



# CONSTRUCTION DESIGN RISK MANAGEMENT

A NEW LOOK AT SYSTEMS AND APPLICATION

# INTRODUCTION



I will look at this afternoon:

- The factors that affect Design Risk Management
- Risk management and risk assessment methodologies
- Risk treatment and hierarchies of control
- An analysis of Designers duties under CDM 2015
- Applying the theory to roof design

# DESIGN RISK MANAGEMENT



- In July 2018 Andrew Leslie and I were asked to draft a new APS Design Risk Management Guide.
- Before we tried to start writing this book, we thought we would research the subject outside what had already been written in the context of CDM.
- We were prompted, by a member of the books workgroup, to look at the **IChemE's Six Pillars to Process Safety**.
- This research led to standards published by the American Society of Safety Professional and the International Standards Organisation [ISO].
- After studying design risk methodologies proposed by IChemE, the American Society of Safety Professional and the International Standards Organisation, we quickly realised that most of what needs to be said about the fundamental principles and processes of design risk management has already been said.
- It also became clear that the necessary models are set out within the guidance given in these standards.

# WHY MANAGE RISK



## MONEY, MORALS AND MAGISTRATES

- It is often said if you think risk management is expensive try having an accident.
- Projects also need to be financially viable and achieve the clients objectives.
- There is course a moral imperative that anybody involved in the construction, use, maintenance, cleaning and demolition of a structure should not be adversely affected by the work they do.
- The risk of corporate or personal prosecution, where it is obvious to those involved, is a powerful incentive.

# RISK



- Risk is defined by the International Standards organisation as the “*effect of uncertainty on objectives*” An effect is a positive or negative deviation from what is expected.
- Risk management is only one element of the construction design process.
- Although health, safety and fire risks are considered by some to be the most important risks to manage, there are other risks that need to be considered including the risks that the structure or service will not be fit for their intended purpose or will be unaffordable.
- Ultimately all projects, structures and services designed must be fit for purpose and affordable.

# CONTEXT



- All risk management standards require the user to understand the context in which the company is operating or the project is being undertaken.
- The context includes both **internal** and **external** factors all of which can influence the design risk management process.

# EXTERNAL FACTORS



External factors can include:

- the cultural, political, **legal, regulatory**, financial, technological, economic, natural and competitive environment in which the company is operating or the project is being undertaken;
- the perceptions and values of external stakeholders.

Legal and regulatory compliance is only one of the many considerations when assessing design risk.

Compliance with health, safety and fire legislation forms only part of the an organisation's or project's legal and regulatory compliance requirements although some might argue it is the most important requirement.

# INTERNAL FACTORS



Internal factors include:

- the commitment of the project client to the design risk management process and their tolerance to risk;
- the organisational capability of the project and design teams;
- the skills, knowledge and experience of the design team members;
- the design and risk management standards and models adopted by the project; and
- the risk management processes being used;
- company and project policies, objectives and standards;
- project and design team perceptions, values and culture and their tolerance to risk; and
- project team cohesion.

## OTHER FACTORS



- Business is driven by the need to make money and there is often little:
  - client recognition or financial benefit gained by improving H&S in the design; and
  - client appreciation of risk of being penalised for failure.
- The control of financial, planning and often aesthetic risks usually and perhaps necessarily take precedence over health and safety risks.
- Risk management is a complex subject. This complexity and the need for specialist advice is often not fully understood within the construction industry.
- Risk tolerance and commitment is rarely discussed with the client.
- Risks manifest themselves on site during construction or when the designed structure is being used which is often a long way from the designer's pen or keyboard.
- Designers are very rarely prosecuted / penalised where there is a failure.

# RISK MANAGEMENT METHODOLOGIES



- To date the management of design risk in the UK construction industry has generally followed the guidance given in the Approved Codes of Practice and / or guidance given by the Health and Safety Executive HSE on compliance with the various CDM Regulations.
- Many of the methodologies and some of the guidance conflate design risk management and CDM compliance as a means of tempering standards – the absence of prosecutions or enforcement notices does not necessarily mean that a solution is legally acceptable – although where there is a significant benefit associated with the solution it may justify accepting the risk.
- There are however many well documented methodologies that are appropriate and look at risk in a holistic way.

# SIX PILLARS OF PROCESS SAFETY



The Institution of Chemical Engineers (IChemE) espouse the Six Pillars of Process Safety:

- knowledge and competence;
- engineering and design;
- systems and procedures;
- assurance;
- human factors and
- culture.

# ISO/DIS 31000 COMPONENTS OF A RISK MANAGEMENT SYSTEM



The standard sets out a system that allows risk to be managed both within organisations and on projects.

- **Mandate and commitment** from the client or senior management team;
- **A framework for managing risk** that includes:
  - An understanding of the organisation/project and its context;
  - A risk management policy that sets out the objectives for and commitment to risk management;
  - Integration of risk management in to the organisation's / project's processes;
  - Established accountability and authority for managing risks;
  - Allocation of appropriate resources for risk management; and
  - Internal and external communication and reporting mechanisms.
- **Risk management is implemented** by ensuring that the risk management process is applied at all relevant levels and functions of an organization as part of the organization's practices and business processes.
- **Monitoring and review of the framework**
- **Continual improvement of the framework**

# BS 31100:2011 RISK MANAGEMENT: CODE OF PRACTICE



- BS 31100:2011 provides practical and specific recommendations on how to implement the key principles of effective risk management as specified in [BS ISO 31000 Risk Management. Guidelines.](#)

# BS 31010:2010 RISK MANAGEMENT: RISK ASSESSMENT TECHNIQUES



BS 31010:2010 is a supporting standard for [ISO 31000](#) and provides guidance on selection and application of systematic techniques for risk assessment. Described methods include:

- Brainstorming;
- Structured or Semi-structured Interviews;
- Preliminary Hazard Analysis;
- HAZOP;
- **Consequence likelihood matrix;** and
- Cost benefit analysis.

Not all are relevant to construction design risk management but it proves that there are a number of ways of ways of assessing risk and more than one technique can be used on a problem or project.

# RISK TREATMENT



There are a number of models and legal standards which set out a hierarchy of risk treatment (control):

- American Society of Safety Engineers and American National Standard ANSI/ASSE Z590.3
- European Union 'OSH Framework' Directive 89/391 'general principles of prevention';
- ISO 31000:2018 risk treatment options;

The American Standards are perhaps simpler and clearer than those set out in the EU's 'general principles of prevention' however they follow the same broad principals.

Compliance with the 'general principles of prevention' is however legally mandated by CDM 2015 and other regulations.

# ANSI/ASSE Z590.3



## ANSI/ASSE Z590.3: Guidelines for Addressing Occupational Hazards and Risks in Design and Redesign Processes

- **Elimination:** Remove or avoid the risk
- **Substitution:** Substitute with something less hazardous or that creates less risk;
- **Engineering:** Use engineering solutions to reduce the risk;
- **Warnings:** Automatic and manual warning systems;
- **Administrative:** training, safe systems of work and organisation; and
- **Personal Protective Equipment [PPE]:** Always the last resort. Available, effective and compatible.

# 'GENERAL PRINCIPLES OF PREVENTION'



- avoiding risks;
- evaluating the risks which cannot be avoided:
- combating the risks at source;
- adapting the work to the individual;
- adapting to technical progress;
- replacing the dangerous by the non-dangerous or the less dangerous;
- developing a coherent overall prevention policy which covers technology, organization of work, working conditions, social relationships and the influence of factors related to the working environment;
- giving collective protective measures priority over individual protective measures;
- giving appropriate instructions to the workers.

# KENNEDY V CORDIA (SERVICES) LLP [2016]



- The judgement in Kennedy v Cordia (Services) LLP [2016] 1 WLR 597, [2016] ICR 325 <https://www.supremecourt.uk/cases/docs/uksc-2014-0247-judgment.pdf> states the general principles of prevention:
- “set out a hierarchical order in which the measures necessary to protect health and safety should be considered”. “Where possible, risk is to be avoided rather than reduced; means of collective protection are to be preferred to means of individual protection (such as PPE); and merely giving instructions to the workers is to be the last resort.”

# CDM 2015 – DESIGNERS DUTIES



*“When preparing or modifying a design the designer **must** take into account the **general principles of prevention** and any pre-construction information to **eliminate, so far as is reasonably practicable, foreseeable risks to the health or safety of any person:***

- (a) carrying out or liable to be affected by construction work;*
- (b) maintaining or cleaning a structure; or*
- (c) using a structure designed as a workplace.”*

*“If it is not possible to eliminate these risks, the designer **must, so far as is reasonably practicable:***

- (a) **take steps to reduce or, if that is not possible, control the risks through the subsequent design process;***
- (b) provide information about those risks to the principal designer; and*
- (c) ensure appropriate information is included in the health and safety file.”*

**Principal designers have similar duties**

# SO FAR AS IS REASONABLY PRACTICABLE



The definition set out by the Court of Appeal (in its judgment in *Edwards v. National Coal Board*, [1949] 1 All ER 743) is:

*'So far as is reasonably practicable' (SFAIRP) is a narrower term than "physically possible", and implies that a consideration must be made by the duty holder in which the quantum of risk is placed in one scale and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) is placed in the other.*

*If there is a **gross disproportion** between them (the risk being insignificant in relation to the sacrifice) the duty holder does not need to implement those measures.'*

# SO FAR AS IS REASONABLY PRACTICABLE



The Health and Safety Executive (HSE) makes it clear at, <http://www.hse.gov.uk/risk/theory/alarpglance.htm>

***“The decision is weighted in favour of health and safety because the presumption is that the duty-holder should implement the risk reduction measure. To avoid having to make this sacrifice, the duty-holder must be able to show that it would be grossly disproportionate to the benefits of risk reduction that would be achieved. Thus, the process is not one of balancing the costs and benefits of measures but, rather, of adopting measures except where they are ruled out because they involve grossly disproportionate sacrifices.”***

## ‘Where there is a body there’s a crime’

I would suggest, where failure can result in fatality or a major accident designers need to ensure they choose a robust control even if an accident is very unlikely.

# DESIGN HEALTH AND SAFETY RISK MANAGEMENT



- Legal compliance is one element of design risk management.
- The law requires that designers follow the hierarchy set out in the 'principals of prevention'.
- Each level of the hierarchy is qualified by so far as is reasonably practicable (SFAIRP) so a duty holder has to consider avoidance before combating the risks at source and combating the risks at source before adapting the work to the individual, etc
- Risk must be avoided or controlled so far as is reasonably practicable which means that “the decision is weighted in favour of health and safety because the presumption is that the duty-holder should implement the risk reduction measure.”
- The difference between assessing and controlling **project risk** and **health and safety risk** need to be recognised.

# APPLYING DESIGNERS DUTIES TO ROOF DESIGN



The Building Regulations 2010

Approved Document K states that where access will be required to areas for maintenance

*“less frequently than one a month; it may be appropriate to use temporary guarding or warning notices”.*

It makes it clear however that CDM 2015 and the Work at Height Regulations 2005 [WAHR 2005] give provisions for such measures.

# THE WORK AT HEIGHT REGULATIONS 2005



Where work is carried out at height, every employer shall take suitable and sufficient measures to prevent, so far as is reasonably practicable, any person falling a distance liable to cause personal injury.

Where the measures taken do not eliminate the risk of a fall occurring, every employer shall **so far as is reasonably practicable**, provide sufficient work equipment to minimise:

- the distance and consequences; or
- where it is not reasonably practicable to minimise the distance, the consequences, of a fall

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## THE WORK AT HEIGHT REGULATIONS 2005



This OC provides advice to visiting staff (HSE & LA) on the interpretation and enforcement of the Work at Height Regulations 2005 (WAHR).

A duty holder **must** be able to show that it was **not** reasonably practicable to have taken the measures advocated by Reg 6(2) to 6(5)(a) (avoidance, fall prevention, fall mitigation) before relying on additional training and instruction or taking other additional suitable and sufficient measures to prevent a fall liable to result in personal injury.

Each level of the hierarchy is qualified by so far as is reasonably practicable (SFAIRP) so a duty holder has to consider avoidance before prevention and prevention before mitigation etc.

A risk assessment may be able to justify less visible fall prevention or mitigation measures for heritage cases.

**Pure aesthetic arguments for non heritage buildings will carry less weight in determining which part of the hierarchy and what type of permanent measures or work equipment to apply.**

# CDM 2015 – DESIGNERS DUTIES



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# APPLYING DESIGNERS DUTIES TO ROOF DESIGN - CONCLUSION



- Designers must undertake their duties SFARP and apply the principals of prevention.
- Designers must ensure that their design will allow compliance with the control hierarchy in the WAHR.
- From a purely legal standpoint they must have a robust justification for choosing a fall restraint system over fixed edge protection.
- Fixed edge protection is inherently safe. It is hard to see how having specified such a system they could ever be asked to justify their position.
- By specifying a fall restraint system a designer is relying on a person they may have no connection with, maintaining and using the system correctly. If they fail the designer may need to justify their decision.
- However there is no evidence of a designer being prosecuted in this area.
- Ultimately a project risk review might come up with a different answer to a design safety risk review.

# SUMMARY



- Both CDM compliance and design health and safety risk management are elements of design risk management.
- There are existing methodologies for risk management and risk assessment that can be used to improve construction design risk management.
- The commitment of the project client to the design risk management process is essential.
- Strict compliance with CDM 2015 is perhaps more onerous than is often understood.
- Legal compliance must always be considered the context of the risk environment that the project is being carried out.