an existing structure should be designed taking account of the stability of the existing structure eg:
a) Underpinning should be carefully detailed and sequenced;
b) Excavations should not undermine existing foundations;
c) Driving piles should not affect fragile facades;
d) Temporary works equipment should not affect the stability of existing structures.

Designing to avoid exposure to substances harmful to health

14. In existing buildings, many harmful substances may already be present from previous specifications. Typically, the following may be found in old buildings:
a) Lead, in paint;
b) Arsenic, in wood preservatives;
c) Asbestos – see Health Guidance Series **H 10.002, Asbestos**;
d) Horse-hair in plaster;
e) Combustion by-products in chimney flues.

15. The design should not specify processes, which may release the potential for harm in these materials, eg, grit-blasting lead paint. Any uncertainties about what to do about what has been found should be discussed with someone competent.

16. Neither should the new design specify materials nor assemblies, which could be:
a) Harmful to health, eg, solvent paints –see General Guidance Series **G 30.001 What Designers Should Know**; and
b) Unsafe to work on or near, eg, fragile materials.

17. Knowledge about previous building use may provide information about biological and other hazards that may be present, eg, toxic metals.

Designing to avoid falls from height

18. This usually occurs where workers are required to work near unguarded edges or newly created openings in floors and external walls. This is illegal and its control is the responsibility of contractors. However, where possible, designers should prevent these situations occurring. Where it is unavoidable, they should consider the requirements for the provision of PPE [work restraint], while these openings are being created and for protecting the open edges [barriers or coverings] afterwards - see Technical Guidance Series **T 20.008 Working at Height** and **T 20.007 Use of PPE**.

Designing to facilitate work on confined sites

19. Where refurbishment projects are carried out on congested sites, eg: town centres, inside buildings, etc, site work could be constrained by other considerations, eg: the need to ensure traffic flows and pedestrian movements. Therefore, designers should:
a) Restrict members to sizes, which can be lifted by a crane that can fit within the site constraints;
b) Restrict the weight of members, which have to be manhandled into location and position, eg: in existing buildings. For example, a UB could be designed to be:
  i) Replaced by 2 $\times$ lighter RSCs back to back; or
  ii) Erected in parts and spliced on site.
  Information on manual handling is given in General Information Series **I 001 Manual handling**.
c) Allow as much off-site prefabrication as possible;
d) Minimise construction loads, eg, by specifying composite construction, lightweight partitions;
e) Require processes, which can be carried out by plant that can operate within the confines of the site, eg: mini-pilers in basements;
f) Restrict the lengths of components to fit in with:
  i) The size of delivery vehicle that can be used;
  ii) Manhandling within an existing buildings, eg, around corners, along corridors, etc.

USEFUL REFERENCES

SCI Publication 138 - Appraisal of Existing Iron and Steel Structures **:** The Steel Construction Institute;
CIRIA report C579 – Retention of masonry facades, best practice guide;
Appraisal of existing structures [2nd edition] Institution of Structural Engineers
BCSA Publication 11/84 Historical Structural Steelwork Handbook
Building Construction and Drawing CF Mitchell [BT Batsford Ltd]
BRE Digests - Various

Construction Industry Council
CDM Guidance for Designers

Designing to make management of hazards associated with temporary works equipment easier

Technical Guidance Note

T 20.006

INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with temporary works equipment [TWE].

2. Temporary works are provided either to provide access to the workplace or to support the permanent works, until design strengths have been achieved. If designers ignore their responsibility in this area, the provision of adequate temporary works could become impossible and workers using them could potentially be put at risk.

3. Except for special circumstances, designers do not need to tell a contractor how to build something or to anticipate the actual method of construction. However, they should be able to demonstrate that their design can accommodate a method of construction, which is safe.

4. There are two reasons why designers ignore issues associated with temporary works:
a) Some consider them to be a contractor's problem;
b) Others do not understand what is required.

5. However, designers can no longer ignore these issues, because there are hazards associated with temporary works, which designers should be aware of. Such knowledge would help designers to facilitate the provision of safe temporary works. This guidance deals with the issues associated with temporary works equipment

HAZARDS ASSOCIATED WITH TEMPORARY WORKS EQUIPMENT [TWE]

6. The hazards associated with TWE include:
a) Instability of the temporary works;
b) Manual handling: heavy loads, awkward shapes - mainly for falsework; and
c) Falling from height: people and objects.

WHAT DESIGNERS SHOULD DO

7. Although control of many of the hazards associated with TWE are a contractor's responsibility, designers of the permanent works should give consideration to measures, which would assist a contractor in controlling them, including Providing:
a) TWE lateral stability attachment points;
b) fall protection attachments;
c) Information on loads to be carried where the design requires retention of structural components, especially load bearing ones;
d) Information on capacities of structural components, which could be used to support temporary works, eg:
 i) suspended floors under props;
 ii) ground under TWE bases;
 iii) lateral stability requirements, eg, for beams carrying formwork, for trusses carrying stacks of roof sheets, etc;
 iv) Back-propping requirements;
e) Information on lateral thrusts exerted by permanent works, which TWE will support until the structure is complete, eg:
 i) from portal frames, which are resisted in the permanent state by tying into the floors,
 ii) from arches;
f) Important information about the restrictions on the use of the permanent works that [is known] will be used to support the temporary works for following on works, eg:
 i) strength gain of masonry walls carrying joist hangers;
 ii) strength gain of rc floors;
 iii) steelwork, which relies on lateral restraint from other connected members;
g) Adequate space around the permanent works for TWE. For example:
 i) The width of scaffold can be in the range 600mm[access only]– 1200mm [heavy duty], depending on the duty rating;
 ii) Where scaffold cannot be attached to the permanent works, stabilisation by rakers is possible but this needs additional space;
 iii) Mobile towers can be 1.2 x 2.4 m in plan, excluding outriggers;

BACKGROUND INFORMATION ON TEMPORARY WORKS EQUIPMENT

8. While temporary works are governed by the same design rules as permanent structures, they are different enough to have their own dedicated design standards (British or European). Many temporary works are still constructed according to custom-and-practise, and the best of these practises are included in the standards.

9. Designers should read these standards, to gain a better understanding of safe use of temporary works.

10. Temporary works fail for a multitude of reasons. For example, collapse resulting from components essential for their stability being omitted, or in some cases, these omissions resulting from careless erection. In other reported cases, the form of the permanent works made their installation virtually impossible. For example, it is extremely difficult to tie a scaffold to a glass façade, unless provision has been made for it.

11. This guidance covers **scaffolding, edge protection, falsework** and **mobile access towers**, which have rules for safe use that designers should be aware of. Some of these rules are set out below.

Scaffolds

12. Design of scaffolds is covered in BS 5973, which requires the following for their stability:

Frequent tying

13. Therefore, designers should consider providing tying points, capable of supporting 10 kN applied horizontally:

a) For tube and fitting scaffolds:
   i) at least every $40m^2$; or
   ii) for scaffold < 8 m high, ensure there is clear space around a scaffold to install rakers inclined at 1 in 4;

b) For prefabricated scaffold systems, this is required on every standard [approximately] every 4m;

And inform the contractor about what has been provided.

14. Scaffolds can cantilever a maximum of 2 m above a tied lift. Therefore, if it is required to use a scaffold in this way, eg, for building masonry walls, detail the masonry so that it can be built up in 2 m lifts.

Control of loading

15. In some cases, eg, with blocks, bricks, etc, control of loading is normally out with a designer's control. However, where it is within their control, eg, glazing units, lintels, etc, they should consider minimising their weight and/or provide information about their weight.

Good foundations

16. Therefore, service runs requiring excavations should, if possible, be kept away from areas where it is assumed scaffolds will be erected.

Stability of Scaffolds

17. Where it is not possible to use the structure to tie scaffolds, designers should inform contractors about this, consider the possibility that buttresses or outriggers could be used instead and ensure that there is enough space to install them – see **13** a) ii).

Edge Protection

18. While provision of edge protection is a contractor's duty under law, designers should consider how its provision could be facilitated, by design, into the permanent works. For example: 50mm ID $\times$ 100mm long tubes welded to steel or cast into rc, wherever there is an edge, eg, building perimeters, stair and lift wells, etc; at 3 – 6 m centres, would be suitable for most configurations of edge protection. Prefabricated systems are available and information on how these can be incorporated into the design can be obtained from manufacturers.

19. Overhanging eaves and gables present problems, but they can be solved, because much of the prefabricated edge protection currently available has been developed for connection to the permanent works. Therefore, consider discussing possible solutions with suppliers before developing a design.

20. Parapet walls incorporated into the design could act as edge protection. However, they must be at least 950mm high, to comply with the Law.

21. Welding a small bracket on to columns, would allow edge protection to be attached to the columns. The bracket could then be used for gutter support.

22. Roofs with slopes in excess of 30^0 are difficult to provide edge protection for, because existing systems will harm the person sliding into it.

23. BS 1139: Part 3 [implementing HD 1000] covers requirements for edge protection:

24. Where provision of barriers is not practical, the law allows the use of personal protection systems [PPE]. Information on designing for the provision of fall arrest systems is covered in Technical Guidance Series **T 20.007 Use of PPE**.

Falsework

25. Designers should produce schemes, which do not, as far as possible commit contractors to:

a) Providing falsework that is so heavily loaded it has to be closely spaced and makes movements in and about it difficult;

b) Regular movement of plant close to or in between falsework, eg:
   i) By requiring falsework solutions close to excavations for drains, foundations, etc;
   ii) By requiring the erection of other structures close to falsework;

   Generally plant should be given a clearance of its slewing radius + 600mm from any falsework

c) Fabricating complicated shapes, which could require people to work at height for long periods;

26. In addition, designers should:

a) Incorporate as much as possible of the falsework into the permanent works, eg:
   i) Sheet-piles into sub-terranean walls;
   ii) Permanent shuttering;

b) Make available any information about site conditions, eg, wind, geotechnical, tidal, etc;

c) Ensure that the permanent structure can carry any falsework loads that will be applied, eg:
   i) In multi-storey construction the floor at level n can carry the loads from constructing the floor at level n+1;
   ii) For temporary propping, that the structure under the prop(s) will carry the concentrated prop loads;

d) For internal façade retention schemes, ensure that any cross-connections will not interfere with plant movements inside the building.

27. BS 5975 covers the design of falsework.

Mobile access towers

28. Mobile access towers [MATs] are prone to toppling therefore, designers should:

a) Inform the contractor if the intended operation will require significant physical effort, eg, pulling cables through ducts;

b) Allow sufficient clear space around areas where use of MATs is intended and include for outrigger extensions, eg, in corridors;

c) Avoid locating obstacles, eg, steps in floors, holes, etc, in areas where the use of MATs is anticipated;

d) Be aware that the use of MATs on uneven or soft formations should be avoided;

e) MATs should not be used free-standing if they are higher than 8m outdoors and 12m indoors;

f) MATs come in pre-set module sizes. Check that module sizes, including a 1 m guard-rail, will fit into the vertical space allocated while offering a comfortable working stance;

g) Be aware that using free-standing MATS on exposed sites is potentially hazardous.

29. BS 1139:part 3 covers Mobile Access Towers.

Construction Industry Council
CDM Guidance for Designers

Designing to make management of hazards associated with working on roofs easier

Technical Guidance Note

T 20.009

INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with roof working.

2. Roofs are hazardous places to work, because they are at height and have coverings, which are lightweight and often fragile and deteriorate over time through being exposed to the elements.

3. While work on roofs is an infrequent activity, the opportunity for a fatal or serious accident is very high. And, designers who see roofs only as a means making the building watertight, exacerbate the situation. They forget that people have to construct roofs and maintain them. Consequently, little provision is made for this.

4. People are often killed or injured when falling from roofs. Therefore, designers need to consider alternative designs to ensure roof work can be eliminated or significantly reduced where reasonably practicable.

5. This guidance note makes designers aware of the issues and gives information on how they can help to make roof work safer through their designs.

HAZARDS ASSOCIATED WITH WORK ON ROOFS

6. Workers on roofs are exposed to the hazard of falling from height. This can either be off an unguarded edge or through a fragile surface.

7. Manual handling and premature collapse hazards also exist.

WHAT DESIGNERS SHOULD DO

8. Designers should consider two phases: the construction phase and the maintenance phase

The construction phase

9. During this phase, it is inevitable that people will need to be on the roof and designers should consider providing for systems that will help a contractor to manage the hazard of falling from height.

Falls off unguarded edges

10. Constructing a roof creates an advancing unprotected leading edge and the risk from falling off this edge. Therefore, designers should consider provisions to protect the workers from this hazard by:

a) Providing effective anchor points for safety nets;
b) Or, where (a) is not possible, provision should be made for anchoring PPE to structural members with sufficient strength; and
c) Optimise the locations of close-under-the-roof obstructions, eg, service ducts, that are in the deflection zone of fall arrest devices .

11. In addition, designers should consider the provision of parapets, as the structural carcass for these will provide the necessary protection at the edges, for workers constructing the roof and for workers carrying out subsequent maintenance.

Falls though roof assemblies

12. Specify liners and top sheets, which are individually non-fragile when fixed down. Information about non-fragility is given in the Advisory Committee for Roofwork's publication ACR[M]001:2000.

Falls caused by premature collapse of structures

13. Individual roof sheets do not weigh a lot. However, the weight of a stack of sheets is significant. Therefore, ensure that the roof structure can carry these loads.

Providing for deliveries

Locate the building to ensure that there is enough space to site a crane so that every part of the building is within its lifting capacity and for incorporating dedicated loading bays, for storing roofing materials, in the scaffolding.

The maintenance phase

14. For this phase, it may not be necessary for people to be on the roof if designers consider solutions, which eliminate the need to go on a roof.

Designing to minimise the need to go on a roof

15. This can be achieved either by minimising the number of items requiring maintenance on a roof or minimising the number of times people have to go on a roof by, for example by:

a) Routing vent stacks through the building side instead of the roof;
b) Combining exhaust flues into a single vent;
c) Ensure that process by-products are effectively removed and discharged high enough above the roof to allow effective dissipation;
d) Having serious concerns about materials where the manufacturer's guarantee requires annual inspections;
e) Optimising the number and position of rooflights, taking into consideration the requirements in other legislation for providing natural light; – see **28.** Note that rooflights will require periodic cleaning to maintain correct light levels within a building;
f) Positioning gutters so that cleaning can be carried out using either cherry-pickers or from other designed safe access routes– but see **20** b) and **24** b).

16. Resealing joints is a common reason for people being on roofs. Therefore, specify durable seals and details at plant penetration points and flashings, to minimise the need for such reactive maintenance.

17. Robust structural details for areas of the roof exposed to high wind suction should ensure that damage is minimised during predictable windstorms, to minimise the need for maintenance after such storms.

18. However, where it is not possible to remove the need for people to be on the roof, designers should consider provisions which:

a) Minimise exposure to the hazards in **6** and **7**; and
b) Provide sufficient information to allow persons in control to manage the hazard.

19. Designers should consider design solutions, which minimise the chances of people falling off an unguarded edge or falling through the roof.

Minimising the risk of falling off unguarded edges

20. When people have to go on the roof to carry out maintenance, eg, it is not possible to vent exhaust stacks through the side of the building, designers should locate items that need maintenance at least:

a) 2m away from rooflights – see **28** and **29**; and
b) 4m away the edges of roofs to make it unnecessary for people to work close to the edge of the roof and impossible to carry out the work from a ladder;
c) Rooflights should not be within 2.0m of an edge.

21. In addition, provide dedicated walkways to access the items to be maintained, which should be:

a) Non-fragile and non-slip for the life of the roof; and
b) Provided with a handrail, if possible. Where this is not feasible, a horizontal line to which a lanyard can be attached should be supplied –see **23**.

22. Workers are also vulnerable at the gables and eaves. Where parapets are not desirable, design in brackets to which temporary edge protection can be fixed. Discuss solutions with suppliers of temporary edge protection.

23. Where horizontal running lines are provided, design the anchorage points. If dead-weights are the intended means of anchorage, check that the roof can support the weight of the anchor. Work-positioning systems are preferred to fall arrest systems.

Minimising the risks of falls off work areas

24. Gutters will, inevitably, need regular cleaning so, for:

a) Eaves gutters, consider providing a solid base around the building perimeter, which will allow MATs to be used – see **T 20.006**. Only when this is impractical should ladders be used, for which you should provide ladder-tying points at 2m centres close under the gutter and a hard and level base for the ladder for the full length of the gutter.
b) Valley gutters, consider making them strong enough and wide enough for people to walk in. And, for an upslope distance of 2 m either side of the gutter, specify a non-fragile ACR Class B roof assembly, where this is available – see **35**. In addition, provide dedicated access to these areas.

25. In addition, designers should provide for dedicated access points, with a solid base for either:

a) A ladder, ladder brackets at the eaves [to stop sliding] and a solid landing area on the roof; or
b) A stair tower.

Minimising the risk of falling through roofs

26. To prevent people falling through roofs, specify a non-fragile assembly. You do not have to work in isolation. Discuss your options with a supplier and ask them to supply a roof assembly, including rooflights, in accordance with one of the classifications in ACR [M]001:2000.

27. Where people have to go on a roof, eg, high maintenance roofs – see **34** c), the pitch should not exceed 6^0 and there should be dedicated access points and walkways, with handrails, to the work area.

28. As rooflights should **never** be walked on, since this may damage the surface and impair light transmission, rooflight layouts should allow cleaning from the opaque areas and passage across the roof can be in straight lines without walking on rooflights.

29. Highlight hazardous and non-walk areas, by visual warnings, eg, poppy-red fixings around rooflights.

30. When incorporating rooflights, find out how weathering will change the colour of the roof and the rooflights to avoid the whole roof ending up as the same colour. For this reason, always specify rooflights to have a non-fragile design life better than the opaque area and design the opaque colour to avoid the whole roof looking the same.

31. Where fragile assemblies are unavoidable, eg, some translucent assemblies, design in systems for their safe cleaning and maintenance.

Minimising the manual handling risks

32. Roof sheets have to be manoeuvred into position by people. Limit their size. If joints are undesirable, discuss the options with a supplier and try to accommodate his requirements in your design. Provide space around the building to site a crane [or other lifting device] of the correct size – further information on cranes is given **I 002.**

Providing information

After completing the design, which should as far as possible follow the principles set out **10** to **30**, designers should provide contractors with enough information to allow them to control the residual hazards, including information about the issues discussed in **10**(a) & (b), **12, 21, 23,** & **24**.

BACKGROUND INFORMATION ON ROOFS

33. Even non-fragile assemblies can be made fragile if the wrong type of material is specified. Therefore, pay careful attention to the environment in which the building is being erected. Known harsh environments include:

a) Coastal areas, which are highly corrosive;
b) Industrial polluted areas, which contain airborne agents of deterioration;
c) Industrial processes, which release harmful agents;
d) Animal housing

34. There are three basic types of roof:

a) *Low maintenance roofs*, which require very infrequent access, e.g. simple duo-pitched roofs requiring only maintenance that can be done from ladders or MATs. The minimum standard for this roof is a Class C assembly to ACR[M]001:2000;
b) *Medium maintenance roofs*, which require regular access for maintenance but only by experienced roof workers. The minimum standard for this roof is a Class B assembly to ACR[M]001:2000;
c) *High maintenance roofs*, which require frequent access for maintenance, e.g. roofs with penetrations for plant exhausts, etc. The minimum standard for this roof is a Class B assembly to ACR[M]001:2000.

35. Under the current state-of-the-art, not all assemblies achieve class B. However, while most can achieve class C, some are still fragile – see **31**.

36. Manufacturers' recommendations for compatible components in non-fragile assemblies should not be changed without consultation.

USEFUL REFERENCES

ACR[M]001:2000 - Test for Fragility of Roof Assemblies
ACR[CP]001:2003 – Recommended Practice for Work on Profiled Sheeted Roofs [ACR]
HS(G) 33 – Health and Safety in Roofwork [HSE]

Construction Industry Council
CDM Guidance for Designers

Designing to make management of hazards associated with concrete blocks easier

Technical Guidance Note

T 20.015

INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with using concrete blocks.

2. Decisions that affect how a concrete block wall is constructed are made very early in the design process. The criteria for the selection of the blocks to be used are many and will include, for example compressive strength, fire resistance and thermal and sound insulation. Whatever the criteria, designers should not forget that people have to work with these blocks: getting them to site, around the site and to the work face, usually on scaffolds or in trenches. Often little thought is given to what these blocks weigh.

3. Many block layers are asked repetitively to handle blocks far in excess of the recommended maximum of 20 kg, resulting in a wide range of injuries where the damage although gradual is progressive over a period of time.

4. The single-handed handling of blocks in excess of 20 kg is not prohibited as long as the process is not repetitive. In particular quoin and reveal blocks may fall into this category and it would not be expected that different measures be used to lay these types of block.

5. However, where large numbers of blocks greater than 20 kg are specified they should be handled mechanically or lifted by two people, in accordance with industry guidance that has prevailed for many years through manufacturers' literature.

6. And, while it is desirable that all block handling is confined to units weighing less than 20 kg, there will always be circumstances where it is necessary to specify blocks in excess of 20 kg. Concrete blocks that weigh more than 20 kg have traditionally been used for very specific purposes including:

a) Structural stability;
b) Fire resistance;
c) Acoustic performance; and
d) Radiation shielding.

7. This guidance note is to help designers to understand their duties and to be aware of how they can help to make the handling of blocks safer.

HAZARDS ASSOCIATED WITH USING HEAVY BLOCKS

8. The main hazard associated with building with concrete blocks is lifting heavy blocks. This puts the body under strain, which is exacerbated when blocks have to be placed away from the body and/or above waist level. The effects of having to work repetitively in this manner manifest themselves as musculo-skeletal injuries: back injuries, upper limb injuries, etc, which are very debilitating. The effects are cumulative.

9. It should be noted that there are no hard and fast rules about what is a safe load to handle, because this varies depending on where the load is held. Further information is given in General Information Series **I 001 Manual Handling**.

10. Other hazards associated with use of concrete blocks include:

a) Noise, when ties are connected by shot-firing;
b) Contact hazards from protruding ties;
c) Structural stability problems; and
d) Laying with an awkward posture.

WHAT DESIGNERS SHOULD DO

11. Designers should give careful consideration to the hazards listed above, in **8** and **10**, either to remove them or lessen their impact.

Manual handling: lifting heavy blocks

12. As the repetitive use of concrete blocks in excess of 20 kg in single-handed laying presents a significant risk to the health and safety of the person carrying out the task, designers should wherever possible:

a) Eliminate this hazard, by specifying lighter weight blocks, where heavy blocks are not necessary; or
b) Reduce the risk by using alternative detailing such that lighter weight blocks can be used that achieve the same performance criteria that heavier blocks would give.

13. If block substitution or alternative detailing is not possible, designer's should identify this hazard, to allow a contractor to:

a) Provide and use mechanical handling devices; or
b) Make provision for two person teams to be employed in the lifting of the blocks.

This information should be included on drawings, in specifications and bills of quantity. And it **must** also be included in the pre-tender health and safety plan.

14. When a design requires properties that blocks greater than 20 kg would supply, there are available a number of options utilising lighter blocks, which a designer should consider. The appropriate choice depends on the specific application and the characteristic performance requirements of the wall but essentially the choice is as follows:

a) Choose a cellular or hollow block instead of a solid block that has identical properties;
b) Re-assess the design and use alternative construction details such as:
   i) laying blocks flat to achieve the 190 or 215 mm width wall suitable for plastering;
   ii) collar-jointing* to form a 190 or 215 mm wall. This type of detail is unsuitable for use as a party wall in dwellings;
   * collar-jointing is the laying of blocks back to back in normal construction incorporating a 10-15 mm mortar joint between the adjoining block faces. The two leaves are then tied together using appropriate brick ties or bed joint reinforcement.
   iii) internal sound insulation, which satisfies the Building Regulations, can be achieved using lightweight blocks and cavities;
   iv) in basements, using reinforced hollow blockwall construction** to achieve strength;
   ** Re-bar passes through the block and the voids filled with concrete producing composite action between the block and the reinforcement.

15. In addition, blocks with built in lifting aids are available and should be specified when their properties meet the requirements of the design.

Noise

16. Where it is necessary to tie walls together, built in ties should be used in preference to ties shot fired to the blocks on site – see **H 20.002**.

17. Also, to reduce the need for cutting blocks on site, designers should draw a contractor's attention to the fact that cutting blocks is a hazard.

Contact

18. The prevention of contact hazards is a site management problem, which designers can do little about. However, if ties that can be bent up and still supply the requirements are available, they should be specified.

Structural stability

19. "Green" blockwork is susceptible to collapse, especially when the erection requirements are different from normal erection procedures. This is usually only a problem when:
a) Blockwork cannot be built in conventional 2m lifts. But this hazard can be managed as long as designers inform contractors about such limitations;
b) The blockwork is loaded before it has achieved sufficient strength, which usually occurs when:
   i) joist hangers are used to support floors, which allows floors to be installed very soon after the wall has been built, providing a surface on which to stack blocks, which frequently occurs; and
   ii) pc floor or roof units are placed on external cavity walls where the inner [supporting leaf] is built up too far in advance of the outer leaf.

To prevent these types of instability, designers should make a clear statement about:
- when the walls can be loaded,
- what loads the walls can carry at these early stages,
- detailing pc units to be supported on the full width of the inner leaf;
- checking floors for the loads floors that may be applied by any propping scheme, to allow a contractor to back-prop the floors safely.

c) Infill panels are not properly tied in to the framing members, which may be avoided by informing the contractor of the necessity to tie in;
d) The mortar used is different from what the designers specifies, eg, highly plasticised. While this is out with a designer's control, if the type of mortar is critical to the performance of the blockwork, designers should emphasise this;
e) Structural rules-of-thumb, eg, that you can build a block wall up to 10 times its thickness without support, do not apply, eg, lightweight walls or walls subjected to local wind conditions.

Laying in awkward positions

20. If ducts and other services are installed before internal walls are built, blocklayers are, sometimes, forced to adopt awkward postures to lay blocks around these obstacles. In addition, it could be difficult to erect scaffolds to legal standards, because these obstructions get in the way. To overcome this, designers should leave penetrations in walls, which can be filled in later with appropriate sound and fire-retardant material. Such penetrations should, preferably, have whole-block dimensions.
Note: In order to achieve this, designers will have to give consideration to grouping service runs and to hanging them closer to ceilings.

BACKGROUND INFORMATION ON BLOCKS

Market availability

21. The market for concrete blocks is divided into two distinct sectors:
a) Aggregate concrete blocks that take around 70% of the market of which 95% weight 20 kg or less. These blocks are made up of small-scale solid blocks, lightweight aggregate blocks and cellular or hollow blocks; and
b) Aerated concrete blocks that account for 30% of the market share.

USEFUL REFERENCES

Guidance Notes on the Use of Dense Concrete Masonry - Concrete Block Association

Manual Handling Operations 1992 - Guidance on Regulations - Health and Safety Executive

Handling heavy blocks - Health and Safety Executive Information sheet No37

Construction Industry Council CDM Guidance for Designers CDM Guidance notes: Editing Control Sheet	General Administration Note A 002

Sheet ref	Revision	Date	The following paragraphs were revised
General Administartion Series [A Series]			
A 000	00		
A 001	00		
A 002	01	3/3/04	Revisions from editing meeting of 3/3/04 entered
A 003	00		
A 004	00		
General guidance Section [G series]			
G 10.001	01	3/3/04	5, 6 & 11[rewritten]
G 10.003	00		
G 30.001	01	3/3/04	4, 5(b), 6(d), 8, 8(b), 9, 11(d)(v), Table 1, 16, 17(c) and 17(d).
Health guidance Section [H series]			
H 10.001	01	3/3/04	10(c) and Useful References
H 10.002	01	3/3/04	2, 6, 10(a), 10(f), 20 [new 20 a)] & 22[rewritten]
H 20.001	01	3/3/04	11(d), 11(e)(ii), 12(c), 13, Table 1
H 20.002	00		
Technical Guidance Section [T series]			
T 10.002	01	31/8/04	2, 8(d) added, 19(b)
T20.001	01	3/3/04	2, 3(c), 4, 5, 5(a)(i), 7(b), 13
T 20.002	01	3/3/04	New 3, 8(h), new 8(j), 9, 20
T 20.005	00		
T 20.006	00		
T 20.008	00		
T 20.009	01	3/3/04	8(c), 12, 15, 16, 22, 26, 28, 29, 32
T 20.012	01	3/3/04	5, 7, 8, 10, 13
T 20.014	01		9(c), 15, new 17(g)(i), 17(h), Useful References
T 20.015	00		
T 30.001	00		
General Information Section [I Series]			
I 001	01	3/3/04	Figure 1, Table 3
I 002	01	3/3/04	6, 8(b), 10, 14 deleted, new 15, 24

CDM Guidance Notes
INDEX

This index shows the parts so far issued in standard text. Items shown thus: **G 20.001** Bills of quantity are planned.

It should be noted that the issue of the guides is dependent on the availability and currency of information and on the ideas and needs expressed by participants.

Opportunities for feedback and contributions are allowed for in **A 003**. Such contributions would be welcomed.

Compliance with these guidance notes does not necessarily confer immunity from prosecution under health and safety legislation.

NOTE: Always check you have the latest revision.

Revised text is highlighted and underlined for eas of identification thus: revised text.

Current revision:
~~00 issued November 2003~~
01 issued August 2004

T 20.009	Designing to make management of the hazards associated with working on roofs easier	01
T 20.010	Designing to make management of the hazards associated with large-scale building components [lifts, cladding, etc] easier	
T 20.011	Designing to make management of the hazards associated with small-scale building components [windows, doors, etc] easier	
T 20.012	Spatial design considerations to make management of hazards associated with construction easier	01
T 20.013	Designing to make management of the hazards associated with interior finishing easier	
T 20.014	Designing to make management of the hazards associated with maintenance easier: Suspended Access Equipment	01
T 20.015	Designing to make management of the hazards associated with concrete blocks easier	00
Series T 30	**Hazards associated with Demolition, Dismantling and Decommissioning**	
T 30.001	Designing to make management of the hazards in demolition, dismantling and decommissioning easier	00
BUILDING SERVICES SECTION [B Series]		
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Construction Industry Council CDM Guidance for Designers

Preparing practice policies

General Guidance Note

G 10.001

INTRODUCTION

1 A practice CDM policy should demonstrate that a design practice:

a) Is committed to implementing the CDM Regulations;
b) Is committed to an ongoing learning process;
c) Treats CDM as part of the design process.

2 It should also contain concise practical advice for designers about how they can satisfy their duties under regulation 13.

3 And, like any other design aid, it should assist designers in acquiring an awareness of CDM, by the development of concise and user-friendly practice policies, containing information, which will, over time by continued use, become a natural part of the design thought process.

4 This guidance note gives advice on what a practice policy should contain for it to be effective, ie, one that helps designers to discharge their statutory duties under the CDM regulations.

CONTENT OF PRACTICE POLICIES

Preliminaries

5 It is necessary to demonstrate that the Practice Principals support the implementation of CDM. <u>It could</u> contain a statement to this effect, signed by the Principal with responsibility for CDM.

6 In addition, <u>the policy could clarify</u>:

a) The level of CDM knowledge that it expects people at various levels in the company to have. For example, it may not expect a draftsman to have the same level of knowledge as a senior engineer; and
b) Who is responsible for the CDM overview on projects.

Brief overview of CDM

7 There is not a lot to be gained by restating the regulations in the Policy. It is more important to ensure that designers understand the main principles behind the regulations, which are, in order:

a) to make the dangerous non-dangerous, i.e., remove the hazard wherever it is possible to do so; or
b) to make the dangerous less dangerous, i.e., reduce the chances of the hazard occurring; and then
c) to provide sufficient information about residual hazards, to help a contractor to manage the hazard on site;

Technical content

8 The information in the General Guidance Series **G 30.001 What Designers Should Know**, provides a good starting point for the development of the contents in a practice policy.

9 To help designers gain an awareness of the issues dealt with in **G 30.001**, practice policies should contain a list of the hazards on construction sites, which a contractor has to control by law under:

a) Construction (Health, Safety and Welfare) Regulations 1996;
b) Control of Substances Hazardous to Health Regulations 1994;
c) Noise at work Regulations 1998;
d) Lifting and Lifting Operations Regulations 1998;
e) Confined Spaces Regulations 1996;
f) Manual Handling Regulations 1994.

10 A simple statement of what hazards exist is of little use, unless designers understand where they could be encountered or how they could be created, because this is not always obvious [from the text of the Regulations].

11 <u>Within design, choices have to be made. Depending on the choices made, different hazards will arise</u>.

Unavoidable hazards

12 Unavoidable hazards are linked to a necessary process and workers can be exposed to single obvious hazards, eg: side slip in an excavation, or combinations of obvious and not so obvious hazards, depending on their work situation. For example:

a) In an excavation workers will encounter [are exposed to] the obvious hazard of collapse of the sides of the excavation. But, depending on where the excavation is, they could also be exposed to hazards associated with:
   i. Flooding, in excavations below the water table;
   ii. Confined spaces in deep and narrow excavations;
   iii. Hazardous material in contaminated land;
   iv. Explosions, on sites containing methane, etc.
b) Operatives installing pipe-work between beams will encounter [are exposed to] the obvious hazard of working at height. However, if the beams are sufficiently close together and are of sufficient depth, they may also be

exposed to the hazard of working in a confined space.

Practice policies should identify this matrix of hazards and present it in an easily understood form. Tabular layouts, which provide at-a-glance guidance are known to be effective.

Hazards created by design

13 When designers specify a construction process, they could be creating a hazard, because the specified process could expose workers to the harmful side effects that accompany it. For example:

a) Scabbling concrete is accompanied by noise and vibration, which have a chronic effect;
b) Pile driving, is usually accompanied by noise and vibration;
c) Using solvent-based paints is usually accompanied by vapours, which may be harmful;
d) Positioning pre-cast concrete units could be accompanied by workers working close to an unguarded leading edge;
e) Hand breaking out of piles is accompanied by noise and vibration; etc.

To prevent, as far as it is possible to do so, the creation of hazards by a design, Practice policies should contain a list of proscribed activities, which should be implemented across the whole practice. Processes that could appear on such a list include:

a) Continuous-flight augered piling in contaminated land;
b) Lifting loads over a large radius;
c) Scabbling concrete, unless it is absolutely necessary for the strength of a joint;
d) Painting of steelwork on site;
e) Not allowing adequate working space in an excavation; etc

11 However, it is not sufficient to proscribe processes. Alternative ways of achieving the end result should be provided. Therefore, for each proscribed activity, an alternative safer process should be specified. For example:

a) Retarding and washing off as an alternative to scabbling;
b) Using quite driving techniques;
c) Water based alternative to solvent based paints;

12 In addition, policies should require items that would assist contractors to manage the hazard on the site, to be specified, eg:

a) Holes in steelwork to anchor lanyards;
b) Lifting points in pre-cast or pre-assembled panels;
c) Use of lightweight blocks;

and develop details to standardise their specification.

13 Finally, policies should contain information about temporary works systems, which can be adapted for pre-fitting to components of the permanent works, eg: temporary guard-rails, anchor points, etc.

MANAGEMENT OF THE POLICY

14 Practice CDM policies should be kept up to date. They should be subject to continual review which should incorporate:

a) Feedback from sites; and
b) Information about CDM-friendly developments in the state-of-the-art for plant, or other items used in construction; and

Construction Industry Council CDM Guidance for Designers

What designers should know

General Guidance Note

G 30.001

INTRODUCTION

1. The fact that the early stages in a project are important for setting the safety scene was recognised by the EU when the Temporary or Mobile Construction Sites Directive (92/57/EEC) was drawn up. The parts of the Directive dealing with the panning, etc, for a project were implemented by the Construction (Design and Management) Regulations 1994, which placed duties on designers to:

a) Remove completely all risks, if it was possible to do so;
b) Or, when this was not possible, to reduce them;
c) And, finally, after attempting a) and b), to inform a contractor that there were risks to be managed and to pass on to him any information, which would help him to manage these residual risks.

2. The regulations require designers to play a major part in minimising the hazards associated with construction.

3. However, in order to reduce hazards, designers need to be aware of what hazards exist on construction sites. This guidance note is to help designers to understand their duties and to be aware of the hazards that they are required to deal with.

A DEFINITION OF DESIGN

4. In accordance with the definition in the CDM Regulations: "design in relation to any structure includes drawing, design details, specification and bill of quantities [including specification of articles or substances] in relation to the structure".

5. The prerequisites for a good designer include:

a) Good education and training in the chosen discipline;
b) A good awareness of practical processes;
c) A good knowledge of the properties of the materials they are specifying;
d) Keeping up to date; and
e) An ability to communicate.

THE DESIGN PROCESS

6. Prior to 1994, the factors governing a designer's duties included:

a) A requirement for the product to be fit for purpose;
b) Designing to satisfy the Client's budget;
c) Communicating the following information, at least, to the Contractor:
    i) Type of construction,
    ii) Materials to be used,
    iii) Quantities of materials required,
    iv) A quality specification,
    v) Special requirements,
    vi) Testing requirements; and
d) Cooperating with the contractor/ manufacturer.

7. The implementation of the CDM Regulations has meant that designers now have to extend their knowledge in the areas of **5** b) and c); they have to understand in much more detail how construction processes are achieved and what are the inherent hazards associated with a material. Without this knowledge, it would be impossible to satisfy the requirements of the CDM Regulations. For example, it is not enough for designers to assume that an element can be built at height by using a scaffold; to be able to design for safety, they need to know what is required for the provision of a safe scaffold. In other words, they have to extend their knowledge in the area of construction processes.

ADDITIONAL AWARENESS REQUIREMENTS

8. In order to make provision for the safe construction, operation, maintenance and demolition of buildings and structures, designers will need to develop their awareness of the following:

a) Common hazards;
b) The construction and demolition processes;
c) Requirements for provision of safe temporary works equipment;
d) Potential for harm of materials they specify;
e) Processes, which can release potentially harmful agents;
f) Potential for harm in the activities carried out by others;

9. Without such awareness, it is doubtful whether designers could satisfy the requirements of the CDM Regulations.

10. Also, the tendency in the construction industry to 'do what we've always done' could affect designers' ability to discharge their duties under CDM properly. Designers will have to question current practice. To apply CDM properly requires innovation and the development of new ways of doing things.

11. It would be advantageous for designers to familiarise themselves with the following publications:

a) The following health and safety regulations:
    i) Construction (Health, Safety & Welfare) Regulations 1996,
    ii) Lifting Operations and Lifting Equipment Regulations 1998,
    iii) The Manual Handling Operations Regulations 1992,
    iv) Confined Spaces Regulations 1997,
    v) Control of Substances Hazardous to Health Regulations,
b) **BS 5531** Code of practice for safety in erecting structural frames;
c) **BS 5973** Code of practice for access and working scaffolds and special scaffold structures in steel;
d) **BS 5974** Code of practice for temporarily installed suspended scaffolds and access equipment;
e) **BS 5975** Code of practice for falsework;

f) **BS 6037** Code of practice for permanently installed suspended access equipment;
g) **BS 6187** Code of practice for demolition;
h) **BS 8004** Code of practice for foundations.
Note: ENs will replace some of these standards

12. Designers should be aware that a relatively inert material could be rendered harmful by applying a process to it, eg, cutting joints in concrete, which creates dust. Therefore, be aware of the potential for causing this kind of hazard, by processes that you specify.

HAZARDS IN CONSTRUCTION

13. In order to eliminate hazards, a designer must be able to identify that a hazard exists. Hazards that may be encountered on construction sites may be categorised into three main types. They may be:
a) Hazards harmful to health;
b) Hazards likely to cause personal injury; and
c) Hazards likely to lead to catastrophic events.

14. Information about these hazards is given below, in **15** to **17**. The notation alongside each hazard suggests a hazard control measure, as explained in table 1:

Table 1: Notation

Notation	**Suggested control measure** (as far it is possible to do so)
♠	Try to avoid by specifying materials or processes, which lead to these hazards occurring.
♣	Try to design to avoid processes, which lead to these hazards being realised.
♥	Try to avoid by following the advice or methods described in referenced information sheets.
♦	Make easier to manage by passing on adequate information about their existence, to help a contractor to manage the hazard.

Note: the relevant guidance, which deals with the hazard is referenced, eg, [**H 20.002**].

Hazards harmful to health

15. These hazards can be realised in a number of circumstances, including:
a) When workers are exposed to or can come into contact with a harmful substance, eg,
   i) asbestos ♠ [**H 10.002**],
   ii) corrosive, eg, acids and alkilis ♠[**H 10.001**],
   iii) irritants, eg, solvent fumes ♠
   iv) dust associated with a process ♣ [**H 10.001**],
   v) toxins in toxic materials ♠,
   vi) noxious gases ♠,
   vii) infectious diseases ♦, and
   viii) radiation from radioactive materials ♦;
b) When workers are required to work in areas where they could be exposed to:
   i) noise ♣ [**H 20.002**], or
   ii) harmful vibration ♣;
c) When workers have to work in strenuous conditions ♠ [**I 001**, **H 20.001** & **T 20.015**];

Hazardous situations likely to cause personal injury

16. Hazards can be realised when people have to work in situations likely to expose them to the risk of personal injury, including:
a) Working close to:
   i) moving plant and machinery,
   ii) areas into which objects can fall,
   iii) moving site vehicles and plant [**T 20.012**], and
   iv) live electrical circuits, eg, overhead and buried power lines ♣ ♦[**T 20.012**],
   v) fragile materials;
b) Working in the following situations:
   i) at height ♥ [**T 20.008**],
   ii) on fragile materials ♠ [**T 20.009**],
   iii) in/over water,
   iv) on congested sites ♥ [**T 20.012**],
   v) in confined spaces ♦,
   vi) in excavations ♥ [**T 10.002**];
c) In addition, other hazards, which are likely to lead to personal injury include:
   i) handling heavy/unwieldy loads ♠ [**I 001, T 20.015** & **T 20.005**]],
   ii) working on uneven or slippery surfaces,
   iii) working in unergonomic positions ♣,
   iv) instability/unplanned collapse ♦ [**T 20.001** & **I 002**].

Hazards likely to lead to catastrophic events

17. These are hazards, which, if realised, will have consequences beyond the site boundaries and include:
a) Outbreak of fires ♠ [**H 10.001**];
b) Explosions ♠ [**H 10.001**];
c) Flooding ♣ or ♦;
d) Premature collapse of:
   i) structures ♥ [**T 20.001 - T 20.005**], and
   ii) cranes ♥ [**I 002**],
   iii) tunnels and excavations ♥ [**T 10.002**]
   iv) temporary works ♥.

Construction Industry Council
CDM Guidance for Designers

Designing to make the management of hazardous materials easier

Health Guidance Note

H 10.001

INTRODUCTION

1. Designers can play a major part in making it easier to manage hazardous materials.

2. All construction projects involve the bringing together, transporting and placing of materials of one form or another. These activities are all site related and, as such, may be ignored by designers when they assess risks of ill-health to those constructing the works. While the designer usually specifies the materials used in the works, the Contractor will use these materials in the most cost effective way.

3. Too much ill-health is caused by workers coming into contact with harmful materials in one form or another.

4. While it is a contractor's duty to deal with materials, chemicals or pathogens on site, designers should provide information to the Planning Supervisor to ensure that it is not left to the Contractor to discover the hazards.

5. Designers may influence construction policy on a project either directly through the design and investigation process or indirectly by influencing project specifications, selection of contractors, etc.

6. Frequently workers do not recognise that carrying out tasks in a particular way and exposure to particular materials may result in long-term ill-health. Therefore, they need the extra protection provided by a design, which could challenge current practices.

HAZARDS ASSOCIATED WITH HARMFUL MATERIALS

7. Hazardous materials can cause serious ill-health and their effects can be cumulative [chronic] or immediate [acute].

8. Their potential for harm can take several forms; they can be: poisons, pathogens, explosive, irritants, or asphyxiating. This potential can exist either in their natural form, eg, asbestos, or in their form derived from the application of a construction process, eg, dust from cutting concrete.

WHAT DESIGNERS SHOULD DO

9. Designers who are aware of possible causes of ill-health to site workers are in a good position to eliminate hazardous materials from their designs. At the detailed design stage the effects of the materials specified should be assessed and hazardous materials eliminated, where appropriate, to protect the health of all those involved in the construction processes. Where it is not possible to eliminate the material, contractors should be alerted to their existence.

10. Designers should be aware that hazardous materials can be present from a variety of sources, as follows:

a) *Existing contaminants*, already on site from:
   i) previous use, eg, wastes, oil, chemicals, asbestos, process by-products, etc;
   ii) incorporation into building components, eg, asbestos in insulation – see Health Series **H 10.002 Asbestos**,
   iii) site use as a commercial tip or as a community waste tip;
b) *Previous specifications*, which used hazardous materials [acceptable at the time of specification], eg: asbestos, lead paint;
c) *Biological hazards* present due to the nature of the site, eg: leptosporidium, HIV, Hepatitis, animal/bird droppings etc, ;
d) *Work processes*, which could transform inert materials into a hazardous form, eg: hot work on materials likely to fume, cutting hard concrete;
e) *Materials specified* by the designer (who may also be a contractor) for use in the project, as mentioned earlier in **9**.

11. In addition, designers should be aware that some chemicals used in construction can be:

a) Explosive – avoid use near ignition sources, eg, electrostatic, open flames;
b) Flammable – where possible specify materials with flashpoints > 55^0C and not near ignition sources, eg, hot work;
c) Toxic – check how easily they vaporise and avoid specifying application by spraying;
d) Corrosive – avoid application by spraying and in situations where it is likely to drip;
e) Irritants – in solvents, etc;
f) Agents for causing respiratory and skin conditions, eg: Asthma, Eczema

Much of this information is contained in manufacturers' material data sheets, which should be consulted.

12. Potentially harmful chemicals exist in the following commonly specified materials:

a) Adhesives: floors and wall tiles;
b) Concrete work: cement, accelerators, retarders, air, entraining agents, placticisers, curing membranes, formwork release agents, joint sealants, and resin admixtures;
c) Masonry work: cleaners, joint sealants, cavity insulation;
d) Steelwork: paints, primers, undercoats, rustproofers and grouts;
e) Timber work: preservatives, flame retarders;
f) Weedkillers.

Much of this information is contained in manufacturers' material data sheets, which should be consulted.

13. People can also come into contact with harmful materials while working in excavations. Further information is given in Technical Series **T 10.002 Excavations**.

14. Designers should be careful to ensure that any processes they specify will not have the potential to realise harm, eg: the use of highly flammable materials close to hot work. Remember the maintenance phase.

Controlling the hazard by design

15. At the design stage, designers need to assess what hazards are present [10a) – c)] or created [10d) & e)] and how these could, potentially, place the construction workers at risk. Having done this, they should endeavour to eliminate the hazard or, if this is not possible, reduce its effect, as shown in Table 1.

Table 1: Design hazard control measures

Hazard source [para 10]	**Design control measure**
10 a) 10 b) 10 c)	Identify hazardous materials on the site from whatever source, eg: a) early desk study or SI; b) see also **T 30.001**- table 1. If possible, design around the hazard, so that it is not realised. Inform contractor about the hazard.
10 d) 10 e)	Specify construction details, which reduce the workers exposure to harmful substances during construction, maintenance and demolition by: c) Where possible designing for construction techniques, which eliminate or control exposure to the hazardous materials; d) Specifying materials, which are less hazardous; Not specifying or requiring processes, which generate hazardous by-products.

16. In addition, in certain circumstances, it may be prudent to discuss the design and its assumed construction method with the contractor for the work, in order to identify the preferred construction methods and materials to be employed. Otherwise the designer should determine for himself how he envisages that the works will be constructed.

17. Table 2, in the next column, gives some examples of how designers might achieve elimination or reduction.

Informing about residual risks

18. It is not acceptable for the designer just to carry out his design and then expect the contractor to control all the risks resulting from the design, on site.

19. It is essential that information about residual risks be conveyed to the Contractor, to allow him to manage these risks. Normally this information would be included on drawings, in the Health and Safety Plan and the Health and Safety File.

20. If you specify a hazardous substance, it is always useful to include the COSHH data sheet in the pre-tender health and safety plan.

TABLE 2: Examples of hazard control measures

Operation	**Health risk**	**Possible Control measure**
Developing contaminated Land [dealing with an existing hazard]	**Toxic material & biological hazards**	As far as possible, eliminate excavation or other dusty operations; Design services in sealed trenches to avoid future contact; Specify driven or displacement piles to reduce spoil; Treat land to reduce exposure (remove/treat in situ);
Cutting and chasing for services [problems of specification]	**Dust**	Design to eliminate the need, eg: surface mounted or cast-in ducting.
Scabbling [problem of specification]		Specify other means of joint formation, eg, retarder & washing
Painting [problem of specification]	**Toxins and solvents**	Specify water based or solvent free paints. Do not specify use in confined spaces.
Restoration/ refurbishment [dealing with an existing hazard]`	**Asbestos**	Leave untouched or design to minimise exposure. Inform contractor of its **exact** location **–** see **H 10.002**
	Other : eg, lead paint, arsenic	Leave untouched. If not, inform contractor of what & where it is.
Grouts / sealants/ epoxy [problem of specification]	**Toxins, irritants**	Specify alternative materials.

USEFUL REFERENCES

HSG 224 Managing health and safety in construction 0 7176 2139 1
L27 Control of asbestos at work 1999 0 7176 1673 8
HSG 213 Introduction to asbestos essentials 0 7176 1901 X
CIS 24 Chemical cleaners HSE
CIS 27 Solvents HSE
CIS 36 Silica HSE
INDG 315 Stone dust and you HSE
HSG 97 A step by step guide to COSHH assessment 0 7176 1446 8
HSG 110 Seven steps to successful substitution of hazardous substances 0 7176 0695 3
CIRIA A guide to the safe use of chemicals in construction 691.614.8
EH40 (include MELs / OELs)

Construction Industry Council
CDM Guidance for Designers

Designing to make management of hazards associated with asbestos easier

Health Guidance Note

H10.002

INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with asbestos.

2. Asbestos was used extensively in buildings in the UK throughout the twentieth century. It is a very hazardous material and, as such, its use is banned. In addition, to deal with situations where asbestos exists, it has its own set of regulations, which govern how people must work with it.

3. High exposures to asbestos can occur in the construction industry during renovation or refurbishment, if proper precautions are not followed.

4. This guidance note assumes that designers are not specifying asbestos containing materials. Instead, it provides information on where asbestos may be found on existing sites, as a result of its specification in the past, when its use was not prohibited.

HAZARDS ASSOCIATED WITH ASBESTOS

5. Asbestos is extremely dangerous and can cause asbestosis, mesothelioma and asbestos-related lung cancers. The risk of developing these diseases depends on the degree and frequency of exposure. All exposures should, therefore, be reduced to the lowest level reasonably practicable. There are no cures and sufferers experience a very uncomfortable life and painful death.

WHAT DESIGNERS SHOULD DO

6. The list in **20** illustrates that asbestos was used in many construction products, before it was completely banned in 1999. Therefore, designers should be aware that when designing for works on or in any building or structure built before the mid-eighties, it is likely that asbestos will have to be dealt with.

7. Designers working on demolition, renovation or refurbishment contracts should inform clients that it is their duty to provide contractors with information, which would help them to manage significant hazards. **Asbestos is a very significant hazard**. Therefore, clients should be advised that the location of any asbestos containing materials should be established prior to any work on the fabric of the building.

8. While the safe handling of asbestos on site remains a contractor's responsibility, designers should ensure that they contribute to making the hazard safe by:

a) Informing clients about the importance of carrying out an asbestos survey; and
b) Alerting contractors to its presence.

9. The best way to eliminate the hazards associated with asbestos is to leave it undisturbed, if it is possible to do so. For example:

a) Leave suspect floor ties or covering down and overlay them;
b) Leave existing insulation in place and provide additional protection.

But in doing so:

a) make sure that it is covered over at the earliest opportunity; and
b) Keep full records of its location and include these records in the health and safety file.

10. To help a contractor to plan the work, designers should supply the contractor with at least the following information:

a) Any asbestos survey reports [received from the duty holder] – see **20**;
b) A physical description of the work area, eg:
   i) Number of windows and doors,
   ii) Number of other ventilation points – see **9** e),
   iii) Number of penetrations, eg, for pipes, ducts, other services, lift shafts, etc, in the fabric of the work area,
c) Approximate quantities of ACMs to be moved and/or retained (This should be carried out by a licensed asbestos removal contractor);
d) The physical state of the ACMs, eg, are they badly degraded [friable to touch, which means that they can become airborne easily] or completely intact;
e) A schedule for turning off ventilation systems if they have to be left active while the work is ongoing;
f) Location of the nearest licensed dump (if known).

11. Generally, designers have two situations to consider:

a) Sites where ACMs are to be retained; and
b) Sites where ACMs are to be removed.

Where ACMs are to be retained

12. When the Asbestos Survey report indicates that the ACMs are in a degenerated state, discuss their retention carefully with an expert before making a decision about retention.

13. Where ACMs are to be retained, designers should follow the recommendations in **10.**

14. Designs, which would require operations to be carried out close to ACMs and are likely to increase the chances of an [accidental] impact with an ACM, should be reconsidered where it is possible to do so.

15. In addition, designers should not require processes to be applied to it, which are aggressive and likely to cause the ACM or its protective barrier to dust, break, disintegrate or crumble, allowing it to become airborne. Operations, which could be classed as aggressive include any form of:

a) Cutting;
b) Sanding;
c) Hammering; or
d) Drilling.

16. Where existing protective coatings are degraded or damaged otherwise, a new and effective protective barrier should be specified. The project should be designed, as far it is possible to do so, to allow this remedial work to take place at the earliest opportunity. In addition, the location of these ACMs should be recorded and included in the Health and Safety File.

Where ACMs are to be removed

17. Where ACMs are to be removed, designers should follow the recommendations in **10.**

18. In addition, any restrictions that apply to the site should be transmitted to the Contractor, eg, restrictions on transportation routes.

19. To prevent the spread of asbestos, contractors should be informed about any ventilation systems that cannot be shut off.

BACKGROUND ON ASBESTOS

Where asbestos may be found

20. Asbestos or asbestos-containing materials [ACM] have been found in the following:

a) Slates and roof sheeting;
b) Some cement pipes;
c) Cement wallboard;
d) Asphalt floor tiles;
e) Vinyl floor tiles and sheets and wall coverings;
f) Construction mastics;
g) Acoustic plasters and some decorative plasters;
h) Some textured paints & coatings;
i) Some ceiling tiles;
j) Some fireproofing materials;
k) Thermal taping compounds;
l) Some packing out materials, especially where services and other pipework penetrate the building fabric;
m) High temperature gaskets;
n) Fire curtains;
o) Elevator equipment panels and brake shoes;
p) HVAC dust insulation;
q) Thermal insulation:
   i) to boilers and pipes,
   ii) spray-applied insulation,
   iii) blown-in insulation,
   iv) to electric wiring,
   v) breaching insulation,
   vi) some industrial chimneys;
r) Flexible connections in service runs, especially hot runs;
s) Cooling tower channels;
t) Chalkboards;
u) Roofing shingles and felts;
v) Base flashing;
w) Thermal paper products;
x) Fire doors;
y) Caulking putties;
z) Some industrial adhesives;

Note: this list is not exhaustive. It is intended as a general guide to show which types of material may contain asbestos.

RECOGNISING COMPETENT ASBESTOS SURVEY REPORTS

21. Competent asbestos survey reports (asbestos register) should contain all the information in **10** c) and d). In addition, it should indicate:

a) The exact location of any asbestos or ACMs; and
b) Any areas that could not be accessed for surveying.

ASBESTOS: THE FUTURE

22. Regulation 4 of the Asbestos at Work regulations 2002 states that the dutyholder must arrange for all non-domestic buildings to be assessed for ACM content. Their position and condition must be recorded and a management plan put in place to manage them safely. This information must be made available to anyone who may need to know, such as the occupants and any contractors or others who may need to work on the building structure.

23. In the interim, designers should pursue the course of action suggested in **6**. In addition, they should carry out designs in accordance with principles set out in **9** to **13**.

USEFUL REFERENCES

HS(G) 227 A Comprehensive Guide to Managing Asbestos in Premises [HSE]

MDHS 100 Surveying, Sampling and assessment of Asbestos-Containing Materials [HSE]

Construction Industry Council
CDM Guidance for Designers

Designing to reduce the potential for musculo-skeletal injury while constructing the works

Health Guidance Series

H 20.001

INTRODUCTION

1. Designers can play a major part in minimising workers' exposure to operations, which may cause or contribute to musculo-skeletal injury [MSI].

2. All construction projects involve the bringing together, transporting and placing of materials. These activities are all site related and as such are frequently ignored by designers of works when assessing risks of ill health to those constructing the works. Generally, the processes used by the contractor will be the most cost effective ones (to him).

3. The majority of ill-health experienced by site workers is caused by the following:
a) Lifting heavy or awkward materials or equipment;
b) Carrying out repetitive strenuous activities;
c) Using damaging equipment; or
d) Working in awkward positions.

4. It is not acceptable for the designer to simply carryout his design and then expect the contractor to control all the risks resulting from the design, on site.

HAZARDS ASSOCIATED WITH LIFTING, ETC

5. When workers have to operate under any of the conditions listed in **3**, the body is put under strain. If the condition is too strenuous, the worker is exposed to the risk of MSI, which could manifest as strains and sprains, causing short-term discomfort or, in more serious cases, long-term injury. Constant exposure to overstraining could be cumulative, meaning that a worker never recovers fully, leading to permanent disability.

WHAT DESIGNERS SHOULD DO

6. Designers, through their early involvement in projects, are ideally placed to reduce the incidence of MSI, by eliminating or minimising the hazardous conditions listed in **3**.

7. This may be achieved in two ways:
a) Controlling the hazard by design; or
b) Providing adequate information to allow the hazard to be effectively managed by a contractor.

8. It may also be possible to control hazards indirectly by influencing the project specification, selection of contractors and so on.

Controlling the hazard by design

9. At the design stage, designers should assess the risks to health introduced by their requirements and change the details if necessary. In certain circumstances it may be possible to discuss, with a contractor, the construction methods likely to be employed. If not, designers will need to consider how the work is likely to be constructed.

10. Generally, overall design concepts should, as far as possible, reduce the need for long duration repetitive or strenuous activity.

11. Some of the common construction operations, in which operatives are exposed to MSI are given in **17**. Generally, designers should consider details, which avoid these operations. For example, designers should consider:
a) Eliminating the need for manhandling heavy components, eg, high density blocks – see Technical Series **T 20.015 Concrete blocks**.
b) Designing to allow use of plant for materials handling and processing rather than manual methods, ie:
   i) by using layouts, which provide sufficient space for mechanical plant, and
   ii) by detailing, components so that their sizes are compatible with machines currently available;
c) Not specifying operations, which require
   i) hand-held tools, which vibrate, eg, needle guns, power saws, etc, or
   ii) tools, which are heavy or awkward to use, eg, concrete drills, pneumatic breakers;
   because they are likely to contribute to MSI;
d) Not specifying operations, which will require people to work in awkward or cramped conditions. Information on anthropomorphic (human body) measurements is widely available;
e) Detail the works to allow for maximum off-site prefabrication, eg:
   i) using reinforcing mesh instead of individual bars wherever possible,
   ii) detailing reinforcement to allow fabrication in a more accessible situation;
f) Dimension the works to allow the use of non-hand held tools for cutting, excavation and compaction. For example:
   i) Trench widths should be sized to allow remotely controlled compaction,
   ii) Trench widths should not be narrower than minimum excavator bucket sizes,
   iii) Detail reinforcing mesh so that it arrives on site at the correct size, rather than to be cut on site;

12. Layouts, dimensions of buildings and structures and clearances should allow good access for building and maintenance tasks, for example:
a) Heights of work should fit with module sizes of temporary works equipment [TWE] – see Technical Series **T 20.006 Temporary Works Equipment**.
b) Corridor widths should allow use of mobile TWE;
c) Service runs could be designed to be at heights, which fit in with TWE module sizes;
d) Service runs should be detailed with enough space around them, so that they can be grasped properly;

Controlling hazards by information

13. When it is not possible to eliminate the hazards, it is essential that this is communicated to the contractor and others involved in the project. Designers must supply relevant information on residual hazards. This can be communicated through meetings, noted on drawings and must be included in the Health and Safety Plan.

14. Some examples of how the designer might be able to help are given in Table 1. Note that this table is not exhaustive and is for guidance only. It is for the designer to identify the risks and to set out appropriate control methods.

TABLE 1 Examples of risk control measures

Activity	Health Risk	Possible Control Measure
Laying block paviours	WRULD	Design for machine laying: space, component size, etc
Brick laying	WRULD	Design to reduce long duration repetition
Tying reinforcement	WRULD Back injury	Use welded mesh; detail to allow prefabrication and lifting in.
Block laying	Back injury	Use lighter blocks
Materials Handling	Back injury	Adequate space for available machines; Specify low weight packages
Working in small or awkward spaces	Back injury & Other MSIs	Dimension: height, width, to fit modules of TWE; Size rc components to minimise pushing /pulling while fixing re-bar.
Use of hand tools, eg, a) in rc work, b) compaction	HAVS	Design for: a) use of crack-inducers; or non-scabbled joints; b) Remote compaction
Pile cropping	HAVS	Design spacing and pile re-bar for machine cropping
Cutting, eg, a) chases, b) joints in rc, c) blocks, etc	HAVS	a) Provide ducts, detail box-outs, b) Use crack inducers, c) minimise number of cuts

Note: WRULD work-related upper limb disorder
HAVs hand arm vibration syndrome

BACKGROUND INFORMATION ON MUSCULO-SKELETAL INJURY [MSI]

15. MSI is a cumulative disorder, caused by continuous exposure to the conditions, which cause it – see **3**. In its advanced stages it can be extremely painful and debilitating, sometimes rendering sufferers disabled.

16. Generally, any activity, which requires a person to work under strain or in an unergonomic position, is likely either to cause or contribute to MSI.

17. Construction operations in which workers are particularly exposed to MSI include:

a) Bricklaying – high density blocks;
b) Glazing – installing heavy windows;
c) Manoeuvring heavy components while laying paving and kerbstones;
d) Working while bent over, eg:
   i) Concrete work requiring – hand spreading, vibrating, hand floating large areas of concrete and cutting joints;
   ii) Steelfixing, especially in ground slabs;
e) Working while stretching, eg:
   i) Fixing services in ceiling spaces;
   ii) Steelfixing in retaining walls;
f) Using tools, which vibrate, eg:
   i) breaking out concrete,
   ii) scabbling concrete,
   iii) pressure washing;
   iv) compacting equipment;
g) Using hand held diggers and breakers;

18. Common types of MSI and the activities, which can cause them, may be summarised as follows:

a) *Back injury*: caused by lifting and carrying of plant and materials or working in awkward conditions;
b) *Work- related upper limb disorder [WRULD]*: caused by carrying out repetitive tasks over long periods;
c) *Hand arm vibration syndrome [HAVs]* : caused by exposure to vibrations from plant and machinery.

19. The situation is exacerbated by:

a) Workers who often do not recognise that carrying out tasks in a particular way may result in long-term ill-health. Their working methods are frequently based on 'how it has always been done'; and
b) Contractors work methods, which are usually driven by site, planning, time or financial constraints;
c) Sometimes thoughtless design creates the problem.

20. Further information on manual handling is given in General Information Series **I 001 Manual handling**.

USEFUL REFERENCES

HSG 224 Managing health and safety in construction 0 7176 2139 1
HSG 149 Backs for the future 0 7176 1122 1
L23 Manual handling (Regulations and AcoP) 0 7176 2415 3
INDG 171 Upper limb disorders – assessing the risks 0 7176 1063 2
HSG 88 Hand arm vibration 0 7176 0743 7

There are other HSE information sheets available which give guidance on dealing with musculo skeletal injury. These are available from HSE Books.

Construction Industry Council
CDM Guidance for Designers

Designing to make management of hazards associated with erecting structures easier

Techinical Guidance Note

T 20.001

INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with erecting structures.

2. Some designers have been found to have a narrow view of design, viz, that it requires structural analysis followed by detailed design. This is not adequate for the purposes of their duties under the CDM regulations, which require them to take into account how something will be erected followed by how it will be maintained and, in due course, demolished.

This guidance note makes designers aware of some of these issues.

HAZARDS ASSOCIATED WITH STRUCTURAL ERECTION

3. The erection of structures requires people to work on partially complete structures, where they are exposed to the hazards associated with instability and working at height. In addition:

a) They often have to work close to machines, eg, cranes, which are used during the erection of structures;
b) Sometimes, unplanned work exposes them to health hazards, which arise out of applying a remedial process, eg, cleaning and then painting corroded steel; and
c) Delays in the programme could mean that many tradesmen are working in close proximity to others, eg, under or above.

4. Therefore, the hazards associated with erecting structures and associated temporary works may be summarised as including:

a) Temporary instability;
b) Falls from height;
c) Lifting: Overturning of cranes;
d) Working on or near fragile materials;
e) Handling heavy unwieldy loads;
f) Collapse of temporary works equipment;
g) Danger to adjacent properties.

WHAT DESIGNERS SHOULD DO

Therefore, in order to prevent, as far as possible, workers exposure to the hazards in **4**, designers should consider:

Designing to minimise temporary instability

5. Structures in their temporary state could become unstable for many reasons for this, which include:

a) *Omission of temporary works***,** which usually occurs when the design is out of the ordinary and usual erection practice is insufficient, eg**:**
   i) Slender rafters, which require additional bracing until the roofing is fixed;
   ii) Portal frames where the cladding contributes to sway stability;
   iii) Long-span members, which require bracing until another one is connected, eg: some bridge beams
b) *The part-erected structure is inherently unstable***,** which could occur when:
   (i) It is stabilised by other [remote] parts of the permanent works, eg:
      - Shear walls,
      - Shear cores,
      - Adjacent structures;
   (ii) Provision for lateral stability is either by unsymmetrical bracing or contributed to by other members to be added later, eg: cladding;
   (iii) It is subjected to significant unanticipated [by the designer] construction loads, eg:
      - Complete roofs being lifted;
      - Timber or pc floors supported on "green" masonry walls are loaded out too soon;
   (iv) A member has inadequate seating on another member in the temporary state, because erection tolerances add up unfavourably, eg:
      - pre-cast slabs on narrow flange beams,
      - purlins on main rafters,
      - beams on corbels.
   (v) Members in isolation cannot sustain normal erection loads, eg:
      - Pinned base columns under lateral loads from ladders,
      - Long-span beams and trusses.
c) *Temporary supports are removed prematurely*, which usually occurs when a structure is apparently complete, eg:
   (i) Composite beams and panels supporting "green" concrete,
   (ii) Portal frames, which rely on ties into the floors to carry significant horizontal thrust at their base;
   (iii) Guying systems supporting columns.

6. While it is preferable for designers to eliminate these hazards by design, the minimum requirements are for them to:

a) Advise the Contractor that these hazards exist;
b) Inform the contractor about design assumptions and design forces, eg:
   i) Construction loads allowed for,
   ii) Portal base horizontal thrusts, etc.

Designing to minimise falls from height

7. When erecting structures, workers often find themselves in precarious positions, eg, straddling unattached beams, working towards an open edge, etc. This is against the law and, although it is a matter to be controlled by contractors on site, designers should give consideration to details, which could help to limit the workers exposure to these hazards or mitigate the consequences of them, for example by:

a) Contacting suppliers of temporary edge protection and discussing how their products could be integrated into the design of the permanent works;

b) Designing elements, which allow the attachment of anchorage lines or nets, where appropriate;
c) Accounting for erection and manufacturing tolerances to minimise the need for vigorous manhandling while slung at height, eg:
   (i) pc slabs on steelwork,
   (ii) Steel beams between columns;
d) Specifying a good quality sub-base for ground slabs, which would carry the loads from the necessary cranes and mobile platforms required for the erection of the building envelope, eg: for MEWPs erecting steel envelopes;
e) Removing the need for some work at height, eg, getting rid of sag bars for purlins;

8. Further information can be found in Technical Series **T 20.008 Working at Height**.

Designing to minimise hazards while lifting

9. This usually means being aware of the conditions under which a crane could overturn or collapse.

10. While it is not always possible to limit the weight of components: members or frames, or the radius over which they have to be lifted into position, designers should give consideration to the following:
a) Cranes need working room therefore avoid heavy lifts or large lifting radii on congested sites;
b) The radius of a lift limits the weight that a mobile crane can lift; even moderate weights lifted over a large radius could create a lifting hazard;
c) It is always helpful to know the weight of components. Therefore, inform the contractor about maximum loads of components;
d) It is essential to know where the centre of gravity is, especially if it is not the middle of the load;
e) Lifting points are always helpful;
f) Cranes need good foundations therefore do not specify designs, which require heavy lifts on sites where the ground is poor;
g) On exposed sites, wind on assemblies with large effective areas could create a lifting hazard;
h) Long span large section beams have a significant momentum when they start to swing.

11. Where you have designed heavy items to be lifted or have contemplated lifting moderately heavy loads over a large radius, discuss the options with a competent crane supplier.

12. Further information can be found in General Information Series **I 002 Safe Working with Cranes**.

Working on or near fragile materials

13. This is a problem largely, but not solely, associated with roofing. Designers should only specify non-fragile components and assemblies.

14. A non-fragile roof assembly is defined by ACR[M]001:2000 and the principles of this test could be extended to other assemblies.

Handling heavy or unwieldy loads

15. This is a problem of specification. If lighter alternatives exist, specify them instead. For example:
a) Use light concrete blocks or bricks instead of heavy ones. Where heavy blocks are unavoidable, eg, for acoustics, specify half size blocks to reduce the weight. Further information is given in Technical Series **T 20.015 Concrete blocks**;
b) Where steel sections have to be lifted manually, eg: some lintels, consider composite members like back-to-back channels or angles instead of I-beams. Further advice is given in Technical Series **T 20.005 Refurbishment**;
c) Where standard details govern the specification, discuss the possibility of removing the heavy objects with the specifier, eg: concrete kerbs;

16. Where it is not possible to specify lighter alternatives, inform the contractor about their weight. Or investigate whether mechanical installers exist and design these components to be compatible with their use. For example, machines are available to install heavy glazing units and concrete kerbs.

17. Even "light" components can be unwieldy and difficult to manhandle if their shape is unusual or the centre of gravity is away from the geometric centre. Therefore designers should consider:
d) Providing seating cleats for members;
e) Providing lifting points, which allow vertical and horizontal members to be dropped into position vertically and horizontally;

Collapse of temporary works equipment

18. While it is not the duty of the permanent works designer to design the temporary works, it would help designers of temporary works if the design of the permanent works incorporated components, which could be used to stabilise the temporary works, eg: by providing for the tying of scaffolds.

19. Further information can be found in Technical Series **T 20.006 Temporary Works Equipment.**

Designing to minimise danger to existing adjacent structures

20. Sometimes the location of existing buildings or structures could limit the erection processes that are possible. For example:
a) Noise and ground vibrations may not be acceptable, eg, close to hospitals;
b) Excavation [without agreed precautions] may not be possible close to canals or other watercourses;
c) Crane operations are restricted by a number of constraints – see **I 002**.

USEFUL REFERENCES

BS 5531:1998 – Safety in erecting structural frames

Erectors Manual – A guide to Health and safety in Steel Erection [BCSA Publication No 16/93]

National Structural Steelwork specification for Building Construction – BCSA Publication No 1/89

Construction Industry Council
CDM Guidance for Designers

Designing to make management of hazards associated with erecting steelwork easier

Technical Guidance Note

T 20.002

INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with erecting steel.

2. Erecting steelwork can expose workers to several of the hazards that it is necessary, under law, to protect them from. On site, this is a contractor's duty, but designers can help by giving priority to measures, which will reduce workers exposure to these hazards.

3. Designers should be aware that the state-of-the-art in erecting steelwprk is changing. Increasingly, it is being erected using MEWPs and designers should be aware of how this might afect their design –see **8**(j).

4. This guidance note makes designers aware of some of these issues.

HAZARDS ASSOCIATED WITH ERECTING STEELWORK

5. The erection of steelwork requires people to work on partially complete structures, usually at height. In addition, they are often exposed to the hazards associated with:

a) Working close to machines, eg: cranes;
b) Unplanned work, eg: remedial processes, could expose them to health hazards; and
c) Programme delays, which could mean that different trades are working close to others, eg, under or above.

6. Therefore, the hazards associated with erecting steel structures and working on the associated temporary works may be summarised as including:

a) Temporary instability;
b) Falls from height – people and objects;
c) Lifting components [exacerbated by site constraints];
d) Handling loads; and
e) Collapse of temporary works equipment and other equipment.

WHAT DESIGNERS SHOULD DO

7. Designers should give consideration to measures, which will either remove or lessen these hazards.

Designing to minimise the chances of temporary instability

8. Usually, steelwork is erected piece by piece. Therefore, at any time there is a chance for frame instability. However, the risk of instability can be reduced by some fairly simple measures, which include:

a) Providing bracing between the first two bays to be erected, to form the basis of a braced erection;
b) Checking all steel members for assumed erection loads. Particularly vulnerable members include:
   i) Long-span [slender] members –also see **8** g);
   ii) Floor beams, especially when they are part of a composite system, due to:
      - Stacks of profiled steel forms;
      - Torsional effects of placing pc panels on one side of the flange;
      - Concrete discharged in a heap;
      - Other foreseeable storage;
   iii) Roof beams, especially portal rafters, for stacks of profiled roofing assembly materials;
c) Providing bracing, which is symmetrical;
d) Ensuring that plan bracing connects into vertically braced bays;
e) Designing columns as free-standing cantilevers during erection, to resist short-term erection loads, eg: working wind loads [V_S = 18 m/s], ladder lateral forces, etc. meaning that pinned columns, ie, two bolt connections, may not be adequate;
f) Ensuring that design effective lengths can be achieved by assumed construction techniques;
g) Ensuring that slender members can resist the compression imposed by lifting slings, ie, the component of the sling forces. If there are restrictions on sling angle inform the contractor to allow him to design the lifting points;
h) Considering worker fall protection loads, see **12**;
i) Designing bases for portal and arch-type structures to resist the lateral thrusts developed at their base;
j) If MEWPS are to be used, their loads on the partially erected structure must be accounted for.

9. Having carried out these checks, designers should act as follows:

a) For **8** a) and b) inform the contractor about your assumptions and erection load allowances – how much, applied where;
b) For **8** c) & d) if lateral stability is by other means, eg: diaphragm action of floors or cladding, or by shear cores or when symmetry cannot be achieved, inform the contractor;
c) For **8** e) – **8** g) inform the contractor about any design assumptions, to allow him to develop his method of erection;
d) For **8** h) inform the contractor about any members, which may not be used for this purpose;
e) For **8** i) tell the contractor what the forces are.

Designing to reduce the hazard of falling from height

10. Falls from height can occur off any unprotected edge. Designers should give consideration to measures, which would protect workers from this hazard, by reducing the time they have to spend at height and by designing in provisions for worker protection.

11. To reduce the time workers spend at height, designers could:

a) Design to maximise prefabrication, eg, portal frames to be erected flat and lifted to vertical;
b) Limit the number of bolts in connections;
c) Minimise components, eg, purlins;
d) Design buildings with fewer members;
e) Use pc floor construction in preference to profiled steel forms, which need bolting down;

12. Operatives are most vulnerable when the steel is ready to receive following on components, eg: pc floor units, profiled steel formwork, roof assemblies, etc, which create an advancing unprotected leading edge. Therefore, designers should consider providing some means for attaching collective protection and PPE. For example, designers could:

a) Design in parapets at the eaves, which could act as temporary guard-rails;
b) Provide holes in column flanges at 2.1m above floor steel level for anchorage of lanyards, capable of resisting 15 kN;
c) Specify the provision of anchorage points in follow on components, eg: pc units, profiled steel forms;
d) Ensure that the steel members can resist the loads from safety net anchorages: 4.5 kN, 6 kN, 4.5 kN at 2.5m crs, and specify net anchorage components;

13. In addition, access to the place of work at height, should, wherever possible, be provided by permanent staircases, which have been designed for construction loads [possibly as free-standing structures].

14. To assist erectors making connections at height, designers should consider the provision of seating cleats, pre-attached to columns.

15. Where steel sections are to be connected to other materials, eg, concrete, the brackets for this connection should be installed while constructing the other component, eg, cast into the concrete. This could be more of a problem in existing buildings.

16. To prevent falls through roofs, designers should only specify non-fragile assemblies, in which all the components are non-fragile. [This would also mean that removal of components for maintenance would not render the remaining assembly non-fragile]. Non-fragile assemblies are defined in ACR[M]001:2000.

17. Where the steelwork is to support horizontal lifelines, designers should consult experts about the magnitude of forces that may have to be resisted.

Designing to reduce hazards with lifting

18. To facilitate the lifting of members, designers should:

a) Consider the space requirements for cranes;
b) Consider the provision of lifting points and specify these as an item for the fabricator to design;
c) Design members to resist loads from lifting points, eg: sling component loads;
d) Where necessary, ensure that the spacing of purlins allows for the largest component to be lowered down through them with sufficient clearance;
e) State on the drawings, the maximum piece-weight to be lifted and its location [to allow a contractor to size a crane – see also 14 a)];

Handling loads

19. This problem occurs mainly, though not exclusively, on refurbishment projects, where, due to the situation of the work, eg: inside an existing building where cranes cannot be used, operatives are often required to manhandle steel members into position. To facilitate this, designers should minimise the weight of the steel member by:

a) Designing beams with splices, to allow:
    i) piece-meal installation of the beam, and
    ii) Manoeuvring in limited spaces;
b) Replacing one section with two, eg: 2 × RSCs instead of a single UB;

20. In addition, members should be detailed with site constraints in mind. For example, where members have to be transported through corridors, their length should be compatible with manoeuvring them around corners – see **19** a) ii).

21. Erection tolerances should be taken into account when detailing members for fabrication. This is more of a problem in existing buildings into which steel sections are being installed. In these circumstances, a detailed survey of the building should provide the necessary dimensional accuracy. Designers should also be aware that erection tolerances for other materials are different.

22. When connecting steel to other materials, it is likely that fin type connections will pose less of a handling problem than end-plate type connections.

23. It should be possible to lift members that are to be installed vertical hanging vertically.

Designing to reduce the hazard with temporary works and other equipment

24. Temporary works equipment [TWE] needs to be stabilised – see Technical Guidance Series **T 20.006 Temporary Works Equipment**. Designers should consider the provision of members, which could be used to attach TWE. For example:

a) Cladding side rails could be designed to carry the lateral loads that could be applied by attaching scaffold ties: 10 kN;
b) Eaves beams could be designed to carry lateral loads that could be applied by attaching mobile towers to them: 3 kN;
c) Profiled steel forms and supporting steel beams should be designed to carry the concentrated leg loads that could be applied by a mobile tower: 6 kN;

25. The ability of members to support loads from fall arrest devices being brought into use should be checked and any members that are not strong enough to support these loads highlighted **unambiguously**.

26. Ladders can apply lateral loads up to 1kN where they are supported at the top.

27. In order to allow a contractor to design temporary supports, designers should provide sufficient information, to ensure that a contractor has a clear understanding of stability concepts.

28. On industrial type of buildings, much of the steelwork is erected from MEWPs. Therefore, designers should ensure that there is space around the building perimeter, to accommodate these machines.

29. In addition to designing to make erection safer, designers should give consideration to designing to minimise maintenance, to reduce the exposure of workers to health and safety hazards when carrying out maintenance.

USEFUL REFERENCES

Erectors manual BCSA Publication No 16/93

National Structural Steelwork Specification for Building Construction BCSA Publication No 1/89

BS 5531 Safety in erecting structural frames

HSE Guidance Note GS 28 parts 1 –4 [HSE]

SCI Publication 178 Design for Construction

Construction Industry Council CDM Guidance for Designers

Designing to make management of the risks associated with work at height easier

Technical Guidance Note

T20.008

INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with work at height.

2. Falling from height is the most common cause of fatal accidents on construction sites. Often, the accident happens because fall protection had either not been provided or used incorrectly.

3. In many cases, the design of works is such that the provision of fall protection is either not practicable or requires workers to work beyond the confines of the protection. In such circumstances designers should attempt to prevent the development of conditions in which an accident can happen.

4. Nevertheless in many instances work at height is necessary and cannot be avoided. Even so-called low-rise buildings and structures have some element, eg, roofs, chimneys, requiring work at height

5. Information from accident reports show that there are four main reasons why people fall. These are:

a) Poor work place design
b) The access support collapsed, eg, scaffolds, ladders etc;
c) The worker was required to work beyond the confines of the protection provided;
d) The edge protection was inadequate or not provided or pf poor design or construction;
e) Restrictions placed on the movements of workers did not accommodate the construction activities and hence were ignored.

WHAT DESIGNERS SHOULD DO

6. Designers do have a role in trying to ensure that the designs eliminate, as far as possible, the need to work at height. For example:

a) Retaining walls in a cutting could be designed as bored contiguous piles installed from existing ground level, which would eliminate shuttering and concreting operations at height;
b) Service runs could be designed for access for maintenance from the floor above;
c) Trusses, etc, could be designed to allow pre-assembly and lifting;
d) Floor heights in buildings should be determined so that proprietory temporary works systems, which can be installed by working from the floor below can be used.

7. However it has been established above, in **4**, that in many instances this cannot be avoided and for the work that remains to be done at height, designers should aim to assist the Contractor by <u>applying the following hierarchy of control in their design</u>:

a) Facilitate the provision of fall <u>prevention</u> measures [to make temporary work at height during construction safe];
b) Facilitate the use of temporary access equipment, eg, scaffolds, MATs;
c) Facilitate the provision of fall arrest measures;

<u>In addition the design should:</u>

d) Eliminate requirement for persons to work outside the confines of the edge protection;
e) Facilitate the use of suspended access and/or mobile access equipment [if applicable] during maintenance.

Facilitating the provision of fall protection measures

8. Workers are at their most vulnerable when working around the perimeter of a structure or when they are working close to advancing edges inside the structure. While it is difficult to limit the former, the design should aim to limit the exposure of workers to the hazard in the latter, for example designers could:

a) Specify composite flooring which can carry erection loads, to allow placing of permanent formwork immediately the support frame is complete, the designer eliminates the need for people to work at height to erect falsework to temporarily support floors;
b) Specify attachments for temporary edge protection on perimeter members, eg, tubes welded to steel members or cast into concrete members;
c) Position splices for steel columns at 1 m above floor level, to allow splicing from a completed protected floor;
d) Consider using precast slabs and elements to potentially reduce the time spent working at height;
e) Design stairways with **7**b) to be installed early in the construction phase to avoid the need for temporary access.

Facilitating the provision of safe temporary access to work at height during construction

9. Temporary access equipment, for access above 5 m: scaffolds and towers, needs to be tied at regular intervals, to provide restraint against buckling and overturning. Usually, they are tied to the structure. Therefore, the designer needs to ensure provision is made for this. This is particularly important with facades where glazing predominates. Further information relevant to the safe use of TWE is given in **T 20.006**.

Facilitating the provision of fall arrest measures

10. The most commonly used fall arrest systems are safety nets and personal fall protection equipment [PPE]. Safety nets are preferred to PPE.

Safety Nets

11. The designer should refer to BS EN 1263-1&2 regarding the use and provision of safety nets.

12. General considerations include*:*

a) Discussing the use of nets with a competent supplier before developing the design;
b) Where safety nets are to be attached to a structural grid, designers should:
   i) Check that the grid will resist the lateral loads, especially when nets are attached to steelwork in composite construction or to purlins in roof work;
   ii) Ensure that the net installation points are located such that they minimise the falling height. For example: detail pre-installed anchors at 1.2m centres, attached to the webs of beams a maximum of 100mm below the flange (to-date within 1.5m of the work area has been considered as acceptable);
c) Giving consideration to restricting service runs to limited areas so that they cannot obstruct a fall into a net or prevent a net deflecting;
d) Consider restricting the net area enclosed by the grid (eg, to 45m^2 with one maximum dimension of 9.0m);
e) That the storey height is at least 3.75m, so that nets attached close up to the working surface can dfelect safely.

13. Safety nets in industrial developments are often installed from mobile elevating work platforms [MEWPs]. Therefore, designers should allow for the concentrated loads applied by MEWP wheels/outriggers.

PPE: Lanyards used with Harnesses

14. Lanyards must be attached to a suitable and sufficient load-bearing anchor. Therefore, designers should:

a) Provide anchor points capable of supporting 12kN applied horizontally;
b) Be aware that:
   i) Lanyards should be as short as possible,
   ii) Impact forces are lower when the anchor is above the worker,
   iii) Lanyards can be cut by sharp edges;
c) Show, clearly, where these anchors are located;
d) With horizontal lifelines anchor forces may be greatly in excess of 15 kN. Therefore, the manufacturer should be consulted for advice.

15. For PPE used in steel erection, designers should consider the provision of holes in flanges of columns and beams, where:

a) holes in columns are 1.5m above beams,
b) holes in beams should be at 2.0m c/c;

16. For pre-cast concrete, designers should specify anchor points:

a) In slots, 50mm × 125mm× 75mm deep;
b) Located as far as possible behind the leading edge;
c) At a spacing not in excess of 2.5m.

Facilitating future maintenance

17. Designers should also give due regard for the future maintenance of the proposed facility, because they are in a strong position to eliminate and/or minimise the requirement to work at height during maintenance operations. For example they could:

a) Ensure any service plant/structures are not located at height, ie, on roofs;
b) Specify high durability materials;
c) Locate system/process pipework at ground level where practical;
d) Avoid locating high maintenance items above stairwells and other deep recessses;
e) Specify reversible windows over 2m. When this is not appropriate, ensure provisions for access equipment are incorporated at the design stage;
f) Where suspended access equipment is the intended means for maintenance of a building façade, information for designers is given in **T 20. 014.**
g) Roofs are always hazardous places to work. For further information see **T 20.009**.

18. Remember the designer shall need to apply the principles of prevention ensuring where reasonably practical, that the hazard of working at height is firstly removed, then minimised and finally controlled.

PROVIDING SUFFICIENT INFORMATION

19. Sufficient information on the significant hazards that remain within the design must be highlighted and included within the Health and Safety Plan and/or the Health and Safety File.

USEFUL REFERENCES

EN 1263 parts 1 & 2

Construction Industry Council CDM Guidance for Designers

Spatial Design considerations to make management of hazards in construction easier

Technical Guidance Note

T 20.012

INTRODUCTION

1. Designers can play a major part in minimising the hazards associated with ill-considered location of a building on a site.

2. Designers are involved in and often give overriding advice in relation to the design of the spaces in a building. They are also often responsible – either in whole or in part – for the external form of the building. The spatial configuration: heights of spaces; balconies; overlooking; roof and soffit shape; etc, can have a significant effect on health and safety issues for constructors, maintainers and demolishers. Decisions made regarding placement on site, configuration of building volumes, storey numbers and heights, use of atria, double (or more) height spaces, stairwells, etc all have to be thought about in the context of designing out hazards for people who have to build them and, later on, maintain them.

3. Work on the form and spatial configuration of a building occurs very early on in the design process. Hence it has very significant effects on the buildability and safety of construction and subsequent maintenance and demolition. It is important that these early stages of the design process are adequately resourced both in financial terms and in terms of time. Rushed and/or under-funded initial stages of a project will always lead to a deficient result not only in safety terms but also in other terms such as:

a) lack of development of the brief
b) lack of consideration of whole life cost issues
c) lack of user, participant or stakeholder consultation

4. The creation of a new building or the re-working of an existing building is the primary means by which value is added in the construction process. Without this adding of value, the whole project would be pointless. (Value is not necessarily measured in monetary terms.) Because of this, this act of creation is also the prime means by which project risk of all types is created. The risks which are created include safety, health and welfare risks. The overall spatial and formal configuration of a building is arguably that part of the project development which adds most value – in the provision of internal and external space, for instance; in turn, it can add most risk (all the more so in that it occurs generally at the outset of projects), and is often that part of the project most closely controlled by the project designers.

5. Aside from those formally and legally responsible for the spatial and formal composition of the building (usually an architect, building surveyor or architectural designer) other parties may influence or even control some of all of these matters, <u>by the restrictions, considerations and constraints that they may place on people who undertake design. These parties may include</u>:

a) planning consultants
b) Local Planning Authority personnel and planning committee members
c) conservation officers
d) amenity societies
e) members of quasi-governmental bodies (CABE, English Heritage)
f) funders
g) letting or land agents and advisors, especially when advising clients on the form & density of buildings.

6. All these contributors to the design process should be aware of and acknowledge either their duties under CDM Regulation 13, or the duties of the principal designers. This guidance explains how this can be achieved.

HAZARDS ASSOCIATED WITH SPATIAL CONFIGURATION

7. Depending on where a building is located, some or all of the hazards associated with construction could be present and/or exacerbated, because placement or <u>form of</u> a building could have a significant impact on how a building can be built <u>and maintained</u>. For example:

a) A building at the waters edge could present problems for window cleaners, unless provision for the safe cleaning of windows is given some thought at the outset;
b) A very high glass atrium could present problems at the construction stage and for post construction maintenance.

8. And, as architects, building surveyors or architectural designers are aware, there is usually a key "gateway" that occurs during these earlier stages of a project that is very often irreversible: the obtaining of Planning Permission – <u>see **5**</u>. Beyond this, the large-scale reworking of the formal and spatial configuration of a building is often either extremely difficult, expensive and time-consuming or entirely impractical. Matters not included at this stage of the project are very difficult to add later. Some examples of this will be given below.

WHAT DESIGNERS SHOULD DO

9. There is a wide range of matters which designers should take into consideration in relation to the overall spatial and formal configuration, which include:

a) Local infrastructure: roads, rail, etc, which might affect:
   i) deliveries of materials,
   ii) siting of plant,
   iii) slewing radius of cranes;
b) Site space requirements for transportation and movement of people around/near the site, eg:
   i) can site traffic and people be segregated,
   ii) can cranes be sited.
c) Adjacent occupied buildings, which might affect processes that can be used, because this could:
   i) limit slewing radius of cranes,

ii) limit noise levels,
iii) limit hours of working.

d) Contaminated land issues, because they could affect groundworks: foundations, drainage, tipping, etc;
e) Natural features: slopes, watercourses etc, which might affect methods and processes;
f) Location of services – electric, gas, above and below ground, because they could affect the processes that can be used by limiting:
   i) the erection of scaffolds;
   ii) where cranes can be sited and their slewing radius;
g) Imposed requirements, eg:
   i) planning requirements,
   ii) results of local consultation,
   iii) historic environment issues, and
   iv) conservation issues,

   which might restrict the options for building form;
h) Economic requirements;
i) Retention of existing natural features: trees, other planting, watercourses, which could restrict space for circulation – see **9** b);
j) Entrances and exits to vehicle routes;
k) Emergency access to the site;
l) Height of internal spaces:
   i) Stairwells,
   ii) Atria,
   iii) Storey heights.
m) Arrangement of roofs and other overhanging elements and how they might affect post-construction operations;
n) Post-construction maintenance, including cleaning and regular maintenance of items of plant, etc;
o) And finally, when the building's useful life is over, its demolition.

10. Each of these may have an effect on how a designer can discharge his duties under the CDM Regulations. Designers will have to balance the need to satisfy the requirements of CDM against the operational requirements of the building.

EXAMPLES OF APPLYING CDM TO SPATIAL DESIGN

Designing out potential hazards

11. A land surveyor, in advising a client about a warehouse project, provided a block plan indicating its location between a busy road and a railway. This plan was used to obtain outline planning permission. The site was sold on to another developer, who engaged an architect to obtain full planning permission. The Architect met with a contractor familiar with erecting these types of buildings, to assess if there were any unnecessary hazards associated with the outline design. At the first meeting it was pointed out that if the location of the building could be changed, then:

a) The movement of vehicles, goods and individual people around the site would be improved and therefore made safer;
b) Existing flora concentrated in a particular area of the site, which would be less damaged;

These matters were taken into account in the full planning application; the building was moved and significant hazards were designed out.

Minimising the hazard

12. All buildings need to be cleaned externally from time to time. This applies particularly (but not only) to the windows. Where a building is of any height, it is likely that cleaning will present a safety hazard. Minimising the risk from this hazard would involve considering how the cleaning can be done as safely as possible. The design process in achieving this might be straightforward, eg, following the design guidance provided in British Standards; or, in the case of more complex or larger buildings, might be more involved, making it necessary for the building designers to liase with cleaning specialists.

13. One solution is to provide a building, which steps in a series of terraces, so that outside each window there is a terrace, protected by a handrail that can be used, by anyone at any time for safe access to maintain the building.

14. Obviously, this results in a very distinctive building form, which might be appropriate in, say, a green-field site in an under-populated area, but which may not be appropriate in an inner-city office block. In the latter case, there are three possible solutions, as follows:

a) Provide windows that are reversible;
b) Provide suspended access equipment, designed in conjunction with the overall form of the building; or
c) Provide anchor points for cleaning by rope access methods.

15. The first option is preferred. However, where this is not possible, there would have to be a good reason for favouring method c) over method b), for example, the building is extremely iconic in an historically sensitive location, eg, the Louvre Pyramid, a consideration that could outweigh the safety issue.

USEFUL REFERENCES

Designers should make reference to the following publications. The first two in particular cover a wide range of issues, which are not possible to outline in brief guidance such as this.

CIRIA Report 145 CDM Regulations **-** case study guidance for designers: an interim report:

CIRIA Report 166 [Section A] CDM Regulations **–** Work Sector Guidance for Designers:

HS(G)136 Workplace Transport Safety: Guidance for Employers

Construction Industry Council
CDM Guidance for Designers

Designing to make management of hazards associated with maintenance easier:Suspended Access Equipment

Technical Guidance Note

T 20.014

INTRODUCTION

1. Designers have a duty to ensure that any building or structure they design can be maintained safely. Suspended access systems provide one way of doing this and designers can play a major part in making it easier to manage the hazards associated with using suspended access equipment [SAE].

2. All buildings have to be maintained. Such maintenance varies from simply cleaning the windows to significant structural repairs. Whatever the task, workers will need safe access to carry out this work.

3. Suspended access, eg, cradles, whether it is temporarily or permanently provided, is one way of providing access to the workplace at height, on a completed building.

4. The provision of access for future maintenance should not be an afterthought, because trying to work around inappropriate decisions, made early in a project, is difficult and time consuming. Therefore, it should be part of the design phase, when its provision can be thought out properly.

5. This guidance note is to help designers to understand their duties and to be aware of how they can help to make the use of SAE safer.

HAZARDS ASSOCIATED WITH USING SUSPENDED ACCESS EQUIPMENT

6. When working from suspended access equipment, people are exposed to the hazard of falling from height. This may happen when:
a) Getting into and out of the cradle, usually because safe access points are not provided;
b) They are in the cradle, due to:
  i) structural failure, or
  ii) accidental tipping when the SAE snags on something protruding from the building.

7. People may also be exposed to the hazard while installing the system or while maintaining the system.

8. Also, people who are in the vicinity of the cradle while it is being used are exposed to the hazard of being struck by objects, which may fall out of the cradle.

WHAT DESIGNERS SHOULD DO

9. Therefore, where suspended access equipment is the [designers] prescribed method for cleaning and light maintenance, designers must make adequate provision for it to be:
a) Installed safely;
b) Accessed safely; and
c) Used, inspected and maintained safely.

10. Designers can achieve this by Providing:
a) Dedicated access areas;
b) Dedicated routes to reach the SAE, which are non-slip and appropriately guarded;
c) Dedicated inspection and maintenance areas from which operatives can work safely;
d) Adequate anchorage points properly fixed to the permanent structure.

11. In addition, where it is possible to do so, designers should consider providing:
a) Adequate attachment points on the building façade, eg, guiding mullions;
b) A building form without snagging points, eg:
  i) windows that open outwards,
  ii) decorative corbels,
  iii) ledges;
which could obstruct the passage of SAE down a building and cause the cradle to tip.

12. In order to achieve this, designers should consider the following:

Preliminaries

13. The design and use of SAE is covered by several British and European standards: BS 6037, BS 5974 and BS EN 1808. Obtain copies and familiarise yourself with the technical requirements of SAE and the generally accepted good practice for use of SAE.

14. You do not need to work on your own. Providers of SAE have a wealth of experience in this field. Use it to your advantage, by involving them at the earliest possible stage. They will give you a good indication of what is and is not achievable with SAE.

15. The Specialist Access Engineering and Maintenance Association [SAEMA] represents providers of SAE. You should contact this organisation, which will put you in touch with people who can help.

Developing the design

16. After these initial discussions [with experts], designers should try to incorporate any advice and recommendations while developing the design of the building. Returning to the problem and trying to retro-fit SAE into a fully developed scheme is difficult and not recommended.

17. Points that should be considered include:

a) *How far the SAE needs to reach:* which is particularly a problem on buildings with curved or stepped facades, because as the curve or step develops, the SAE will need to reach further out, or in, depending on the shape. SAE, which has to provide varying reach will need more space on the roof, to accommodate the extra width of track or counterweights.

b) *Operating clearances*: SAE needs space in which to operate. Consider this when designating the areas in which the SAE is to operate. If you need to limit the space for SAE operation, you should inform the provider of SAE early, so they can adapt their equipment to suit your needs. SAE needs space for the following:
   i) tracks to run on,
   ii) clearance from obstructions, if possible SAE width + 600mm,
   iii) counterweights, which may project beyond the rear of the SAE,
   iv) cornering, on curves in the track, which are not too severe,

manufacturers know exactly what is required, talk to them;

c) *Structural adequacy:* SAE will apply significant loads to the structure supporting it. Make sure that these loads are taken into account;

d) *Adequacy of track:* In addition, SAE track needs to be held down. Ensure that the surface over which it runs has sufficient structural depth into which the anchors can be fixed. And, to aid inspection of these critical items, design and detail them so that they are accessible;

e) *Form of the façade:* SAE needs to be restrained and sometimes guided. The building façade should, if possible, incorporate systems to allow this. Many unobtrusive fittings are available, which SAE providers will know about. Talk to them.

f) *Safe access*: workers who use SAE need to get into and out of SAE. They should not be exposed to the hazard of falling from height by requiring them to perform dangerous manoeuvres while accessing the SAE. Therefore, consider providing:
   i) a safe area, ie, appropriately guarded, for getting into and out of SAE,
   ii) access on to the roof by an internal staircase,
   iii) dedicated access routes across the roof, away from edges and other hazards, eg, rooflights. If this is possible, then provide handrails [or other protective measures] when people have to pass close to edges and other hazardous areas.

g) *Providing for safe maintenance*: like all other work equipment, SAE needs to be maintained, to ensure that it remains fit for purpose and safe to use. In order to provide for this, designers should consider the following:
   i) Providing safe access for maintenance;
   ii) for permanently installed SAE, maintenance will have to be carried out in-situ therefore, consider providing a maintenance area on the roof, away from unguarded edges and likely fragile areas, eg, rooflights,
   iii) tracks also require maintenance. Inevitably, they are close to the edge of the roof therefore, provide some fall protection measures for maintenance people. Ideally, this should be a barrier. However, if this is not possible, a permanent running line onto which a lanyard can be attached should be provided.

h) *Garaging:* By preference, designers should provide garaging of an adequate size that allows for maintenance to be carried out on equipment safely. It is easier to incorporate a garage structure at the outset than when you have completed the scheme.

Problem buildings

18. Some buildings are more problematic than others when it comes to providing SAE. In particular, buildings of the following types need careful attention to detail:

a) Domed glass atria;
b) Stepped façades;
c) Curved elevations;

19. Buildings with the following features also need careful attention to detail:

a) Windows that open outwards;
b) Localised steps in the facades, eg, sun shading, ledges, canopies, etc;
c) Glazed facades; and
d) Sloping roofs, ie, roofs > 30^0;
e) With attachments to the façade, which protrude, eg, CCTV cameras, signage;
f) Recessed windows.

20. Many of the problems referred to in **18** and **19** can be allowed for, as long as the SAE supplier is made aware of them.

USEFUL REFERENCES

BS 6037:1 – 2003

BS EN 1808

LG3 [SAFED],

Construction Industry Council
CDM Guidance for designers

Designing to make management of hazards in Demolition, Dismantling and Decomissioning easier

Technical Guidance note

T 30.001

INTRODUCTION

1. Designers can play a major part in minimising the hazards associated with demolition, dismantling and decommissioning.

2. Although HSE statistics show that demolition is a high-risk activity, it would appear that demolition is either not given much consideration or is included at the end of the planning process and given whatever time is left in the programme. The avoidance of accidents depends on the quality and thoroughness of the Designers plan for the project

3. In order to achieve this, designers of demolitions should give as much relevant information to the demolition contractor as possible, to enable him to submit a properly resourced tender, that includes for Health and Safety. Remember, demolition is carried out on structures no longer required. Often there is little or no information related to their original design.

4. Demolition is not just the removal of whole buildings. Refurbishment often includes smaller scale demolitions, which need equally careful consideration. Therefore, many of the principles in this guide will also apply to refurbishment projects.

HAZARDS ASSOCIATED WITH DEMOLITION

5. The nature of demolition work is such that people often have to work close to severe hazards including: falling from height, premature collapse of structures, temporary hazardous situations and exposure to harmful substances.

6. Also, because they are not aware or have not been adequately informed about any hazards, people carrying out demolition may:
a) Stray into areas they are not supposed to;
b) Knock down parts of a structure they should not; or
c) Inadequately support a temporarily weak structure;
leading to an accident.

WHAT DESIGNERS SHOULD DO

7. While it is a contractor's duty to control hazards on site – see **5** and **6**, designers should give consideration to measures, which either remove the hazards or reduce the chances of them occurring.

8. Therefore, it is very important that when a demolition is designed, all the hazards are thought about and provisions for removing them put in place. Broadly speaking, designers should:
a) Obtain all the relevant information regarding the works;
b) Consider, fully, the dangers in working on structures at or near their point of collapse or failure;
c) Consider any hazardous temporary situations that the design creates, which have to be managed;
d) Consider how the hazards associated with work at height can be designed out or lessened; and
e) Consider the hazards associated with working on or with harmful substances.

Obtaining information

9. Designers should obtain and then pass on to tenderers as much information as they have, to allow them to plan and resource the demolition properly. There are two categories of information:
a) *Existing information:* which includes:

Existing information	Source
Historical drawings	Client/current owner, Local Authority [LA], Library, Local Interest Groups, Original Designers and Ordinance Surveys [OS].
Calculations	Client/ Building Owner, Original Designers or LA
History of use	Building Owners, Local People
Storage on site	Building Owner, Fire Brigade, Environmental Agency
Structural Frame	Original Designer, LA
Building Materials: strengths, rules for use, etc	Original Design or LA, Design Standards of the time.
Hazardous Materials	Original Design, Recent Surveys, Historical Knowledge of Works, Locals
Recent Inspections: Use/Abuse/ Neglect	Building Owners
Adjoining Structures	Ordinance Survey Maps
All statutory service records including [where applicable]: Cables and flood Plain information	Statutory Authorities, Environment Agency

Table 1: Likely sources of existing information

b) *Information to be obtained*: which is absolutely necessary, is usually obtained as part of a site visit and should include:
   i) A contamination survey and chemical analysis- including materials identified;
   ii) An asbestos survey, see Health Series **H 10.002 Asbestos**
   iii) Soil and water samples and samples from fixed plant and process machines
   iv) Structural inspections of all buildings, structures and boundaries. Also adjacent buildings, which may be affected by the work;
   v) A survey of existing surface treatments, which may contain substances harmful to health, eg, paints used earlier in the century.

Minimise the chances of premature collapse

10. Whenever demolition work of a building or other structure is carried out, there is the potential for premature collapse. Therefore, designers should consider structural stability and include at least the following information with their designs:

a) The basic structural form;
b) The framing, if any, and materials;
c) Construction details, eg, curtailment rules for reinforcement, strength of steel/concrete;
d) Pre-stressed concrete is particularly difficult to deal with, because of the stored energy in the tendons. It is important to establish whether the pre-stressing tendons are in ducts or cast in;
e) Load paths: assumed load paths and alternative load paths during the temporary condition;
f) Identify any critical loading conditions, which could cause collapse;
g) Identify, **unambiguously**, any critical load-bearing elements, which should not be removed without a suitable temporary supporting arrangement, eg:
   i) Load-bearing walls;
   ii) Columns under simply supported beams;
   iii) Some columns under continuous beams;
   iv) Floor beams and lintels;
   v) Slabs providing torsional restraint to beams with a significant cantilever in front;
   vi) Members providing lateral restraint to compression members;
   vii) Individual members of trusses.

Information about dealing with the hazards associated with some of this list given in guidance note **T 020.005 Refurbishment**.

Minimise hazardous temporary situations which have to be managed

11. Temporary situations, which have to be managed, often arise during demolition. While they are often overlooked, they are sources of hazards. Therefore, designers should consider whether the demolition could:

a) Create retaining wall situations, eg in cellars;
b) Turning propped cantilever walls into cantilever walls, eg, when floor slabs are demolished;
c) Create excavations of any depth, eg, demolition of foundations;
d) Undermine any adjacent structures, eg, when demolishing basement retaining walls;
e) Destabilise adjacent structures, eg, when demolishing an adjoining structure.

12. In addition, consideration should be given to whether:

a) Groundwater is likely to be a problem;
b) Diversion works are required for statutory services before demolition starts;
c) Any temporary support works for retaining facades cause obstruction to the public or a highway;

13. Other works that fall outside the scope of the demolition can also threaten the stability of structures (e.g. underpinning or creating openings). Designers should consider how structural stability could be maintained in these situations.

Designing to lessen the hazard falling from height

14. Further information is in Technical Series **T 20.002 Working at Height.**

Designing to lessen the hazard from harmful materials

15. Further information is in Health Series **H 10.001 Hazardous Materials** and Technical Series **T 20.005 Refurbishment**.

16. Always check whether **asbestos** is present and, if it is, what type, its condition and exactly where. Further information is in Health Series **H 010.002 Asbestos**.

Other hazards

17. Other hazards that may affect a design and should be considered include:

a) Site restrictions, including:
   i) Access/exit restrictions
   ii) Working hours, eg, consideration for local residents, school pickup times;
b) Storage areas for deliveries;
c) Lifting, for which designers should give consideration to:
   i) Whether it is to be by mobile or fixed cranes;
   ii) Whether sufficient area is available to site the crane;
   iii) Whether there are any services under where the crane will operate;
   iv) Whether ground conditions are suitable;
   v) The loads to be lifted over what radius.
d) Demolition generates dust, noise and vibrations. Therefore, designers should consider how this could affect:
   i) The public and other third parties;
   ii) Adjacent buildings, roads and railways;
   iii) Other sensitive structures, which are close.
e) Other areas, which will require attention include:
   i) Shutting down existing plant: whether it needs to be in a controlled manner and raw material and products removed;
f) Whether the demolition process creates a hazard, eg, hot work close to flammable substances;
g) Radiological hazards: What type and isotope is the source and the means of their safe disposal;
h) Tipping on the site: is it special waste?
i) Temporary site roads: is it possible to provide adequate site roads?

USEFUL REFERENCES

Party Wall Act
BS6187: 2000 - Code of Practice for Demolition

Construction Industry council
CDM Guidance for Designers

Information on manual handling

General Information Note

I 001

INTRODUCTION

1. The Manual Handling Regulations were intended to reduce the high number of incidents associated with manual handling, ie, the transporting or supporting of loads by hand or bodily force.

2. Many manual handling accidents are cumulative rather than attributable to any single handling operation. Sometimes, a full recovery is not possible resulting in a permanent disability. Construction workers are particularly prone to this type of injury, because they are required to handle significant loads in awkward positions.

3. Designers can help to reduce the incidence of manual handling incidents by giving more consideration to what their designs require a site worker to do.

WHAT THE REGULATIONS REQUIRE

4. The Manual Handling Operations Regulations 1992 establish a hierarchy as follows:

a) Avoid, as far as reasonably practicable, hazardous handling operations;
b) Make a suitable assessment of any handling operation, which cannot be avoided;
c) Reduce the risk of injury from those unavoidable operations.

5. Designers can help in satisfying a) of the Hierarchy by limiting the weight of components. They can also help to satisfy c) by designing in features, which would facilitate movement by mechanised means.

WHAT MAKES MANUAL HANDLING HAZARDOUS

6. The strain on the human body, is affected by the following:

a) The magnitude of the load;
b) Having to adopt incorrect posture: twisting, stooping, reaching, etc, while handling the load;
c) The time for which the load is supported: carrying long distances, prolonged physical effort;
d) The time for which incorrect posture has to be adopted;
e) The distance from the body that the load is supported, eg, does the load have to be lifted above waist level? and
f) Ease of grasping; if the load is large, rounded, greasy or smooth, its handling will call for extra effort, which is fatiguing.

7. Therefore, if the design commits someone to manoeuvring a load, in combination with one or more of (b), (c) and (d), it should be reconsidered to reduce their effects.

GUIDELINES FOR SAFER MANUAL HANDLING

Lifting and lowering

8. Basic guidelines for lifting and lowering loads are given in Figure 1. It is assumed that the worker can grasp the load easily and that he can work in an upright position.

9. If the design restricts the lifting operations to the guideline figures, there is a good chance that it will offer reasonable protection to the majority of the workers on construction sites.

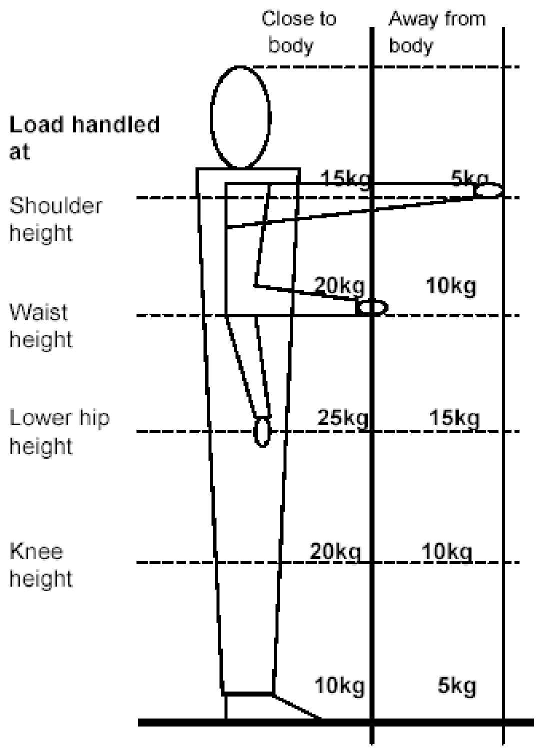

Figure 1: Basic guidelines for handling

10. The basic guideline figures are for 25 handlings per hour, which should be reduced as follows:

a) 75 handlings per hour 30%
b) 150 handlings per hour 50%
c) 300 handlings per hour 80%

11. In addition, if the person lifting has to twist to the side during the lifting operation, the basic guideline figures should be reduced by the following amounts:

a) Handler twists through 45^0 10%
b) Handler twists through 90^0 25%

12. Further reductions to the basic guideline figures are required when the equipment has to be carried more than 10m without a rest – see table2.

Posture
13. The basic guidelines recognise that construction operations require a degree of working in unergonomic positions, therefore, they concentrate on reducing the amount of time that operatives have to work in these unergonomic positions as shown in table 1:

Work position	Max exposure
Stooping [back is bent more than 20^0]	< 10 minutes per hour or < 24 stoop pers hour;
Working above shoulder level	< 10 minutes per hour; or < 24 operations per hour
Twisted head [head is bent at an angle > 20^0	< 10 minutes per hour
Kneeling or working with knees bent	< 10 minutes per hour

Table 1: limiting exposure to unsafe posture

Physical strain
14. Again, the guidelines concentrate on limiting the exposure to the risk. This is linked to figure 1 and guidance is given in Table 2.

Activity	Position	Max exposure
Supporting the figure 1 load for more than 6 secs	Above shoulder level	8 per hr
	At waist level	15 per hr
	Below knee level	4 per hr
Carrying the figure 1 load at waist level	< 15m	Reduce figure 1 load by 15%
	< 25m	Reduce figure 1 load by 30%

Table 2: Limiting physical strain

CONSTRUCTION WORK WITH HANDLING HAZARDS

15. Many of the day-to-day operations in construction expose workers to the possibility of harm from lifting and lowering, working with poor posture and from physical strain. The list of operations and how they affect the worker are given in table 3.

hazardous handling operation	Site operation[s] which could expose workers to the the hazard
Lifting heavy loads	Placing re-bar, blockwork, installing structural elements, eg, I-beams.
Stooping while working	Fixing re-bar, finishing concrete, digging, scabbling concrete, pipe-laying, spreading concrete,
Working above shoulder height	Brickwork, scaffolding, installing services, glazing,
Working with a twisted neck	Working in confined spaces, eg, installing services.
Working while kneeling or with legs bent	Fixing HD bolts, in confined spaces, finishing concrete, scabbling concrete, pipe-laying,
Carrying heavy loads	re-bar, blockwork, steel sections;

Table 3: Operations introducing handling hazards

Construction Industry Council
CDM Guidance for Designers

Provisions for the Safe Use of Cranes on construction sites

General Information Note

I 002

INTRODUCTION

1. Cranes are designed to lift freely suspended loads in a vertical plane

2. Lifting operations in construction are commonly carried out using cranes and they should be covered in the Health and Safety Plan. When constructing the plan consideration would need to be given to the ways in which the cranes are intended to be used, ie, by the manufacturer and hirer, and any limitations that would affect safety in the conditions expected on site. Consequently, information would need to be provided by various parties so that factors influencing crane safety can be assessed at a sufficiently early stage.

3. The purpose of this Guidance is to provide designers with basic information on crane types and the factors they should consider when designing a structure whose components will be delivered by cranes. It includes typical site and environmental constraints to be taken into account at the design stage of a project that are important for the safe use of cranes.

4. The information in this note will help designers to fulfil their responsibilities. They should study it and apply the information with the assistance of expert advice [as necessary] to their designs and modify them, to create safe conditions for lifting operations.

LIFTING ON SITES

5. Any plan should include information to everyone involved in the specification, installation or use of cranes to be made aware of the fundamental criteria and planning issues needed to ensure that lifting operations are initiated and proceed in a logical and safe manner.

6. While contractors have a duty to operate cranes safely, these duties can be made extremely difficult by thoughtless design, which puts pressure on them to use cranes at their operating limits and beyond.

7. Information relating to the site is an important contribution to a safe system of work particularly with regard to planning the lifting operation and selection of the correct crane and associated equipment.

TYPES OF CRANES

8. There are many types of crane and a detailed classification is given in ISO 4306. However, the vast majority of cranes used for construction work in the UK can be classed as:

a) **Lorry Loaders,** which are suitable for delivery purposes and routine lifting operations associated with the vehicle on which they are fitted.
b) **Truck Mounted/Mobile Cranes,** which are suitable for short duration operations where mobility around site is important.
c) **Crawler Cranes**, which are suitable for longer duration operations and 'pick and carry duties' and for use on some types of terrain where a wheel mounted crane would not be appropriate.
d) **Tower Cranes** are suitable for semi-permanent installation for covering large areas whilst taking up relatively little room at ground level.

9. Within each class of the above classes there is a wide variation of types and lifting capacities. Descriptions of the various types and details of requirements for their safe use are given in the respective parts of BS 7121.

SELECTION OF CRANES

10. While economic factors may influence the choice of a crane, it is essential that the crane selected is capable of lifting ALL loads that it would be expected to handle, **within its capacity and stability limits**. Manufacturers supply duty charts, which show the SWLs for specific duties. These would give designers useful information about the size of crane required and, consequently, the space and loading requirements on the site.

FACTORS AFFECTING SAFETY WITH CRANES

11. Some of the important factors affecting safety with cranes are explained below.

The characteristics of the load to be lifted

12. For a safe lifting operation, it is necessary to know the weight, dimensions and position of the Centre of Gravity [CoG] of the load. Therefore, the information provided should, at least, include:

a) The maximum weight to be lifted;
b) Any non-routine handling instructions that are necessary for a safe lift;
c) The position of the CoG of asymmetric loads or loads of non-uniform mass [preferably marked].

13. Special lifting accessories may have to be designed for lifting asymmetric loads or loads of non-uniform mass. Lifting is made safer when designated lifting points are either provided or marked on the load.

14. deleted

15. The weight and dimensions of lifting accessories add to the weight to be lifted.

The crane position

16. Where the load is to be lifted from, the route it will take during the lift and where it will be landed should be taken into account. Therefore potential obstructions, either permanent or temporary, should be taken into account. Obstacles include: buildings and other structures, trees, overhead power lines, etc;

17. If the crane is to be positioned on or next to an existing structure it may overload such a structure - a design calculation check may be required to establish whether temporary strengthening or propping is needed.

18. The radius over which a crane has to lift will have a significant effect on the loads that can be lifted and to what height they can be lifted. Table 1, below, for a particular type of crane, illustrates this point:

Tabel 1: Illustrating the relationship between lifting capacity and lifting radius

Radius [m]	Capacity [t]	Max height [m]
3	30	50
10	7.3	47
20	2.2	44
30	0.5	35

Clearances

19. Safe distances of the crane from the structure under construction, adjacent buildings, roads and pedestrian accesses must be maintained.

20. Mobile cranes need adequate space for the correct deployment of outriggers. In addition, they should be able to slew and manoeuvre the load with adequate clearance from obstructions. A minimum clearance of 600mm should be allowed for.

21. Other, equally important, considerations include:

a) Clearance to overhead electric cables: Cranes must never be positioned in the exclusion zone around overhead electricity cables. Lifting operations close to electricity cables or pylons may have to be scheduled during power off conditions.

b) Clearance to railway tracks, overhead catenaries and public highways: If a crane is to be positioned adjacent to a railway, canal or public highway an independent design check may be required, proving that the scheme has been planned and engineered such that no damage will occur to existing structures, property or to the public.

c) Clearance for aircraft near airfields: cranes operating within 6km can be a hazard to air traffic, especially if their height exceeds 10m, or when the top of the crane is higher than the surrounding structures or trees. [Notify the Airfield Manager]

Erection and dismantling constraints

22. Cranes have to be erected and dismantled. Normally more space will be needed for these operations.

Ground conditions and foundations

23. In order to operate safely, cranes need adequate foundations or support. Therefore, the ground conditions on a site are important. Crane operators need to know about:

a) Character of the ground including water conditions;

b) Engineering properties of strata relevant to the support of the crane or design of the foundations;

c) Location of any underground hazards eg open or back-filled excavations, services, drainage pipes, tunnels, trenches and basements.

24. Some of these factors may govern the design; many of them can be removed or made easier to control by considering them during the design.

Site weather conditions

25. Prevailing weather conditions and exposure of the site can affect a lifting operation. Wind, in particular, can affect how a load behaves when it is lifted. Structural items, which offer a large effective area to the wind can be difficult to control, even in very moderate winds, eg, shutters for concrete.

26. Manufacturers will specify maximum wind speeds for erection, lifting, out of service and dismantling operations. In very exposed areas (eg.cliff tops) or areas subject to wind turbulence (eg. built-up areas), these speeds may have to be reduced.

TOWER CRANES FOUNDATIONS

27. The design of tower crane foundations requires close consultation between a number of parties such as the Crane Manufacturer, Temporary Works Designer, Permanent Works Designer and Structural Engineer.

28. Sometimes, due to limitations of the tower crane or its foundation it is necessary to tie the crane tower to another structure to achieve sufficient height to complete the project under construction. Most tower sections can only be connected to a tie at certain points and the designer will need to consult the Crane Manufacturer for the maximum allowable shear forces on the tower.

ROUTES TO AND ACCESS ONTO THE SITE

29. Cranes need access routes and space for erecting and extending them and vehicles delivering the loads. Special access may be required for both the crane and high capacity trailers often used for deliveries such as counter-weights and jib sections.

30. When working in city centres, getting the crane on and off the site will require advance planning often in conjunction with police and local authorities and will possibly require facilities for overnight working.

USEFUL REFERENCES

ISO 4306-1:1990 Cranes- Vocabulary Part 1: General
ISO 4306-2:1994 Lifting Appliances- Vocabulary Part 2: Mobile Cranes
BS 7121:Part 1:1989 Code of practice for the safe use of cranes – General requirements.
BS 7121:Part 3:2000 Code of practice for the safe use of cranes – Mobile Cranes.
BS 7121:Part 4:1997: Code of practice for the safe use of cranes – Lorry Loaders
BS 7121:Part 5:1997 Code of practice for the safe use of cranes – Tower Cranes
BS 1377: Methods of test for soil for civil engineering purposes
BS 5930: Code of Practice for Site Investigations
BS 1377: Methods of test for soil for civil engineering purposes
Crane stability on Site: CIRIA publication 131

Construction Industry Council CDM Guidance for Designers

Designing to make management of hazards associated with excavations easier

Technical Guidance Note

T 10.002

INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with excavations.

2. The most effective way of eliminating the hazards associated with excavations is to design excavations out. However, with current state-of-the-art foundations and drainage this is not possible. Therefore, designers should concentrate on not creating conditions, which increase the likelihood of the hazard occurring.

3. An incident in an excavation is often serious. Therefore, designers need to consider modifying their designs to ensure excavations can be eliminated or significantly reduced where it is reasonably practicable to do so.

4. This guidance note aims to make designers aware of the issues and gives information on how they can help to make excavation work safer through their designs.

HAZARDS ASSOCIATED WITH EXCAVATIONS

5. The most common form of hazard associated with excavations is collapse of the sides, which often happen without warning. Excavations can collapse if:

a) The sides of the excavation are not sufficiently self-supporting;
b) Surcharges from spoil, adjacent foundations, stored materials, plant or temporary works-imposed loads overload the ground adjacent to an excavation;
c) Groundwater ingress reduces the strength of the ground and can lead to unexpected inundation of excavations;
d) Excavation supports are removed prematurely, to facilitate backfilling or compaction.

6. Other hazards of working in excavations include:

a) The presence of contaminants, which may be harmful to health, whose levels cannot always be assessed by sight or smell;
b) Gases migrating into excavations and creating explosive or poisonous atmospheres. Remember, excavations could be defined as confined spaces;
c) The presence of buried utility services;
d) The presence nearby of other excavations or other voids.

7. Work in an excavation may involve kneeling down to carry out a task and thus increase the hazard for the person(s) working in it, ie, what is a relatively shallow excavation becomes a "deep" one, simply because the person is completely within it.

WHAT DESIGNERS SHOULD DO

8. Designers should give adequate regard to ensuring that an excavation can be constructed safely and that work required to be done in that excavation can also be carried out safely. Designers can help in making working in excavations safer in several ways including:

a) Avoidance of foreseeable risks in excavation work from the hazards listed in **5**; or
b) Reducing the risks from the hazard; and
c) Providing sufficient information to allow persons in control of the excavation work to manage the hazard effectively;
d) Carrying out, or commissioning, a proper site investigation [SI] to determine whether the hazards listed in **6** could be significant**.**

Designing to avoid foreseeable hazards

9. The risk of side slope collapse can only be avoided by not requiring excavations, thereby not creating slopes. While this is difficult to achieve, designers should consider alternatives to run-of-the-mill solutions, which require the excavation of a trench first. For example, they could consider:

a) Replacing retaining walls by bored contiguous piles, installed from the existing ground level;
b) Designing services so that their installation can be by the use of trenchless techniques, such as directional drilling;
c) Piling, where the ground is poor rather than excavating down to a level where the ground offers the required bearing strength.

10. The risks associated with hazardous materials [on contaminated sites] can be eliminated by designing to avoid excavations in contaminated areas, if it is possible to do so. However, if this is not possible and the installation lends itself to trenchless techniques, they should be given serious consideration. Remember that excavations can initiate the migration of contaminants, especially gases.

11. Similarly, where groundwater would be within designed excavation depths, avoid the requirement to excavate and give serious consideration to alternative techniques for foundations, if it is possible to do so.

12. Design trench supports to be stable without intermediate supports, if it is possible to do so.

13. Carry out proper site investigations to identify utilities and avoid, the need for excavating close to them, if it is possible to do so.

14. Excavating close to existing foundations is always hazardous. Therefore, designers should consider the effects of excavations on any adjacent structures and, if necessary, provide solutions, which would move excavations away from them, eg:

a) By using cantilever foundations; or
b) Bored piles;
c) By routing drain and other service runs a safe distance away.

Designing to reducing the hazards

15. When it is not possible to eliminate excavations, designers should give consideration to design solutions, which would reduce the risks from the hazard.

Side collapse

16. Practical design solutions could include reducing the depth of the excavation by:

a) Determining, as accurately as possible, the engineering properties of the ground and using this information to reduce the depth that any foundations have to be taken to;
b) Designing foundations with the minimum depth by, for example, using reinforced bases, which are wider and thin, instead of deeper mass concrete ones;
c) Minimising the depth of drainage runs by the use of back-drop manholes at connections into existing sewers;
d) Not requiring destabilising processes, which may undermine the slope, eg, moving shear-toes for walls away from the foot of the slope;
e) And, when space, site layout or other restrictions allow, the design of the permanent works should allow excavations to be located so that they can be constructed with safe side-slopes or batters, which do not require additional support. Where this is not possible, allow for sufficient working space to install effective temporary supporting works.

17. Where the design allows for items to be lifted into trenches, eg, drains and backfill, consider the position of the lifting device in relation to the excavations. Lifting devices need space - see General Information Series **I 002 Safe Working with Cranes.**

Reducing risks by reducing exposure to a hazard

18. The risks can also be reduced by minimising the time that people have to spend in an excavation. Therefore, designers should consider:

a) Detailing work items so that they can be fabricated away from the excavation and lifted in, eg, reinforcement for bases, pc manhole rings, etc.
b) Designing permanent shuttering, which can be left in place;
c) Casting the concrete against natural ground.

Providing information to allow the risk to be managed

19. Designers, <u>as appropriate</u>, should pass onto the Planning Supervisor and the Contractor information about residual risks. This <u>could</u>, include:

a) The location of utility services;
b) The results of any site investigations <u>[SI] – see 8(d)</u> to allow the Contractor, to:
   i) identify the nature of the ground [type and engineering properties], to allow proper design of the support works,
   ii) locate hidden obstructions confirmed by the site investigation,
   iii) assess whether groundwater could be a problem [it would be useful to know rate of seepage],
   iv) assess whether there is a gas migration problem,
   v) the extent, nature and concentrations [ppm, mg/ml, etc] of all ground contamination,
   vi) information about stability of adjacent structures [including how close an excavation can come to them];
c) The maximum depth of excavations;
d) Any assumptions that the design is based on, eg, space allowed for plant;
e) Maximum permissible surcharges;

USEFUL REFERENCES

HSG 185 Health and safety in excavations – *Be safe and shore* 0-7176-1563-5