Design Risk Management Guidance.
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Glossary.

ACOP
Approved Codes of Practice published by The HSE as guidance.

BCSA
British Constructional Steelwork Association

BIM
Building Information Modelling (BIM) is a digital representation of a structure. BIM is a collaborative tool showing detailed information about a structure which can provide a reliable basis for decision making during its life-cycle.

The Board
In this context the board is meant to mean the controlling officer(s) of the design organisation whether this is the board of directors, a group of trustees, partners of an organisation, or the main decision makers of some other organisational structure.

BSI
British Standard Institute

CEN
European Committee for Standardization

CITB
Construction Industry Training Board

CIRIA
Construction Industry Research and Information Association

CDM
The Construction (Design & Management) Regulations 2015 or in Northern Ireland, the Construction (Design & Management) Regulations (Northern Ireland) 2016

CPD
Continuing Professional Development – this is the term used to describe the learning activities undertaken by professionals to develop their skills, it ensures that an individual’s skills, knowledge and experience does not become out-dated or obsolete.

Contemporary design practice
Reference to ‘contemporary design practice’ in this guide relates to current acceptable good and best practice for designers in the design process itself. It is contemporary practice which would be considered acceptable design output, by peers, or as set out in design guidance. Use of this contemporary design practice will lead to construction risks on site which can be routinely dealt with by those with the necessary skills, knowledge and experience.

Competence and capability
It is assumed throughout this guide that those involved are individuals or capable organisations, fielding individuals who are either competent (i.e. having the necessary skills, knowledge and experience (SKE)), or are under the supervision of a competent individual. Both are necessary for adequate risk management, and are requirements of CDM.
The Designer.
In this document The Designer is a reference to the Design Organisation (of whatever size or form) who is acting as The Designer under the CDM regulations. Where necessary, the term ‘individual’ is used to describe the single human being acting in a design capacity to discharge the duties of The Designer on behalf of the organisation.

DRM
Design Risk Management

ERIC
Acronym: Eliminate, Reduce, Inform and Control. There are variants on this acronym eg ERIC-PD but this is considered the most appropriate for the industry (and featured in the CDM2007 guidance for designers). It continues to feature in a number of industry guidance publications.

ISO
International Organisation for Standardization

MHSW Regs
The Management of Health and Safety at Work Regulations 1999 or in Northern Ireland, the Management of Health and Safety at Work (Northern Ireland) Regulations 2000

SCI
Steel Construction Institute

Significant residual risk
The significant residual risks are not necessarily those that involve the greatest risks but those which are not likely to be obvious, are unusual, unexpected or difficult to manage on this occasion. (Ref1 Glossary)

Routine Activity
Routine activities are, in this document, defined as standard operations or tasks carried out by competent contractors or operators as part of their normal day to day activities. Those which are an inherent part of the common construction or maintenance process, having accepted contemporary solutions which are accepted as suitable ways to eliminate or reduce risk; for example, dealing with in-situ concrete.

Irregular activities
All work other than routine activities as described above. (examples are given in the text)

Structure
Any (temporary or permanent) building, timber, masonry, metal, or reinforced concrete structure, railway, tramway, dock, harbour, canal, tunnel, shaft, bridge, viaduct, waterworks, reservoir, pipe, cable, aqueduct, sewer, sewage works, gasholder, road, airfield, sea defence works, river works, drainage works, earthworks, lagoon, dam, wall, caisson, mast, tower, pylon, underground tank, earth retaining structure or structure designed to preserve or alter any natural feature and fixed plant as defined in CDM 2015.

Well-being
Workplace Wellbeing relates to all aspects of working life, from the quality and safety of the physical environment, to how workers feel about their work, their working environment, the climate at work and work organization. The aim of measures for workplace well-being is to complement OSH measures to make sure workers are safe, healthy, satisfied and engaged at work.
**EXECUTIVE SUMMARY.**

The purpose of this document is to provide the reader with an understanding of how to discharge certain duties relating to the management of risk where projects fall within the remit of the CDM 2015 Regulations.

This simple guide has been developed by members of the ICE Expert H&S Panel and its aim is to improve design risk management (DRM) within the construction industry.

This risk-based management process creates new opportunities in project delivery that can be reflected within an organisation’s business processes. Through taking a pragmatic approach, DRM not only builds upon an organisation’s existing good engineering practice, it helps to provide a more holistic solution for all stakeholders.

A benefit of this approach is that other important issues such as competency, clarity of responsibility, supervision and review can be addressed at the right time.

Hence, it is relevant to all those in the industry who either carry out, or instruct ‘design work’ and this includes clients, contractors and consultants. Indeed, health risks beyond construction can also be addressed in this way. The Guide is written as a complementary advice piece to enable Readers to use as a “go to” document to get quick and easy support and a means to “sign post” to existing published CDM documents.

It may be perceived that design risk management and the definition of how to approach it has not been covered particularly well in the past, however, this guide, through its simple and pragmatic approach, describes the process with the aid of flow charts and descriptions of how individuals and organisations can better approach the issue of ‘so far as reasonably practical’.

Core to the understanding of how to carry out these duties (notwithstanding the existing and well known ‘Principles of Prevention’) is the adherence to the ‘Three Fundamental Principles’ which takes the reader through the steps of;

- **Safe and Healthy Design** – with examples of designs that conform to the accepted norm and those amendments which might have status quo.

- **Use of Contemporary Guidance** – makes reference to the use of standard designs to provide safe outcomes and also where variations are required and justified to depart from the norm.

- **Communication and Collaboration** – describes the process of recording residual risk.

Having carried out the Three Fundamental Principles it is important to note that outputs should ideally relate to only irregular activities where a significant risk has been identified. This approach helps in the reduction of unnecessary paperwork.

As already mentioned, key to the successful application of DRM is how the findings are communicated to the various members of the wider team and there is an example of how this can be done in Appendix C.

The production of this guide by the ICE H&S Expert Panel is seen as a vital and welcome addition to those seeking to put DRM in to meaningful practice and to enable users to proceed with confidence.

Date: Sept 2018
INTRODUCTION.
This guide is designed to provide the reader with some advice on how to discharge the duties relating to Design Risk Management under the CDM Regulations 2015 (Ref 1). It assumes that the reader is familiar with the principle requirements of CDM 2015 and has an understanding of the duty holders and their key duties.

Additional information regarding the CDM 2015 regulations themselves is provided by the HSE in L153- Managing health and safety in construction (Ref 2), by the CITB industry guidelines (Ref 3) or the ICE website (Ref 4).

The following advice is a clarification of the ICE’s understanding of what is required in order to sufficiently discharge the designer’s duties in relation to design risk management. The purpose is to provide to its members, and the wider construction industry, with a straightforward Risk Management based guide, as against the regulatory based guidance provided elsewhere; that can be read alongside other the guidance available, whether of a regulatory (eg Industry Guidance) or a practical nature (CIRIA). It also sits alongside on the ICE position statement for responsibility for DRM. (Ref 5).

This guide is intended not only for those who carry out design themselves but also for those that manage design and the design process. The regulations place obligations upon all those involved in the design process including line managers, senior managers and The Board (all of whom may represent the corporate design organisation to varying degrees) in smaller organisations these roles may merge, but the obligations placed upon them remain. Managers and Board members can gain an appreciation of the importance of Design Risk Management through this guide as well as find more detailed information in the “Who should do what section”

It is also for Contractors (who construct), Clients (who generally represent those who commission, use, operate, repair, maintain or decommission structures) and Principal Designers who need to know what designers should be doing and how best to support them in carrying out their duties.

Whilst the detail of the legislation, where quoted, may vary in jurisdictions outside the UK & NI, the principles outlined in this guide will generally hold good internationally.

This guide is designed to be accessible to professional designers, and whilst arising out of CDM 2015 is transferable to other regulatory regimes.

DESIGN RISK MANAGEMENT
Design Risk Management is the management of design-related uncertainty. In construction we have a great deal of uncertainty which has to be managed effectively; for example, in terms of cost, quality, time, and of course, always, the health, safety and well-being of those who may be affected by the design (the subject of this publication).

When carrying out Design Risk Management the focus should be on significant risks over which the duty holder can exercise some control or take measures to mitigate. In the context of this guide significant risks are the risks that a contractor or operator would have to devote additional time and resources to manage. These are not the day to day risks associated with managing the construction and subsequent use of an structure e.g. erecting a standard steel frame or pouring a concrete slab but those that require a greater degree of thought and management. The designer should also
recognise when circumstances combine to change a day to day risk into a more significant risk which will need management over and above what would be expected.

The objective with regards to the risks identified during the design process is to maximise the opportunity to eliminate or, if not feasible, reduce the risks during the whole life cycle (construction, commissioning, use, maintenance, repair, decommissioning and demolition) of a structure. It is easier and more cost effective to tackle these issues during the design phase when there is time to develop a suitable solution rather than “on the hoof” during construction or commissioning or to make modifications once the structure is in use. (Ref 7 & Ref 8).

All risks have the potential to add delay, cost, objection and harm to a project and hence require careful consideration. The responsibility for risk mitigation will depend upon contractual roles. In the case of safety and health risk, however, it is also related to whether a particular designer has been involved in developing that aspect of the design which gives rise to the particular risk.

When developing a design, health and safety risks need to be considered alongside other factors that influence the design such as cost, fitness for purpose, aesthetics and environmental impact. Therefore the contribution of other team members engaged on the project is invaluable to the Designer. However, only one Designer (or Design Organisation) is responsible for completing the actual design task for that design element and when doing so they are responsible for ensuring compliance with Regulation 9. Responsibility for that duty cannot be abdicated from by indicating that the design decisions were made by a collective. (Ref 5).

Further information on the team approach to risk management can be found at https://www.ice.org.uk/knowledge-and-resources/best-practice/health-and-safety-risk-management

**Design Risk and other project risks.**

There are a range of challenges and uncertainties faced by those working on projects. Figure 1 below illustrates typical examples of risks (there are, of course, many more) that may find their way onto the project risk register.

A Risk Management strategy is key to anticipating and dealing with those risks associated with the project. Design Risk Management is no different. Design Risk Management should not, therefore, be done in isolation but as an integral part of the project risk management process. In addition, DRM should not be seen as a bolt-on at the end of design but as part of the iterative design process.
Of course design itself can also be seen as a risk to the project; mistakes in safety-critical calculations, for example, need to be mitigated by the use of checking regimes and the supervision of less experienced staff.

**Who is at risk**

The designer needs to consider all those whose health, safety and well-being may be affected by the design not just during construction but also in the commissioning, operation or use, repair and maintenance, decommissioning and finally demolition of the structure (the whole life cycle). This can include the occupants of a dwelling or the staff, operators and maintenance personnel for a structure. Consideration should be given to a variety of different circumstances, including emergency situations and the design adjusted accordingly to ensure the safety of those who may be affected. Examples of the type of situations that the designer should consider include:

- Power industry - has the designer taken into account the need for access in extreme weather conditions?
- Highways - has the designer taken into account alternative traffic flows during repairs or accident by providing removable barriers?
- Rail - has the designer considered emergency access for repairs in the event of a component failure?

Civil Engineers should also bear in mind the ICE Code of Professional Conduct Rule 3 which requires its members to take all reasonable steps to protect the health and safety of members of the public and of those engaged in the project. This covers the whole life of a project during construction, operation, maintenance and decommissioning. (Ref 9).
**Who should do what**

Design Risk should be managed at different levels throughout the design organisation.

**The Board of Directors (or equivalent):**

The failure of an Organisation to manage Design Risk may significantly impact on them through reputational damage, operational failures or financial penalties and could result in prosecution and even the possibility of jail sentences for individuals within that organisation. (Ref 10 & 11).

It is well-established that good ‘health and safety management’ is good business (Ref 12) as the approach to managing risks i.e. identifying and managing by analysis of the designers work ahead of their impact, leads in turn to a correspondingly wider benefits.

A booklet produced by CIRIA (Ref 8) illustrates how improved planning by contractors could lead to significant productivity gains. There are many aspects to that text which could apply to designers, and the central thread to this is integrated risk management, adopting contemporary practice, and good communication. CDM2015 is very much about good communication, co-ordination and co-operation.

Consequently the strategy set by the Board should establish a matrix of risk management responsibilities, ensure staff are trained on the procedures and establish how this process will be managed and monitored. The Board should also instil the correct behaviours. It should make it clear that line managers need to take an interest and give confidence to employees in raising issues of concern. In addition it should also reinforce the need to carry out Design Risk Management tasks.

**Managers:**

Managers take a key role in ensuring that the strategy set out by The Board (above) is carried out. The Managers will put into place and monitor compliance with processes and procedures that have been developed to ensure risk management is undertaken as required by The Board. The adequacy of an organisation’s procedures is central to ensuring that project risks are addressed sufficiently, this includes the risks arising from the design itself, for example an error in the concept or the calculations.

The organisational or management tasks would include, but not be limited to;
- Ensuring that internal procedures and standards are communicated and that relevant staff receive the appropriate training.
- Allowing adequate time for the design process.
- Team capability assurance. (Skills, Knowledge & Experience)
- Design reviews as part of the design process.
- Checking and approval processes.
- Validation of software.
- Risk management formats.
- Procurement.

**The Project Team:**

The project team have a strong influence over the safety outcomes of a project. Project Team tasks would include but not be limited to;
- The implementation of organisational procedures as relevant to the specific project.
- Identifying, eliminating, reducing design related risk.
- Ensuring clarity of responsibility
- Understanding the risk tolerance of the project sponsors
- Keeping records.
- Participating in and recording the outcome of any Design Risk Management discussions.
- Collaboration, Co-operation and Communication with Stakeholders (internal and/or external).

*(see Appendix A for a suggested listing of items to be considered)*
The individual Designer:
The individual's key tasks include;
- Not undertaking a task for which they have insufficient skills, knowledge or experience, unless supported by those that do.
- Adapting to technical progress.
- Considering the risk(s) associated with their design and avoiding or mitigating accordingly.
- Reviewing remaining significant risks as the design progresses to see if they can now be eliminated/reduced.
- Ensuring the risk management process delivers a net benefit by not inadvertently introducing new, more significant risks.
- Communicating the relevant information on significant residual risks in an appropriate format to those that need the information.

HOW IT WORKS
Design Risk Management needs to factor in areas where the designer designs within their capability and where advice is sought from others e.g. new technologies, advances in material science etc. The designer needs to recognise when their capability is challenged. It is at this point that Design Risk Management focuses on the significant risk elements for those involved in constructing, commissioning, operating, maintaining, repairing, decommissioning and demolishing the design.

Most tasks carried out during the lifecycle of the structure will be routine activities where the risks can be managed by simply providing the relevant information to those persons with the relevant skills, knowledge and experience who plan to undertake those tasks.

This is not to say they carry no risk, but rather the Industry has well established ways of managing those risks (e.g. Industry Good Practice, Safe Systems of Working and Standard Design Details). Therefore, for these ‘routine activities’ where there are established industry solutions both in design and construction and where these are followed, the designer will normally have achieved what is reasonably practicable. See table 2 below for examples. Over time these methods of control change as expectations rise, new methods are developed or new materials arrive on the market, so the designer should keep abreast of such developments.

When identifying risk (as the designer is obliged to do), it should be remembered that it is not all of the ‘falling from height’ or ‘manual handling’ genre, important though they may be. The designer is also obliged to think beyond the construction phase to other phases in the life cycle of the structure as well. Can the structure be safely inspected or cleaned? Is there a sequence to be followed when demolishing the structure? Although the designer usually has no presence or control over the work undertaken once the design is complete; their design decisions do impact upon the safety of those interacting with the structure throughout its life cycle.

Appendix C sets out an example format of a pro-forma that may be used to record the consideration of risks and the design decisions arising from that thought process.

It is important to regularly review the design to confirm that the elimination or reduction of one risk does not introduce another or more significant risk. On multi-discipline projects it is also important to liaise and collaborate with other design organisations to ensure that the design does not impact negatively on their design with regards to Health and Safety and vice versa.
The onus for complying with Regulation 9 has been placed upon the designer and not the Principal Designer. However the Principal Designer, where one is appointed, also has a role to play under Regulation 11. The Principal Designer is pivotal in supporting the various different parties involved in the design phase in working together to identify risks and the potential ways that they can be controlled. In this way each Designer (or Design Organisation) understands how their own design decisions impact on the overall project during its life cycle. The Principal Designer is not, however, responsible for the design output of others; the role is about promoting co-operation and communication between design teams and ensuring that health and safety risk is considered throughout the design process.

It is useful to note that risk is not linear, but like ripples in a pond, one source of risk may give rise to several effects, or conversely there may be several sources of any particular effect. The overall impact of a group of risks should be considered as a whole.

**Remember**

Risk thrives at Interfaces:

- **Physical**
  - between foundations and superstructure
  - changes or alterations to an existing structure
- **Procedural**
  - Determining responsibilities at the interfaces
  - Communication between designers
  - Handovers from one party to another; such as from one phase of a project to another. eg from one design team to another or from construction to commissioning/operation.
  - Demarcation (communication between adjacent, but separate undertakings).

Risk arises from a wide range of causes including:

- the task itself, its complexity, its location and the environment in which it is performed
- management procedures e.g. changes to requirements such as operational needs following the initial design, and managing the design and checking process itself

As part of the Design Risk Management process the designer should consider early contractor engagement to assist with considering the construction phase risks. Similarly, the designer should also involve the operator, where possible to assist with considering the hazards associated with the operation and maintenance of the structure. In this way, the risks associated with the design, including the assumed method of work, may be tailored to suit the party implementing it, and therefore only include risks which may be safely accommodated. It is acknowledged that this direct contact is not always possible either because a contractual link is missing or because the timing of appointments does not align. (Ref 13)

The designer, however, should do all that is reasonable to communicate directly with other parties as noted above. Where this is not possible:
i) For construction task: the technique assumed by the designer should be provided in writing if not likely to be obvious to a capable contractor, is an ‘irregular or unusual activity’, or if it involves significant residual risk.

ii) For operation and maintenance tasks, the designer should:

- Determine preferences and agree operational/maintenance proposals.
- Produce “design philosophy statements” setting out the anticipated method of work for anything that is not a routine activity (see also Ref 13)

Team discussion is always to be encouraged as part of the wider requirement to co-operate and co-ordinate. However, as explained above, the responsibility for elimination or reduction of a design risk i.e. the Regulation 9 obligation, lies with the designer whose design or element of design may have given rise to the risk in the first place and not through a collective decision on the risk itself. This is an important distinction. (Refs 4 & 5)

For those intimately involved in projects it is easy to get so close to the detail that ‘one cannot see the wood for the trees’. A useful approach is to use an impartial facilitator (one who understands the specific issues associated with that discipline) to lead risk reviews: someone with appropriate experience and knowledge, and leadership skills. This is most likely to be the Principal Designer (where one is appointed) and they should be consulted whenever appropriate as they will have access to information regarding health and safety risks such as the pre-construction information and any existing H&S file, relevant elements of which should be provided to the designer by the PD or Client. Alternatively, someone from within the design organisation with the right skills knowledge and experience, but not otherwise involved in the project would be a good candidate.

On projects where there are several designers or design organisations working on different aspects of the design it is expected that each design organisation will carry out its own internal review of their design output. In addition, the Principal Designer will, where appropriate, bring the various design streams together as early as possible, and then on a regular basis, to look at the design interfaces and to ensure that foreseeable risks are identified and addressed.

Routine Activities

It would be reasonable for the designer to assume that the tasks carried out during the lifecycle of a structure will be implemented by capable persons i.e. those with appropriate skills, knowledge and experience (SKE) who work, when an employee, in organisations with appropriate organisational capability. These persons, therefore, are able to handle day to day routine activities without undue harm to those involved or otherwise affected, provided the relevant information has been provided by the designer at the right time to enable them to do so.

Use of contemporary design guidance will generally lead to situations which may be routinely dealt with by capable contractors or operators, familiar with the situation presented. Designers must, therefore, endeavour to keep abreast of such guidance through maintaining their Continuing Professional Development (CPD) as recommended by their Professional Membership Body

Sources of contemporary guidance

Some design-related risks have already been considered by industry organisations eg HSE (ACOPs & guidance), CIRIA, Learned Institutions and SCI, BCSA, BSI, CEN, ISO etc. and these have published what would be considered to be contemporary and authoritative industry guidance. British
Standards cover a number of design related risks: most specifically structural design codes (against the risk of collapse) e.g. Eurocodes.

No further design modification is required by the designer for Routine Activities in a standard setting, and these account for the majority of design outputs. However it is necessary for the designer to be mindful of what constitutes ‘contemporary practice’ in the construction, commissioning, use, maintenance, planned repair, operation or de-commissioning of a structure as well as any other contributing factors such as environment (e.g. marine) or location (e.g. at height) which may result in an Irregular Activity with potential risk.

Where there is no industry accepted solution or the approach is novel then a detailed assessment of risk reduction is required and that may include discussion with construction professionals or safety specialists as well as those who may use the structure. Those consulted do not need to be those who will be carrying out the actual works, but they do need to have the appropriate level of expertise and understanding of the associated risks.

Further description of routine activities is given in Table 1.

Table 2 gives some examples of ‘routine’ and ‘irregular activities.

Table 1: Task classifications

<table>
<thead>
<tr>
<th>(if in doubt classify task as ‘irregular’)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Routine Activity</strong></td>
<td></td>
</tr>
<tr>
<td>Those that established contemporary practice is able to implement with accepted present-day levels of safeguard.</td>
<td>The designer should be aware that contemporary practice will, by definition, change over time. These activities may be holistic in nature i.e. erection of steel frame, laying of drainage pipes, construction of road pavement, rather than broken down into individual tasks, providing none of these have any aspect to them which categorises them as ‘Irregular activities’ (see Table 2 for examples)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Irregular Activity</th>
<th>An irregular activity is one where it would be difficult to use or adapt contemporary practice, or where none exists or would apply. This could include when a routine activity is subject to complicating factors preventing current safeguards and methods from being effective. Judgement is required here, and advice from contractors or others may be necessary. Eg Occupational Hygienists, Safety Advisors etc. Where feasible, discussions should include contractors (for construction tasks) or operators (for repair, maintenance or decommissioning tasks).</th>
</tr>
</thead>
<tbody>
<tr>
<td>those tasks which are not ‘routine’</td>
<td></td>
</tr>
</tbody>
</table>


Table 2: Example of ‘routine activities’ and issues that would make them ‘irregular activities’

<table>
<thead>
<tr>
<th>Routine Activities involve a range of hazards (safety and health related) but all of which are well known, and for which safe methods of work are established. Therefore a capable contractor can anticipate and deal with the resulting risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 In-situ concrete frame: <strong>Issues which could add risk and therefore make it an ‘irregular activity’</strong></td>
</tr>
<tr>
<td>• Lack of access to construct using normal methods</td>
</tr>
<tr>
<td>• Interim instability issues</td>
</tr>
<tr>
<td>• Slab unable to take predictable temporary loads during construction</td>
</tr>
<tr>
<td>2 Drainage to car-parking area around office building (standard depths, no unusual ground conditions): <strong>Issues which could add risk and therefore make it an ‘irregular activity’</strong></td>
</tr>
<tr>
<td>• Poor ground conditions with lack of Site Information data</td>
</tr>
<tr>
<td>• Proposed drainage runs adjacent to existing buildings</td>
</tr>
<tr>
<td>• Connections into existing system creating high-risk situations (confined spaces or associated highway traffic, for example)</td>
</tr>
<tr>
<td>• Use of car park during construction works</td>
</tr>
<tr>
<td>3 Re-siting of lamp street standard: <strong>Issues which could add risk and therefore make it an ‘irregular activity’</strong></td>
</tr>
<tr>
<td>• Localised contaminated ground</td>
</tr>
<tr>
<td>• Adjacent operational footway</td>
</tr>
<tr>
<td>• Lack of access for lifting equipment</td>
</tr>
<tr>
<td>• Proximity to traffic and traffic flows</td>
</tr>
<tr>
<td>4 Like for like replacement of existing windows: <strong>Issues which could add risk and therefore make it an ‘irregular activity’</strong></td>
</tr>
<tr>
<td>• Difficult access</td>
</tr>
<tr>
<td>• Windows accessible only via fragile roof</td>
</tr>
<tr>
<td>• Windows excessively heavy due to size.</td>
</tr>
</tbody>
</table>

It is acknowledged that for the irregular activities the designer continues to be presented with a dilemma i.e. how far to go in the endeavour to eliminate or reduce risk. This will remain a challenge; however, using the process suggested in Figure 2 below of this guide, this will only apply to a minority of situations.

Note that sizeable elements of the design may be classified in one go (e.g. an entire in-situ concrete frame, or a drainage system) rather than individual work tasks. The designer should be wary, however, of ‘irregular activities’ occurring in amongst routine activities. This process may be beneficially assisted by input from the PD, if applicable.

If the designer has any doubt as to whether items of work are ‘routine activities’ it should be assumed they are ‘irregular activities’, and treated accordingly.

Even for ‘routine activities’ (including those that are grouped as an element of the project) it is important to record that they have been considered, rather than ignored. If in the judgement of the designer they are indeed ‘routine’, as defined in the glossary, then no modification to, or consideration of, the design is required by the designer. The provision of information or additional
contemporary advice, if available or relevant should still be undertaken along with recording the
decision. The pro-forma in Appendix C can be used to record such decisions.

Designing for Safety

Having used the flow chart in Figure 2 above to decide which elements of design will result in routine
activities or irregular activities, the designer can then move onto the next phase in the DRM process
for those irregular activities.

The designer could use the acronym ERIC to assist in structuring the process of design risk
management for the irregular activities, particularly in group discussions. ERIC is derived from the
Management of Health & Safety at Work Regulations 1999: Schedule 1 (Ref 15). The acronym ERIC
promotes the elimination of risk above the reduction of risk and can be applied to the management
of all project risks if required.
<table>
<thead>
<tr>
<th>Element</th>
<th>Comment</th>
<th>Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E</strong></td>
<td>Eliminate</td>
<td>Can the identified risk be eliminated SFARP. If not: See the Three Principles below for the means of doing this</td>
</tr>
<tr>
<td><strong>R</strong></td>
<td>Reduce</td>
<td>Can the identified risk be reduced SFARP.</td>
</tr>
<tr>
<td><strong>I</strong></td>
<td>Inform</td>
<td>Pass on details of significant residual risks to those who need to know (client, other designers, contractors) Very important that only ‘significant’ residual risk data is passed on eg not slips trips and falls on uneven ground.</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Control</td>
<td>The actions taken to control the residual risk. For most risks, this will be done by those undertaking the work eg contractor (it would be unusual for the designer to specify these). Exceptions would include items such as specified construction sequences or temporary works. However, for some design risks e.g. mistake in safety-critical calculations, the control would be implemented by designers e.g. checking regimes,</td>
</tr>
</tbody>
</table>

When preparing a design the designer must take into account the general principals of prevention as described in the HSE publication L153 - Managing health and safety in construction. These provide an aide memoir for designers when considering foreseeable risks that may affect those involved in the lifecycle of the structure. Designs prepared for work places must also comply with the Workplace (Health, Safety and Welfare) Regulations 1992 (Ref 16) which would include consideration of traffic routes and lighting, for example.

The principles of prevention are a requirement of the Management of Health and Safety at Work Regulations 1999 (Ref 15) and apply to all industries, including construction. They provide a framework to identify and implement measures to control risks on a construction project, however the principles do not always lend themselves easily to construction design and some professional judgement is required in their interpretation and use. For ‘routine activities’ there will not be any need to directly refer to these principles as they are already implicit in the method of work.

In addition there are the RED/AMBER/GREEN lists which are practical aids for designers to assist them in deciding what to eliminate, avoid and encourage. These are published in the CITB Designer guidance document , Appendix E (Ref 2) although not always relevant they do contain useful examples of the type of things to be avoided or that may be more appropriate to use .

Many organisations will have their own processes for managing risks some of which will be industry specific and may have proforma for staff to use when recording the outcomes of these considerations as well as key words or scenarios to consider such as security, commissioning or access etc. The process described in this guide is the next step in the evolution of DRM within the industry which organisations can use to build upon their existing good engineering practice and to modify and enhance their current processes and procedures to ensure full compliance with Regulation 9.
Whichever way your organisation expects you to manage out the risks the Three Principles of DRM below should be followed.

THE THREE PRINCIPLES OF DRM
The Three Principles are intended to be a practical interpretation of CDM Regulation 9 which can be applied simply. If designers apply the Three Principles they should be doing sufficient to satisfy Regulation 9. These have been developed by the ICE to guide the designer through the design risk management process.

1: Safe & Healthy Design
Designs shall be safe to construct, commission, operate, maintain and demolish. The designer may assume that these activities will be undertaken by capable persons who will be able to manage the “normal” day to day construction/operational/repair tasks and their associated risks, arising from the design.

Design involves the weighing of risk against the resources needed to eliminate or reduce the risk. Risk may include, for example, cost, planning, market conditions, technical, performance criteria, environmental impact and, always, the safety, health and well-being of others. Where no specific mandatory requirement exists a judgement is made in the light of all the facts.

‘Safe’ is not absolute; there will always be some danger. It means, in this context, that the designs conform to expected norms of work and competence, and that there are no significant unexpected aspects, or similar surprises e.g. lack of access, interim instability, or low-risk activities made high-risk activities, without there having been a weighing of risk, and the provision of adequate accompanying information (see Principles 2 and 3 below).

For example:

- a fall-arrest system installed by the designer as part of provisions for roof maintenance work over the life of a building is ‘safe’ if properly considered, and in accordance with reference 13. However if it is not feasible to provide a quick means of retrieving someone who has the misfortune to fall, it would be classified as unsafe.
- a steel frame of conventional construction is ‘safe’ to construct. However if its stability relied on a particular sequence of construction relating to, say an adjacent building, and this was not considered by the designer, nor brought to the contractor’s attention, it would be classified as unsafe in the absence of further ameliorative action, or pre-construction information.
- a concrete/steel unit which may be manhandled in an acceptable manner is ‘safe’. However if restricted access prevents this, it would be classified unsafe.
- checking of safety-critical calculations and concept is accepted as part of reasonable measures to provide a ‘safe’ structure. However if no account was taken of the competence of the checker, or complexity of the project, it would be classified unsafe.
- a ‘structure’ of conventional design will be ‘safe’. However if there is insufficient access to, and/or around the works, to use conventional means, it would be classified as unsafe.

Thus, this is a qualitative action, using accepted norms as the benchmark (recognising that these change over time) and performed by capable designers, with adequate reviews. It requires oversight.
by capable designers (with others, such as contractors, acting as advisors where required) to be satisfied as to any ‘safe’ classification.

2 Use of Contemporary Guidance.

Designs shall comply with good industry practice as regards the safety and health of persons, unless there is good reason for not complying.

It is important to remember that the required effort to make things ‘safe’ changes with time, as new products come onto the market, new technology develops, better engineering controls emerge, environmental protection constraints and H&S legislation change and societal expectations rise. There may also be external events or circumstances that will make contemporary practice no longer relevant. Thus what is deemed ‘safe’ under Principle 1 will change with time. The contemporary view, on many key issues, is contained within current industry or HSE sponsored guidance.

It is expected (as a matter of duty of care notwithstanding any statutory obligation) that designers follow this guidance (usually created by their peers) unless there is good reason not to do so (for example when the circumstances may not fit the guidance in some way). In the latter case the designer should at least aim to match the intent of the guidance and the reasons for departing from such advice should be recorded as a good practice action. The Principal Designer (PD) (where appointed) may expect to see these records.

Recognised contemporary advice will evolve, but there are examples in Appendix B (published separately) of those currently available, which allow the designer to proceed with confidence. There is an expectation that designers will follow these, unless there is a good, and documented, reason not to do so.

The intent of the approach outlined in this guide is that further examples of good contemporary design practice will follow and that Appendix B will be updated as a consequence.

3 Communication and Collaboration

Information on significant residual risks shall be communicated to those who need to know.

Communication is king and it is essential that the designer provides the right information to the right people at the right time in an appropriate format to enable them to make the right decisions that will underpin the health, safety and well-being of those affected by the undertaking.

The information provided should be about the significant residual risks, it is not intended that all residual risks be scheduled, and they should not be so without good reason.

The question for any designer to ask is:

If I were the contractor’s designer/Temporary Works Co-ordinator (TWC)/foreman/ganger etc, would I be content with the design information presented?

If I were responsible for maintenance or repair, would I be content with the information presented?

If I was compiling the ‘construction phase plan’ would I consider the information from the designer adequate for my needs?

If I was using the Health and Safety file would I have sufficient information? (lifting plans/demolition sequence/access/etc.)
**Recording and communicating the residual risk**

The recording of DRM decisions and actions is good business practice. However, this should be done in an effective manner that does not produce unnecessary paperwork.

Appendix C sets out an example format (following Figure 2) of a pro-forma that may be used to record the DRM process. The rationale behind this form is that for ‘Routine Activities’ no additional consideration of the design is required, and hence no paperwork other than a confirmation that the tasks arising from the design in a particular area, or other aspect of the design, have been considered, rather than ignored, and judged to be ‘routine’. This minimises the paperwork, and allows concentration on the ‘Irregular Activities’. The irregular activities do require a little more detail on the decisions and actions arising from DRM and the pro-forma will enable this to be recorded too. The alternative is a succinct textual description of the judgements made and how they were arrived at.

The information about any remaining significant risk or risks that may be difficult to manage under the circumstances or risks that would not be obvious to a competent contractor or another designer should be communicated in a format that is suitable for use by those that need to know and shouldn’t be hidden deep inside documents where it is easily overlooked.

The designer may wish to consider the use of BIM, Pre-construction Information, (which provides information for all pre-construction activities such as design and planning) or Works Information to convey residual risk information to other parties. However, for those employees carrying out the construction phase tasks; they are unlikely to have access to contract documents or large spreadsheets. It is far better to convey the information succinctly to those who are more likely to be at risk by the use of SHE (Safety, Health & Environment) boxes, notes or symbols on drawings. Other methods of communication for which the designer may be able to provide information could include design co-ordination workshops, safe systems of work and task briefings.

Although the information above focuses on safety risks it may be that health risks or other project issues are highlighted in the same way. Providing this information to the work force enables them to make good decisions for the benefit of the project and for the health and safety of all concerned.

For tasks likely to be carried out post-construction such as planned repair or decommissioning it is more likely that the information will be provided in writing or on as built drawings provided in the H&S file. Again the designer should seek to highlight the safety information so that it is easy to find and understand.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
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<tr>
<td>2</td>
<td>HSE, Managing health and safety in construction L153</td>
<td><a href="http://www.hse.gov.uk/pubns/books/l153.htm">http://www.hse.gov.uk/pubns/books/l153.htm</a></td>
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<td>6</td>
<td>NOT USED</td>
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<td>10</td>
<td>Strategic risk: a guide for directors, Institution of Civil Engineers et al. 2006</td>
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<td>13</td>
<td>Iddon J, Carpenter J, Safe access for maintenance and repair, CIRIA C686 2nd Edition,</td>
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## Further reading

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<tr>
<td>i</td>
<td>Carpenter J, Association for Project Safety. The Business Case for Health and Safety. Practice Note 5/03</td>
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<tr>
<td>ii</td>
<td>A simple approach to the management of risk on civil and structural engineering projects Viewpoint The Structural Engineer 7 April 2010 p20</td>
</tr>
<tr>
<td>iii</td>
<td>Carpenter J, An analysis of construction safety legislation applied to construction industry designers This provides a comprehensive review of s3 of HASWA and Reg9 of CDM, highlighting their limitations as applied to construction industry designers.</td>
</tr>
<tr>
<td>v</td>
<td>HSE. Principals and guidelines to assist HSE in its judgements that duty holders have reduced risk as low as is reasonably practicable. <a href="http://www.hse.gov.uk/risk/theory/alarp1.htm">www.hse.gov.uk/risk/theory/alarp1.htm</a></td>
</tr>
<tr>
<td>vi</td>
<td>Steven S. The different phases in construction- design in health and safety to the project life cycle – in ICE Manual of H&amp;S in Construction 2nd edition</td>
</tr>
<tr>
<td>vii</td>
<td>Institution of Civil Engineers ‘CDM 3 Years on’ report (relating to the 2007 regulations) Sections 3.6-3.9 at <a href="https://www.ice.org.uk/getattachment/disciplines-and-resources/information-sheet/cdm-3-years-on-report/CDM-3-years-on-Report.pdf.aspx">https://www.ice.org.uk/getattachment/disciplines-and-resources/information-sheet/cdm-3-years-on-report/CDM-3-years-on-Report.pdf.aspx</a></td>
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<tr>
<td>ix</td>
<td>King C, Toby O, Health and Safety in construction: Focus on design University College London Department of Civil, Environmental and Geomatics Engineering 23th March 2017</td>
</tr>
</tbody>
</table>
APPENDIX A: ITEMS TO BE CONSIDERED TO AVOID/MITIGATE RISK

This is adapted from a Standing Committee on Structural Safety (SCOSS) Topic Paper (Ref 17)

The following Table shows ‘stages 1-5’ and ‘items to be considered’ over a typical project.

1 Analysis and Design

• ensuring that those involved are capable of carrying out the task in this field.

• Identification of hazards and resultant risks affecting robustness in Stages 2-5.

• Quantification of significant residual risks.

• choosing appropriate design details.

• advising constructors and future owners of assumptions associated with the design detail adopted (via the drawings and health and safety file). For example: the necessary construction sequence; the method assumed for implementing specific maintenance tasks.

• The need for an independent review of design (supplementary to numerical checks). The scope may include design, operability, maintainability, constructability, commissioning and the like, according to need.

• having an overall point of responsibility.

2 Procurement

• competency of those organisations procured.

• ‘best value’ tendering

• clear lines of responsibility and authority.

• clear reporting protocols.

• adequate information for planning and pricing construction phase.

• adequate specification.

• inclusion of adequate monitoring procedures (avoidance of self-certification approaches).

3 Construction

• ensuring that those involved are capable of fulfilling the role in this field.

• understanding the stated objectives and purpose of the design.

• identification of hazards and resultant risks having regard to temporary conditions and commissioning.

• implementing the strategy outlined in the construction phase plan or elsewhere.

• ensuring contractor-design is co-ordinated.

• ensuring adequate monitoring, reporting and action where required.
• collation and assessment (gap analysis) of Pre Construction Information supplied by the Client and the gaining and use of requested Pre Construction Information.
• issue of the Health and Safety File using appropriate information from Designers.

4 Operation

• ensuring that those involved are competent in this field.
• implementing the strategy and requirements outlined in the health and safety file.
• ascertaining and managing the effects of changes/refurbishment.
• ensuring adequate maintenance of critical items.
• ensuring that those involved are competent in this field.

5 De-commissioning

• identification of hazards and resultant risks, specifically those outlined in the health and safety file.
• having regard to temporary conditions.
APPENDIX B: Existing Contemporary Practice Advice

APPENDIX C: example of a form used for recording DRM decisions.

<table>
<thead>
<tr>
<th>Project:</th>
<th>Project Ref:</th>
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<tbody>
<tr>
<td>Originator:</td>
<td>Reviewer: see note 1</td>
</tr>
<tr>
<td>Date:</td>
<td>Date:</td>
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</tbody>
</table>

Describe element of project under consideration: see note 2

Q1. Is Element made up of routine activities in a standard situation? see note 3

Y/N
IF "YES" go to Q2 IF "NO" go to Q4

Q2. Does it comply with available contemporary design guidance, advice and industry good practice?

Y/N
IF "YES" Schedule advice or industry best practice adopted during design here and provide any relevant information or show where it can be found.
ENDS.
IF "NO" go to Q3

Q3. State why contemporary design guidance and advice is not appropriate or why industry good practice may not be sufficient to address risks see note 6

Q4. What are the irregular features of this design/activity?

Q5. Are any of these items covered by any specific contemporary or best industry practice?

Y/N
IF "YES" Schedule advice or industry best practice adopted during design here and indicate how it applies.
For other items of IF "NO" go to Q6

* see notes 4 & 5
### Q6. Has the issue been discussed with contractors/operators /safety professionals as appropriate? *see note 7*

<table>
<thead>
<tr>
<th>Y/N</th>
<th>IF &quot;YES&quot; record salient points here IF &quot;NO&quot; record reasons for lack of discussion</th>
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<td><em>see note 7</em></td>
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### IF "YES" does the design and information provided align with advice received? *see note 8*

<table>
<thead>
<tr>
<th>Y/N</th>
<th>IF &quot;YES&quot; record design modifications and references to key information here IF &quot;NO&quot; provide explanation* see note 9</th>
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<tr>
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<td><em>see note 9</em></td>
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### Q7. Are there significant residual risks remaining?

<table>
<thead>
<tr>
<th>Y/N</th>
<th>IF &quot;YES&quot; record where residual risk information can be found here. IF &quot;NO&quot; ends.</th>
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**Notes.**

1. Review is essential; a lack of review by someone else can be a risk in itself. The reviewer should be a person with the appropriate skills, knowledge and experience. This may be the Principal Designer, if one has been appointed.

2. This may be an area, floor, single design element or, for a small project, it may be the entire design e.g. a plant room, a concrete slab or a retaining wall.

3. Refer to "How it works" section of guide as well as Table 1

4. This is where the designer is able to be satisfied that the guidance, advice and industry good practice adopted will be sufficient to address the risks.

5. Ensure relevant information has been made available to others and indicate where this is shown.

6. There may be a good reason for not following standard practice but, if so this needs to be recorded.

7. Reference can be made to meeting minutes here.

8. Essential that the designer has confidence that the particular detail can be safely dealt with by those who will undertake the task.

9. Having sought advice it should be followed. If not, the reviewer needs to be satisfied with the reasons for not doing so.
It should also be remembered that the risks do not just lie with the physical structure: see Annex A for examples. There may also be site-wide risks e.g. space, access, public etc. or risks with the design process itself (e.g. validation of software, capability of team).