# CDM GUIDANCE SHEETS

# DIOHAS



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The Designers' Initiative on Health and Safety (DIOHAS) is a group of representatives from major architectural practices, other construction disciplines and the Health & Safety Executive (HSE).

# INDEX

# Introduction to Principal Designers toolkit

This toolkit is a sequel to 'CDM 2015 – a Practical Guide (PG) for Architects and Designers' and must be read in full knowledge of its principles and proposals. References to CDM – PG will be made in the text.

The RIBA Code of Conduct to which all architects should comply requires every designer to aspire to, heathy design and creative safety, as well as comply with their statutory duties under CDM 2015.

There is also an ethical and moral requirement for all designers to take these issues into consideration whilst designing. The RIBA toolkit is an essential guide to that which is expected, and needs to be achieved by Principal Designers with everyone in the project team working together on Architectural Projects. It has become clear that the health and safety aspirations and methods may be totally differently addressed on engineering or maintenance projects. Please work with the RIBA to ensure we all adopt the good habits outlined in this toolkit.

This toolkit highlights 'significant design risks' and 'CDM issues' as well as the construction based processes that relate to them.

A careful balance needs to be considered between design alterations to avoid or minimise the risks and/or an adoption of construction related measures to control the risks. This is the principle of proportionality that is required in CDM 2015, and requires project team collaboration to decide what is an acceptable or tolerable risk solution for their issue or project. (Ref – CDM – PG – Pg 23-25).

Every Designer & Principal Designer should check their designs regularly, at all work stages, to ensure that they are meeting the required project safety strategy standards and take corrective action (sfarp) to meet these standards. This toolkit should be used during day to day design activities to alert the design team to safety strategies required in their designs for construction projects.

Project teams should carry out safety reviews looking for instances of acceptable or unacceptable CDM standards and take corrective action as appropriate if required. Reference should be made to the Hazard Awareness Risk Identification Checklist in CDM PG pgs 101-120.

If you find instances of what seems likely to cause poor construction practice or unacceptable risk and cannot be resolved immediately, identify these on drawings or notes for future review and communication within the team. These should not include routine trade risks but primarily significant (design) risks as identified in the CDM HSE 153 Glossary.

All project teams should ensure their designs comply to these visual standards. If every project is maintained to these standards we should help to minimise the risk of personal injury, serious accidents and damage to the environment from occurring

(The cross and tick will be used throughout this handbook to show you what is correct/ acceptable and what is incorrect/unacceptable.)

Unacceptable

Acceptable

# Healthy design creative safety (RIBA & HSE RR925)

## Main Messages

This collaboratively researched and developed report between the HSE and the RIBA has captured all the key drivers and blockers to create health and safety amongst architectural designers and students and academics. Its wider acceptance and understanding is essential for future safe architectural design.

## Summary of Findings

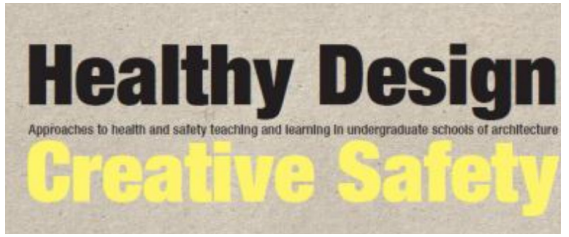
- This research has found evidence of innovative and creative ways of teaching health and safety. It has also revealed that such good practice often addresses health and safety in indirect ways and knowledge is rarely shared between institutions, resulting in variability of approach and delivery of the subject.
- Health and safety is an appropriate subject to cover in undergraduate schools of architecture. There is an academic imperative to the subject and it is not just something that should be dealt with in practice. Many interviewees recognised the need for the subject to be creatively addressed.
- 'Health and safety' is sometimes perceived negatively by students and staff. This is largely due to a misconception that the subject is purely concerned with applying a set of rules in practice.

## Recommendations

- At undergraduate level students need to understand the principles of health and safety thinking, rather than the details of legislation. Students need to understand that as designers they are partially responsible for the safety of others, both during construction and in use.
- A consideration of 'buildability, maintainability and usability' at all stages of the design process is likely to be more engaging and better understood than using the term 'health and safety'.

- Visits to construction sites play an important role in contextualising the students' understanding of health and safety issues. The potential exists for architecture schools to form partnerships with major contractors in order to make site visits more viable. University Estates Departments can also potentially help with this.
- Health and safety strategy should be integrated into design projects where possible, rather than being an abstracted subject.
- University schools of architecture should review the teaching that is given across the undergraduate years to ensure that there is a coherent strategy for teaching health and safety concepts across the degree programme and beyond.

The RIBA and the HSE in conjunction with the Construction Industry Council are endeavoring to embed these recommendations into all UK schools of architecture to develop these skills at the grass roots of the profession. This book assists with the process of understanding a proportionate and practicable approach to education and practice.



# Safety Diiferently-Innovative and critical safety thinking

## Can safety renew itself?

Is the safety profession uniquely incapable of renewing itself?

For a profession that is organized around the elimination, reduction and control of risk, innovation can be a tall order.

Innovation means taking risk. It requires a critique and a questioning of assumptions that under lie our practices. Such a critique, such questioning, can be unwelcomed. These are assumptions and practices, after all, that (many believe) have got us to where we are today, that keep many of us in business. Innovation is risky. It entails reputational risk, psychological risk, financial risk, practical risk even.

Safety innovation, then, is not just an oxymoron. It could be what philosophers call a performative fallacy. By stating itself, it denies the very possibility of what it states. Safety and innovation do not work together, because innovation is per definition unsafe. Or at least it is seen as unsafe by all kinds of stakeholders.

Fear of innovation, of thinking and acting differently, has dogged humanity forever. Yet humanity has always found ways to conquer that fear. The European Enlightenment is an example of a wholesale shift in intellectual thinking, lifting up the power and freedom of human reasoning over hand-me-down truths from Church or Crown.

Immanual Kant, one of the great Enlightenment thinkers, argued that Enlightenment was our release from self-incurred tutelage. Tutelage is the incapacity to use our own understanding without the guidance of someone else or some institution. Tutelage is the ultimate run for intellectual cover. Tutelage means relinquishing your own brainpower and conform, so as to keep the peace, or keep a job. But you also help keep bad ideas in place, and keep dying strategies alive.

Crucially, Kant blamed not a lack of intellect for us submitting to such tutelage. He blamed a lack of determination; a lack of courage. His rallying cry for the Enlightenment became Sapere Aude, or “Dare to Think!” Innovation depends on such courage. It depends on the freedom from constraint, on freedom from the shackles of a current paradigm. It depends on a relentless curiosity, on an impatience or dissatisfaction even with what other people want us to know or do. We are caught in a paradigm that has us confirm to each other what we think we already know.

This is how we train and educate vast cadres of new safety professionals. But innovation means thinking differently from what we think, to how we think. It means, as Michel Foucault once said, straying far afield of ourselves, seeing differently from how we see. It means becoming free from ourselves. Dare to think!

But can safety professionals do that? There is, perhaps, something indelibly conservative about the safety profession—it is a field characterized by a dogma of risk adversity, by an inclination to preserve that which we know (or hope or pray) still works for us. Daring to think could mean playing with fire. It could mean biting the hand that feeds us. Perhaps taking risk is precisely what we do not want to do.

Or is it?

Please help prove that we can dare to think, and change, too.

Immanual Kant
1724-1804

# Safety Can't be measured - Andrew Townsend

The RIBA are developing these ideas to help the creative professionals to achieve 'CDM Differently' in a proportionate and practical way as proposed by the CDM 2015 (and 2007) Regulations.

## The Case for Safety Differently

Andrew Townsend's thought provoking ideas on health and safety are captured in this inspirational book He states in the prologue:-

"I still have that need to understand how to make things happen. How does something work? But health and safety is different. It is a paradox. It is about making things not happen. Learning by experience and safety are mutually exclusive concepts. Safety is not tangible; it cannot be measured. What is measured is the absence of safety - they are called injuries, incidents and ill health.

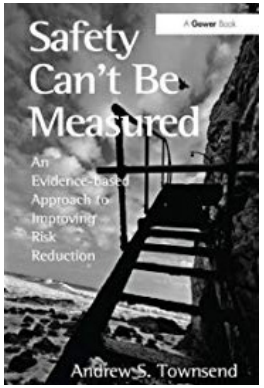
"Safety" is talked about as if it were a physical or social entity that, by implication, can be studied in the same way as a physical or social science. At its best, the study of safety is about understanding that, as time progresses, rates of failure decrease and about trying to interpret the processes involved. At its worst, the study of safety is used to chauvinistically justify a particular way of doing things to the exclusion of others; improving failure rates are used to imply success by association without the admission that there might be other explanations. In the absence of tangible objective measures safety is "measured" using subjective surrogates. These surrogates have all the appearances of the precision of measurement associated with physical sciences or engineering.

Without adequate training in the disciplines of measurement ordinary members of the public, managers and the working level safety advisors may gain the impression that safety is a "science" and conforms to immutable physical laws. Nothing could be further from the truth; the original research upon which much of today's safety management is based is at best fragmentary; at worst it is spurious.

Yet the original assumptions made in the management of safety have been in existence for almost a century. They have had time to embed themselves in the minds of industry and the safety profession; to challenge them now is almost an act of heresy. Reading the language used by its adherents and acolytes safety has assumed a quasi-religious status. It has its own language and conventions which only serve to elevate it to beyond the understanding of mere mortals. The study of safety also is incomplete in the sense of no one knows how it all fits together and whether or not if how it fits together is changing with time. This book is intended to empower middle and senior managers and members of the public with the knowledge of just how complete or incomplete the under-standing of health and safety is; it is intended to encourage them to demand evidence to support whatever they are being asked to do.

It takes at least six months of walking a construction site twice a day before the workers on the tools trust you with what they really think as opposed to what they think you want to hear. One day one of my fitters remarked 'too much safety makes you unsafe'. When I asked him to explain he described that the safety requirements we had placed upon him prevented him from doing what he was good at and what he had been trained to do.

Inhibiting his ability to exercise judgement and skill was in itself unsafe. Where was the evidence that all the restrictions placed upon him actually worked? It was at that point that I realised I was enforcing a dogma for which I had not seen the source data. It was at that point that curiosity got the better of me and I tried to find out what really makes safety work. It was another 25 years before I could answer that question."



# The Architecural Designer's Viewpoint (DIOHAS)

**What is a Significant Risk Management as opposed to a Trivial Risk Management?**

Lack of **understanding by CDM Advisors** and others about **what "Designers"** really **need to know** about Health & Safety. i.e. **As against what can reasonably be addressed by the competent principal and trade contractors.**

**Expectations of CDM Advisors** and others of **Designers' Health & Safety knowledge** is often **excessive e.g. Engineers, Architects, Interior designers etc. all have different requirements and levels of knowledge.**

Designers **can only consider so much** with regard to Health & Safety but how much?
**Significant, project specific, unusual issues only and not everything.**

**Written Design Risk assessments** have proven to be a tedious waste of time **adding no value.**
They have even caused **"Designer disenchantment"** with CDM.

Designers have to deal with CDM documentation within the myriad of other design considerations but often **too much unnecessary bureaucracy** is still expected **by CDM Advisors and others causing a further Design Stage Disconnect within the industry.**

**Architectural designer competence defined by HSE as sufficient skills, knowledge and experience and provided by the RIBA.**

Project **pre-qualification** H&S paperwork is often **unnecessarily excessive. A sample PAS 91 process has been recommended by the HSE.**

# CDM 2007 - 2015 - DIOHAS Views on ‘Risk Terminology‘

**CDM  Regulations 1994, 2007 & 2015 - Target setting legislation.**
Non prescriptive risk management as opposed to prescriptive solutions to risk problems. Requires the exercise of individual and team judgement in the context of all design issues.
**But lack of prescription** means examples poor, best, good or acceptable practice **case studies missing.**
Therefore RIBA are producing the Toolkit of good CDM case studies.

**The Regulations are open to wide interpretation**
**What is Proportionate** - this is different to different people?
**SFARP** - so far as is reasonably practicable? ICE report?
Right information, to the right people, at the right time-examples?
**What is suitable and sufficient?**
**What is proportionate and practicable?**

**Industry reaction have been:**

- Unduly risk averse
- **Risk averse**

**CDM COMPLIANT** or MINIMALLY COMPLIANT? **Is there a difference**?

- **Risk negligent**
- Professionally negligent
- Malicious Compliance

**A lack of understanding of the issues has led to a design disconnect between designers, CDM-C’s/Principal Designers of the industry.**

# What Do Designers Really Have To Do? HSE's - Do's and Don't for Designers

**HSE statement relating to the CDM regulations for designers**

**DO's**

CDM **does** place certain specific duties directly on designers:

To **eliminate hazards** where feasible.

To **reduce risks,** so far as reasonably practicable, from those hazards that cannot be eliminated.

To provide information on **residual risks** if they are significant, so far as reasonably practicable.

And in order to discharge these duties a competent designer will need **some knowledge and experience of the construction process.**

For instance:

To know what the **potential hazards** will be during the construction, maintenance, cleaning and dismantling of your design.

To satisfy themselves that there is at least **one safe way of constructing their design.** (Your client doesn't want a design that can't be built or can be built at disproportionate expense!)

**HSE statement relating to the CDM regulations for designers**

**DON'Ts**

**CDM does NOT** require:

- The **elimination of attractive features** such as atria (including complex geometrical shapes or other innovative designs).
- Designers to choose **"the safest form of construction".**
- Designers to take into account **unforeseeable hazards.**
- Designers to **stifle their creativity,** limit their design freedom or **place safety above aesthetics.**
- Designers **to have a detailed knowledge of the construction process,** or to specify standard construction processes or precautionary measures to the contractor.

Designers to **exercise any health and safety management functions** over contractors or sub-contract designers (who often have designer duties themselves).

# Lofstedt review of Health & Safety 2011

**Executive summary – CDM Highlights**

- 200 Regulations and the 53 Approved Codes of Practice (ACoPs) are putting undue costs on business whilst doing little to improve health and safety outcomes.
- The problem lies less with the regulations themselves and more with the way they are interpreted and applied.
- “Sfarp” allows risks to be managed in a proportionate manner… however, there is general confusion over what it means in practice and many small businesses find it difficult to interpret.
- Regulations designed to address real risks are being extended to cover trivial ones... risk assessment has turned into a bureaucratic nightmare for some businesses.

I therefore recommend that HSE should review all its ACoPs. The initial phase of the review completed in June 2012 for businesses have certainty about what is planned and when changes can be anticipated.

This leads to the development of CDM 2015 regulations.

# Improvement Objectives Summary

Identify “significant” CDM risks and issues only– ignore the trivia.

Agree these in a blame free collaborative culture and allocate lead ownership to each stakeholder where possible.

Highlight the “significant risks” only so they are not lost in all the other project information.

Use Non-text symbols to identify significant risks and issues on design drawings, sfarp.

Provide “CDM Analysis and Options” documentation for all issues that are not easily understood, need further justification or are complicated with other factors.

Have a simple risk management register as an executive summary.

Contractors to add their own site safety information to drawings. When appointed, if in collaboration with specialist subcontractors, these can be communicated with client and design team and displayed on the site.

All stakeholders to understand and manage their own risks.

Provide simple good practice and safe design options visually where possible.

Incentivise the project team to improve safety for added value by simplifying the CDM design process and improving efficiency.

# Guidance - Timing of Principal Designer Appointment

- After RIBA Stage 0-1 and before Stage 2 i.e. with “No Initial Design work undertaken only assimilation of the brief and constraints” is required
- Alternatively it could be expressed as being “before Stage 3 i.e. before Concept design, when design analysis & options are undertaken”
- If we want no misunderstandings we leave it as 1 or preferably 2
- However if we want to allow professional judgement, i.e. “in practice, if the project may not be going to progress beyond an early stage because it is for a competition or planning permission only, someone who has competency from the design or client team can be appointed as PD to discharge the initial duties commensurate with that stage”
- This still equates to a PD appointment before Stage 2, even if he might not take the scheme onward to completion.
- The project pre-construction information simply explains the proposed constructional methodology of the project in parallel with the design. This can be passed on to another.

# The Behavioural or Psychological Approach to Design Safety

No one can think of safety 100% of the time?

Even a Health and Safety Practitioner!

eg: Nobody concentrates on safety all the time whilst driving?

Safety is at the back of our minds all of the time……..

It is in our subconscious mind.

Our conscious mind is addressing the job in hand.

Our brains need to be alerted and safety responses follow.

Our senses are heightened and safety mode clicks in.

We should then take “immediate corrective action”

“See it ,Sort it! …….Don’t pass by!”

The “Design” analogy of this is symbols on drawings

# Construction Guidance - The Silent Book - NCC Construction Sverige AB.

**The Problem/Challenge**
The provision of health and safety information in a simple, non-verbal format.

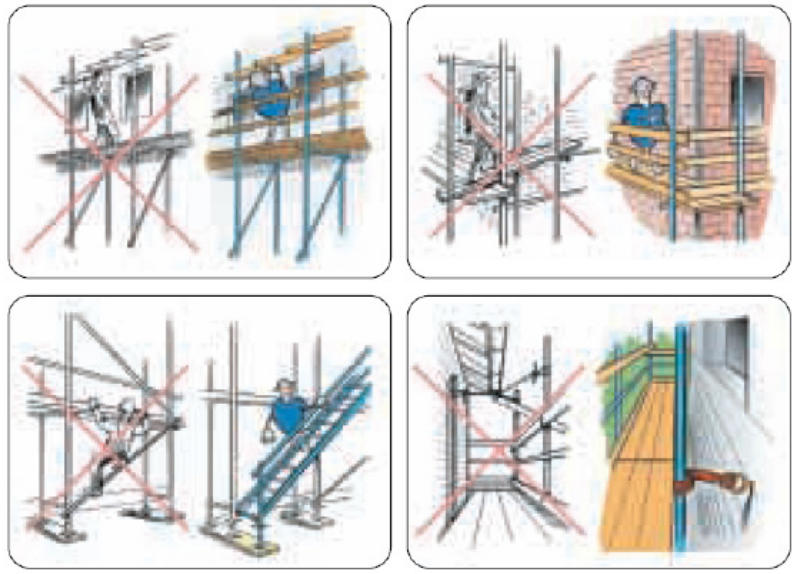
**The Solution**
NCC formed a working group to develop a picture their own information materials for workers. The group decided to develop a picture book presenting different hazardous work situations - The Silent Book - containing pictures of what not to do and what to do.

**The Benefits**
NCC has recieved positive staff feedback about the Silent Book. Employees report that it is fun to browse through and that its use stimulates interesting discussions about hazardous work processes and prevention.

**Key Points**
The Silent Book forms part of NCC's overall and comprehensive occupational safety and health management system. It is just one part of their activities to train and inform about health and safety, and to motivate and promote good heath and safety performance. The Silent Book is an excellent way of providing information to everyone, including those that do not speak the language of the country they live in, and for anyone who cannot read with confidence.

www.ncc.se

Roped access IRATA guidelines Roped access IRATA guidelines.




Roped access IRATA guidelines.

Terminal 5 Heathrow.

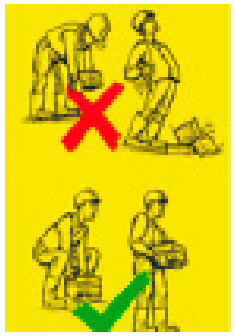
# Effective delivery of Important safety information.

**The Problem/Challenge**
Identifying and implementing a simple and effective way of delivery important site safety information can be challenging. Wordy and excessive documentation can be a turn off to so many site operatives at the workforce. Language barriers can also be a problem. Failure to convey important information effectively can lead to injury and ultimately deaths that are relatively easy to avoid.

**The Solution**
A simple method of using illustrative (cartoons) signage to convey important messages.
Using links with trade associations, component manufacturers and suppliers to provide visually explicit safety information suitable for everyone including foreign workers and other operatives with reading difficulties.
NCC formed a working group to develop their own information materials for worker. They decided to develop a picture book presenting different hazardous work situations – The Silent Book – containing pictures of what not to do and what to do.

**The Benefits**
Safety information is provided by the “experts” ie. Thepeople who design and produce the actual components.
NCC has received positive staff feedback about theSilent Book. Employees report that it is fun to browse through and that it stimulates discussion about hazardous work processes and prevention.

**Key Points**
Use eye-catching cartoon. No need for use on architectural design drawings. The Sile Book forms part of the NCC’s overall and comprehensive safety and health management system.




# Haskell's - 'Designing for safety' Programme.

**The Problem/Challenge**
Traditionally architects were encouraged to stay away from construction safety issues due to potential liability claims, producing a huge amount of paperwork and creating a huge risk register of issues which are not necessary to capture as a way of showing you are doing something.
These embedded attitudes need to change.

**The Risks**
This claim conscious attitude inhibits good integration of design and construction safety and potentially causes accidents instead of avoiding them.

**The Solution**
Haskell Design Build (US) are responsible for design and construction and their motto is "one company , one responsibility". They have corporate liability coverage for all their architects and construction professionals. They use collaborative design-build delivery including a safety alert system using only 8 types of warning symbols on drawings to flag potential hazards.

**The Benefits**
Safety symbols are placed where the hazard is on a drawing, ie. not in other risk analysis documents or in the margins where they are easily missed.

**Key Points**
Symbols are explained in the margins and in other contract documents. Subcontractors are advised that this does not relieve them of their own safety responsibilities.

# Identifying significant risks with symbols.

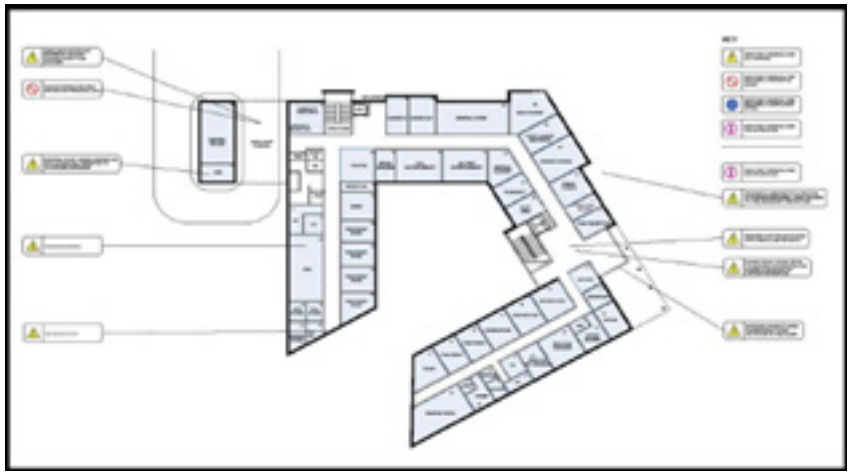
**The Problem/Challenge**
Producing clear visual information that conveys simple messages to all parties about risk. Highlighting significant residual risks outside competent contractors' expectations or of otherwise hidden risks.

**The Risks**
Important information about risk can be easily buried in other project paperwork. Need to allow sufficient time for safety planning.

**The Solution**
Simple identification on the relevant project drawings that can be used at pricing and construction stages. Standardised set of symbols used to represent common hazards. These can be supplemented by text boxes with further clarification if required. Symbols could also be used to identify key safety issues for construction workers on site irrespective of language or reading ability.

**The Benefits**
Simple drawing annotation techniques showing key safety issues economically, with minimal bureaucracy.

**Key Points**
Communicate with other designers to agree common significant design safety issues. Provide information that meets all intended purposes on one drawing. Try to avoid a separate set of H&S drawings but the principal is to make the risk information accessible on the drawings. This can be included on a separate level and turned off if not required.



# Detail Design - Highlighting Residual Construction Risks in the Design

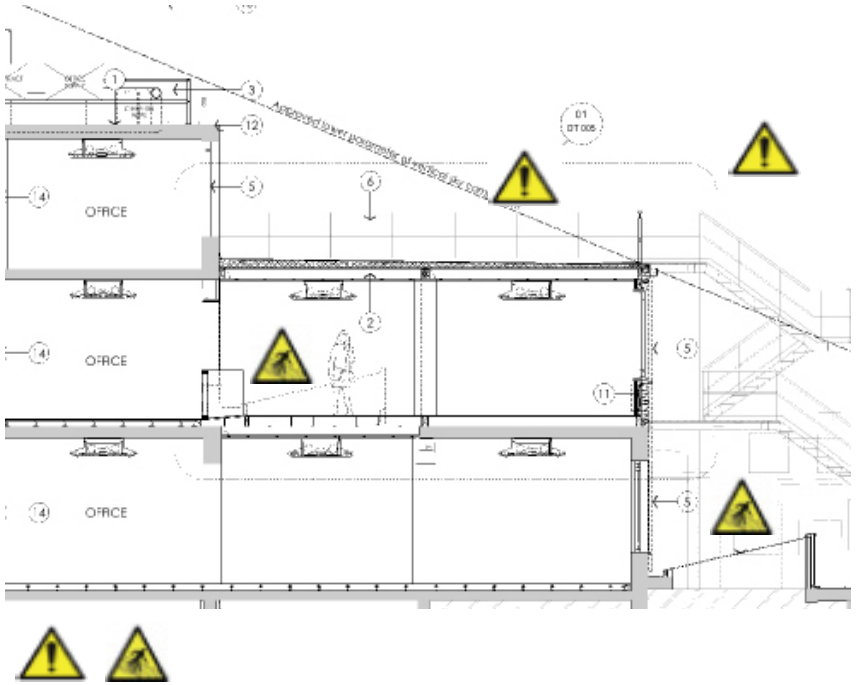
**The Problem/Challenge**
Highlighting significant residual risks hidden or outside of competent contractors' normal experience.

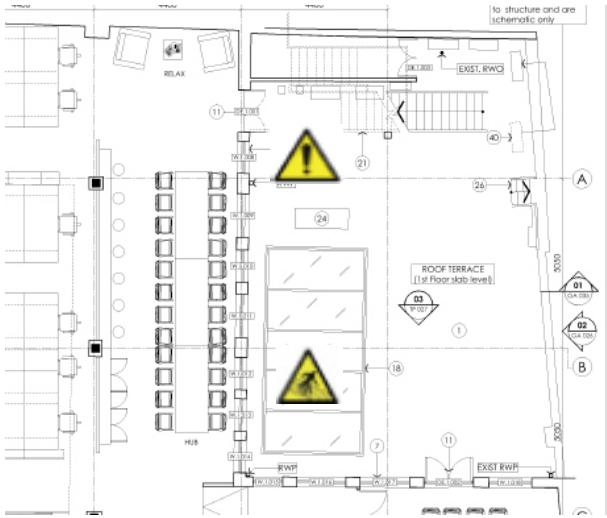
**The Risks**
If these risks are not identified pre-tender it is possible that the contractor will **under-estimate the cost and details** of the temporary works solution for safe construction.

**The Solution**
**Simple drawing and survey annotation techniques** showing existing features, new proposals and possible temporary works solution with commonly recognised symbols.

**The Benefits**
**Simple identification on project drawings** or surveys that can be used at pricing stages. These can also identify key issues for construction workers on site irrespective of language and educational difficulties.

**Key Points**
**Identification only required with symbols and simple annotation.** No need for detailed explanations which can be added to a simple risk register or risk analysis document.



# Hazard, Risk Identification and Communication

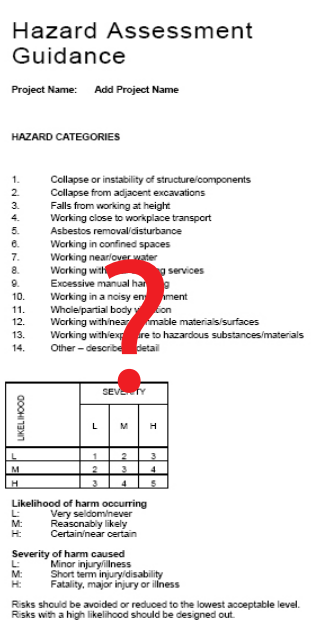
**The Problem/Challenge**
In accordance with the CDM Regulations it is preferred to include all significant risk analysis on **drawings rather than on written or numerical Design Hazard and Risk Assessment documents.** This is to encourage visual analysis and recording of significant construction, maintenance, and demolition issues without unnecessary bureaucracy.

**The Risks**
**Significant hazards and risks can be hidden** in the bureaucracy of a project causing them to be overlooked during design, pricing, construction and maintenance stages of a project.

**The Solution**
**Project drawings to be annotated** in simple graphic manner with key to further detail or references if required. More complex projects may need special CDM drawings. Hand annotation for design stage issues can suffice.

**The Benefits**
**All relevant risk information is collated in one place** with all the associated complexity visually apparent to all participants in the risk reduction process.

**Key Points**
Designer friendly technique ensures all significant and unusual or specific hidden issues are not missed even during design changes.
**Important not to confuse drawings with "trivial", "obvious" or "routine" risk information** which a competent contractor is expected to understand or be aware of.


Hazard Assessment Guidance

Project Name: Add Project Name

HAZARD CATEGORIES

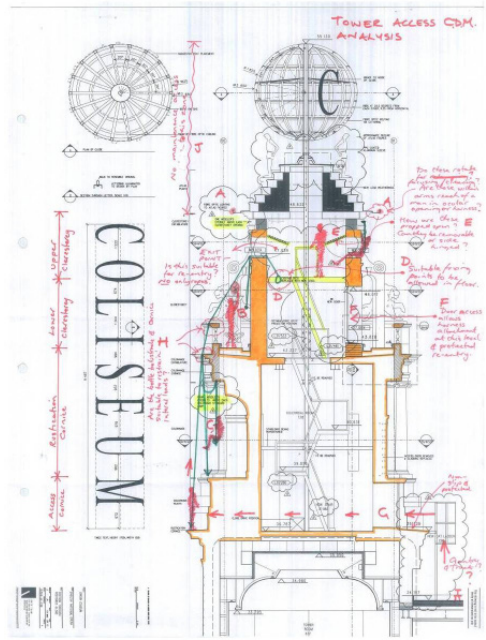
1. Collapse or instability of structure/components
2. Collapse from adjacent excavations
3. Falls from working at height
4. Working close to workplace transport
5. Asbestos removal/disturbance
6. Working in confined spaces
7. Working near/over water
8. Working with [illegible] services
9. Excessive manual ha[illegible]g
10. Working in a noisy en[illegible]ment
11. Whole/partial body v[illegible]ion
12. Working with/nea[illegible]mable materials/surfaces
13. Working with/exp[illegible]re to hazardous substances/materials
14. Other – describe detail

| LIKELIHOOD | SEVERITY L | M | H |
|---|---|---|---|
| L | 1 | 2 | 3 |
| M | 2 | 3 | 4 |
| H | 3 | 4 | 5 |

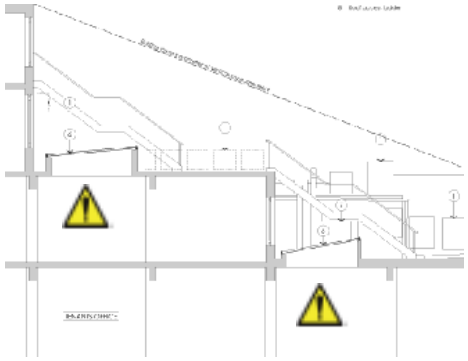
**Likelihood of harm occurring**
L: Very seldom/never
M: Reasonably likely
H: Certain/near certain

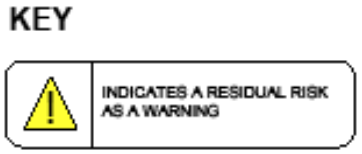
**Severity of harm caused**
L: Minor injury/illness
M: Short term injury/disability
H: Fatality, major injury or illness

Risks should be avoided or reduced to the lowest acceptable level.
Risks with a high likelihood should be designed out.



Hazard and risk analysis sketched and hand annotated

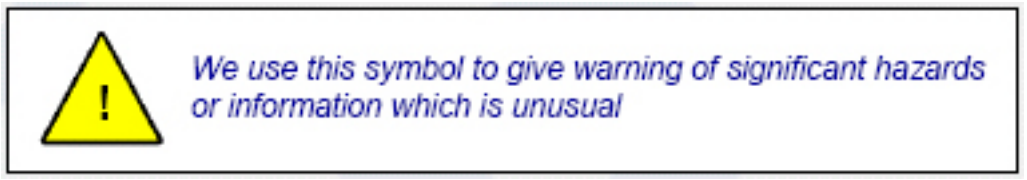

Simple symbols used on survey and construction drawings



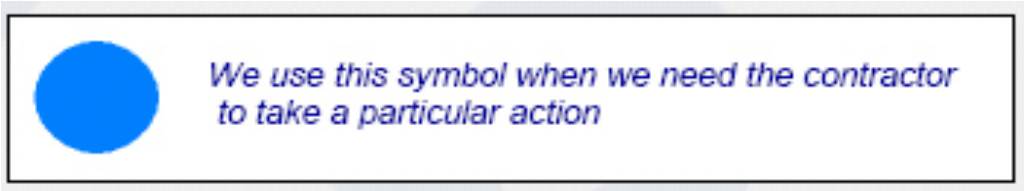
Keys in margin to amplify if required

# Designer Guidance - WSP Engineers Symbols for Design Drawings

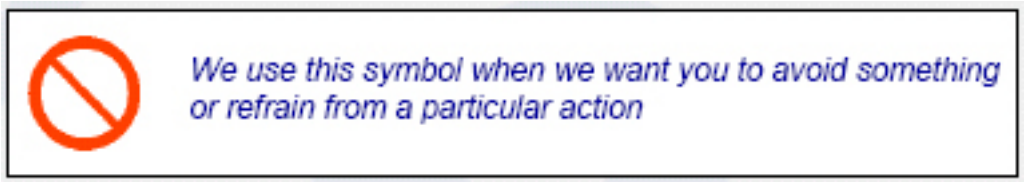
**Significant hazards** - risks that are unusual, difficult to manage and cannot be designed out eg. Fragile roof lights, holes through floors, etc.
**Compulsory actions** - to encourage the contractor to carry out specific tasks in a particular way eg. Structural erection or demolition sequences.
**Prohibited Actions** - having identified significant existing hazards and risks the contractor may need to be informed of particular actions to be avoided eg. Use of access roads prohibited at certain times on school sites.
**Significant Information** – to inform the contractor or user of issues that have been mitigated but of which they need to be aware eg. Maintenance and inspection access to difficult parts of the building once scaffolding removed.
www.wspgroup.com



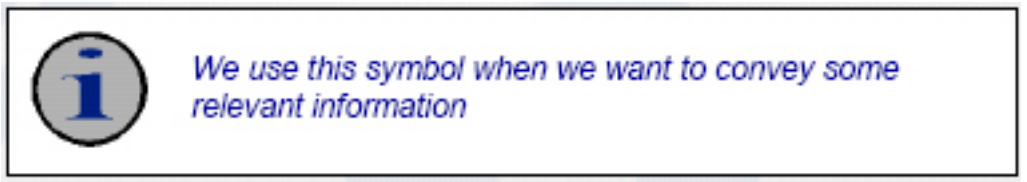

Identifying hazards that cannot be mitigated




Identifying compulsory actions to avoid risks




Identifying actions that should be prohibited




Identifying significant safety information to pass on

# Contractor Guidance - Site Drawing Safety Symbols & Signage

**The Problem/Challenge**
Developing designer drawings to a level of suitability for site operative risk identification. The design team cannot possibly know the contractor's preferred method of construction or interface issues except if contractor is appointed early. Time wasting & abortive risk analysis is to be avoided.

**The Risks**
Too much un-helpful information can be put on drawings by designers which are of no benefit to anyone and diminish the risk reduction process, by hiding the "Significant Risks".

**The Solution**
After prices, contracts and construction methodologies are agreed the design stage drawings can be augmented by the contractor's team. These can be CAD or simple sticker annotation of drawings and displayed in site huts and at the workface.

**The Benefits**
Most operatives irrespective of nationality and education are able to decipher the relevant information at point of use or ask for further information.

**Key Points**
Contractor's team may include a designer to update the drawings or just use their own safety team resources. Some possible symbols shown, but others exist. This is an obvious task for Principal Designers in contractor's teams.

**All note: This level of detail is not needed for all drawings, except the "Hazard" symbol**

# Early CDM Design Decisions of Mass and Form

**The Problem/Challenge**
Identification of the **key CDM design issues** to consider at the concept stage.

**The Risks**
**Constructing, maintaining and cleaning the building's structure and exterior safely.** Other detailed CDM issues may be explored at later design stages.

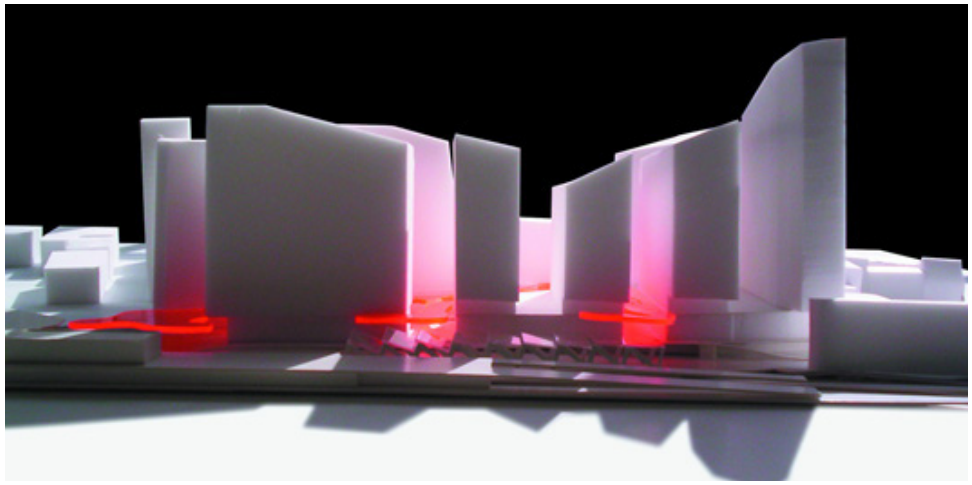
**The Solution**
Identify significant CDM Issues affecting the design:

1. What is the **Cleaning and Maintenance Strategy** of the envelope and any large internal voids such as high spaces, atria or courtyards?

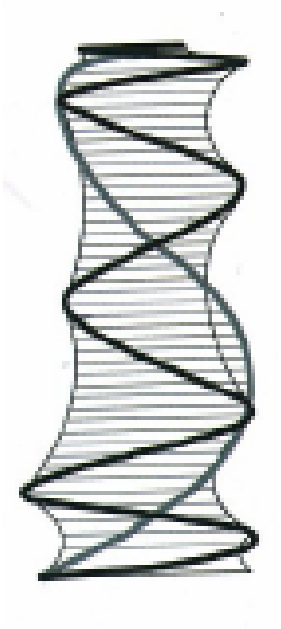
2. **Can it be built with reasonably practicable**, known or specialist constructional **techniques**?

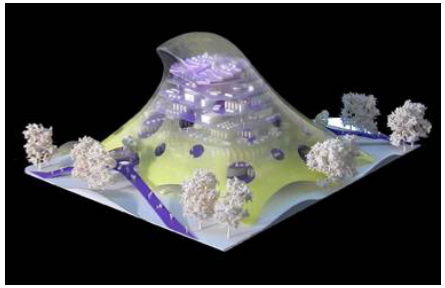
**The Benefits**
**Early consideration of key CDM issues** can simplify safety and set the tone for the entire project. Increased costs and project delays may be avoided.

**Key Points**
**Liaise with the client, FM team and principal designer** in reaching these early decisions. There are clear advantages to **involving a contractor, specialist or a CDM experienced designer** at the concept stage. Early consideration of fundamental safety issues and buildability may avoid wasted effort at later stages, eg. will it be a BMU, roped access, long poles, opening windows or MEWP (or any combination).



Challenging forms and structures





# Envelope Maintenance Systems - Mechanically Based

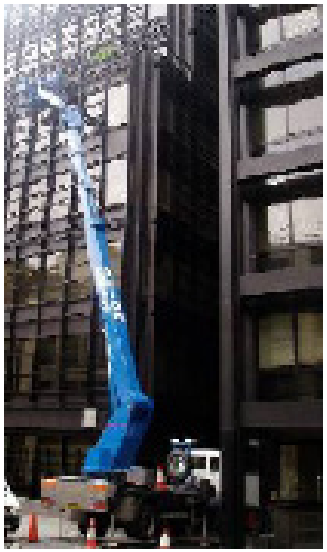
**The Problem/Challenge**
**Cleaning and maintaining glazing** to elevations at high level in a safe manner.

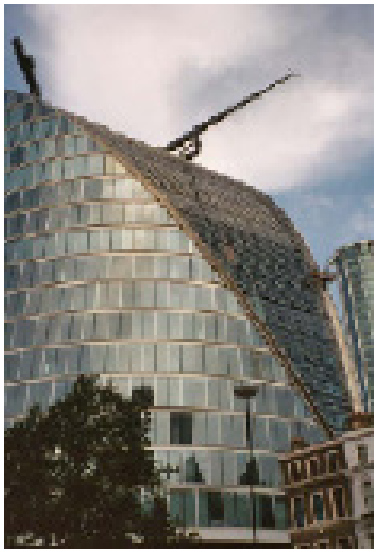
**The Risks**
Falls from height due to **unsuitable systems or inappropriately designed building fabric.** Systems of work that require high levels of supervision for their effectiveness are susceptible to human error. Falling objects can endanger people.

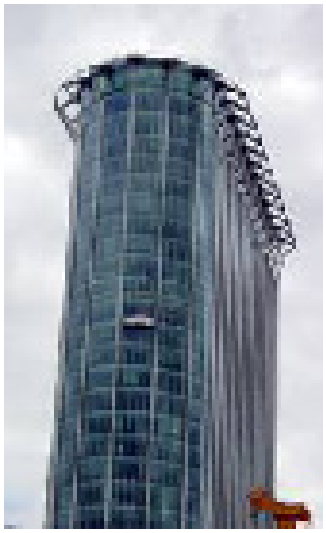
**The Solution**
**Early consideration of cleaning options** should be made in relation to building form, scale and site constraints.
**Careful selection** of engineered mechanical systems is needed to ensure that the required cleaning and maintenance tasks can be undertaken.

**The Benefits**
**Economic and safe maintenance systems** appropriate to the scale, form and type of building. Provide the client with long-term maintenance strategy and **budgetary considerations.** If possible provide a **safe working platform** in line with the Work at Height Regulations hierarchy.

**Key Points**
**Review** relevant viable options for mechanical systems at an **early stage**. Mechanically assisted work placement systems require early discussion with **specialists.** Non-manned **robotic systems** eliminate work at height but **can limit design solutions**. Mechanical systems are best suited to large areas with little geometrical complexity. Any access from the **ground**, including cherry pickers and MEWPs require stable hardstanding and **influences landscaping.**


MEWP


BMU


Cradle


Robotic

# Envelope Maintenance Systems - Manually Based

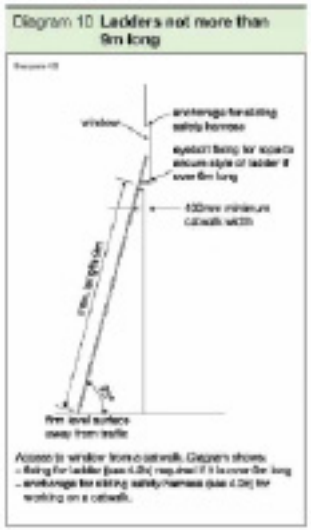
**The Problem/Challenge**
Cleaning glazing to elevations at **high level and in difficult locations.**

**The Risks**
Falls from height due to inappropriate work systems, poorly designed fabric or operative error.

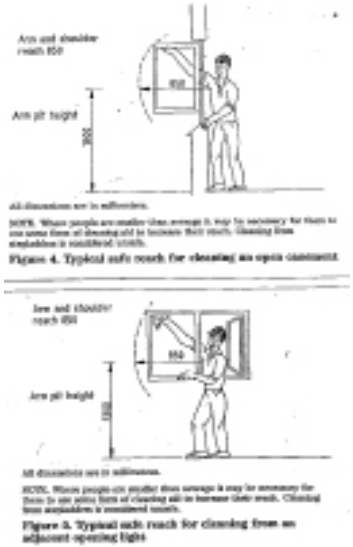
**The Solution**
Early design consideration of cleaning options. Relatively low technology and low cost techniques to be considered, more reliant on manual efforts than mechanical assistance. Ladders, opening windows, long water – fed pole, reach and wash and roped access systems **all rely on trained operators and good management control systems** for their safety. All are inherently safe in the appropriate situations and when implemented correctly. **Limitations of use to be fully understood.**

**The Benefits**
Allows **economies of scale** to be proportionately applied to all building types. Enables **quicker and more immediate** response to cleaning demands. Roped access allows work positioning to **difficult undercuts and geometrically intricate areas.**

**Key Points**
Careful consideration of all relevant associated legislation is necessary especially the Working at Height Regulations to determine the most appropriate system or combination of systems for each building design. Large, flat and high elevations are less suited to these systems.



Ladder Limitations


Opening Window Criteria


Special roped access areas


Water-fed pole

# Envelope Maintenance Case Study - Concept Design

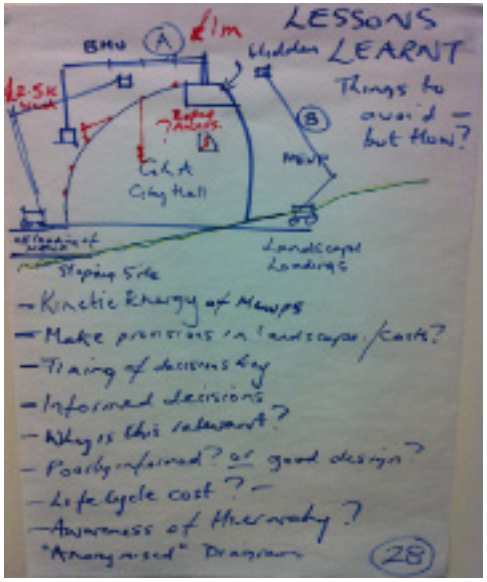
**The Problem/Challenge**
Economic and practicable envelope maintenance methods to clean unusual building forms without compromising design intent.

**The Risks**
High level maintenance techniques with possible falls from height, high costs (£145K.pa), poor results and consequential bad publicity.

**The Solution**
BMU discounted on cost and public area location of machine. Roped access not designed into cladding fabric or structure.
MEWP's used requiring hard landscape.

**The Benefits/Results**
Poor cleaning, broken windows from boom impacts, high costs in use, bad publicity.

**Key Points**
Capital v Revenue costs and other practicable factors to be compared in the decision making process at early stages of the project rather than just the safety Working at Height 2005 Regulation hierarchy.

# FAÇADE ACCESS BMU V ROPE ACCESS- CASE STUDY (P.1)

**Case Study: Getting it Right at Height**

A large corporate client had commissioned a new 12-storey headquarters building in a city-centre location - a significant, landmark building valued at approximately £100m. The building was designed to be three sided in plan with curved corners, the roof sloped from front to back in a series of steps and the office space was distributed round the perimeter of the building leaving the centre as an open space with a full-height atrium, allowing natural daylight to flood all areas of the offices.

The appointment of a professional CDM co-ordinator (CDM-c) had been made by the client at a very early stage in the development of the project. Although an outline building design had been produced, the client had not yet selected a site from three possible locations, and no detailed design work had been carried out.

In the early stages of the design development process the CDM-c organised a Hazard Identification Workshop (HIW). Unlike a traditional design team meeting, an HIW allows all members of the design team to partake in a brainstorming meeting chaired by the CDM-C; the purpose of such meetings is to identify areas of significant health and safety concern, both during the construction and operational phases, which can be logged and considered during the design development phase.

Responsibilities are allocated to specific team members for further review with the aim of eliminating the hazard or reducing the risk prior to the construction phase, if at all possible.

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Responsibilities are allocated to specific team members for further review with the aim of eliminating the hazard or reducing the risk prior to the construction phase, if at all possible.

One issue that was highlighted and discussed was the cleaning and minor maintenance of the external envelope and internal surfaces of the atrium. It was suggested that this issue needed further discussion and that a further workshop be set up primarily to review the options. Initially, a cradle system was considered the favourite means of access both to the external vertical facades and the underside of the atrium glazing.

As a major landmark project, the HSE had shown a great interest in the design stages of the scheme and it was decided to invite them to the second workshop. At this session the pros and cons of the proposed cradle scheme were discussed. The problems with this traditional solution were the stepped nature of the roof, the relatively ‘sharp’ corners of the three-sided building and the curved vertical facades that created a ‘belly’ shape, all of which limited the extent to which cradle operatives could access the surfaces to be cleaned.

An alternative solution of rope access techniques was then proposed for the external envelope.
The relative merits of the two options were explored by the whole team...

# FAÇADE ACCESS BMU V ROPE ACCESS- CASE STUDY (P.2)

... Including the HSE representative. Although the cradle would offer a stable working platform, concerns were expressed about

• areas difficult to access such as the corners and areas under the 'belly'

• The requirement to maintain the cradle equipment over the life of the building, when inspection and maintenance regimes can degrade.

• The difficulty of ensuring only trained and competent personnel operate and use the equipment over the life of the building

• The cost of constructing an elaborate support system for the cradle to operate from.

By comparison, the rope access option allowed cleaning of all areas of the facade, but only by skilled and experienced practitioners who would inspect and maintain their own equipment and would only require sufficient anchorage points to be designed and installed in the building's structure to allow access to all areas.
After careful deliberation, it was concluded that this was an option worth taking forward. Meetings were then held with specialist access providers and a solution was developed, with a rope access strategy being adopted at a saving of around £750,000. By contrast, access to the underside of the atrium roof was deemed to be best served by a cradle system, due to the configuration of the stepped glazing.

**Key learning points:-**
1. Early appointment of the principal designer allowed consideration of cleaning methodology to be developed before major design decisions had been taken. Although a key CDM issue, cleaning and associated access issues are often overlooked by project teams until the project is well advanced and the opportunity to select safer, and sometimes cheaper, solutions is restricted.

2. Initial hazard/risk assessment was carried out as a team activity, giving individual designers a clearer appreciation of which issues were to be given close attention during the detailed design phase.

3. Consideration of the Principles of Prevention would tend to suggest a cradle solution over rope access (giving collective protective measures priority over individual protective measures
- Regulation 4, Management of Health & Safety at Work Regulations). However, a 'suitable and sufficient risk assessment' requires a project team to consider all the factors relevant to that specific situation.

4. By involving specialist access providers in the process, the design team could feel more confident that their solution was not introducing greater risk than that being mitigated.

# Rope Access - Unusual Structures - Spinnaker Tower

**The Problem/Challenge**
Construction and maintenance of an **iconic and unusual structure.**

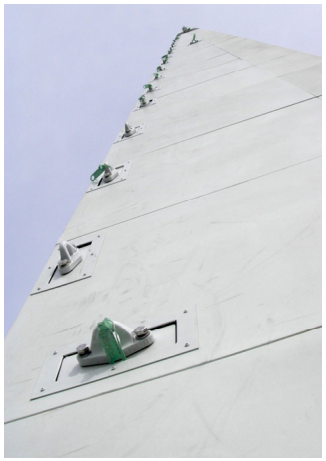
**The Risks**
**Falls from height during future maintenance operations** including aircraft light replacement access, observation deck external window cleaning and painting of metal surfaces.

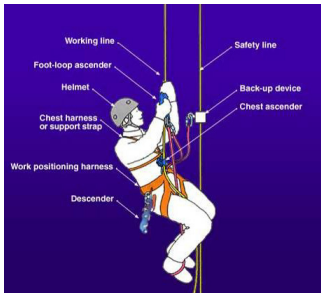
**The Solution**
Industrial Rope Access Trade Association member companies **IRATA, employed by client to ensure the safe design of attachment points and methodology of access**, and their effect upon the structure during design stages. Long life lamps and paints used to minimise access.

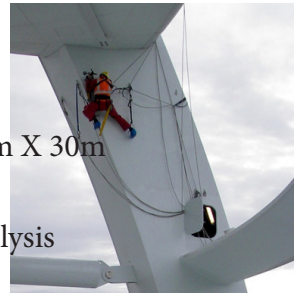
**The Benefits**
**The structure does not have to be modified** to accommodate traditional access techniques higher up the hierarchy of working at height regulations. Rope access is a proportionate method of access to achieve the design intent.

**Key Points**
**Early recognition of safety issues and consultation with specialists** to assist sub-contractor design at a later stage. The **early client appointment of a specialist** to assist with the design of the unusual structure requires special coordination of architectural, structural and specialist design skills, and early client funding.

Gold metallic curved roof 120m X 30m





Roped access +sprinkler options analysis

Robotic system at top

Cherrypicker option

# Unusual Roofs Maintenance Access - Dubai Metro

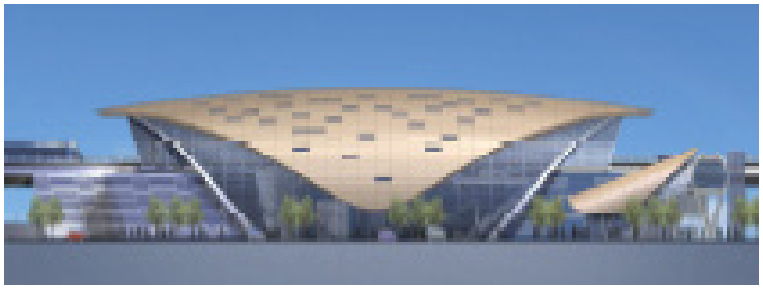
**The Problem/Challenge**
To establish an **appropriate means of roof surface and glazing cleaning** on 40 overground station roofs of iconic structural form in the hot Middle Eastern climate of Dubai.

**The Risks**
**Falls from height and heat exposure** on curved metal roofs and glazed elevations above operational railway and busy 6-lane motorway adjacent.

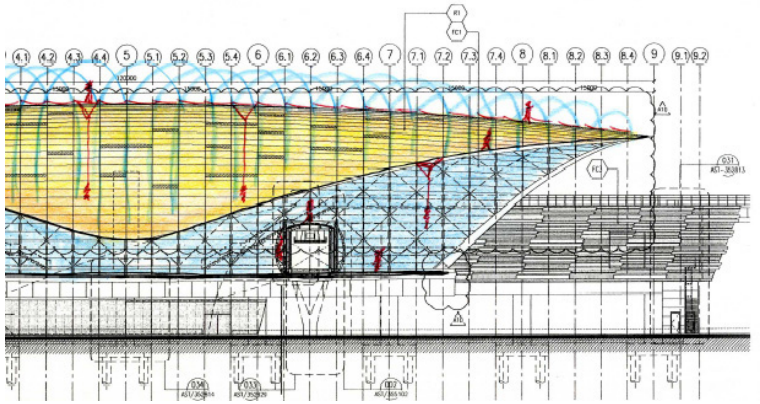
**The Solution**
**Variety of roof access options analysed** including BMU's, cherry pickers and roped access, with possible use of roof cleaning sprinkler system. All discounted on grounds of impracticability and safety to operatives and road users. Design team and client agreed solution was a **purpose designed robotic system.**

**The Benefits**
Man access to roofs eliminated for general maintenance purposes.

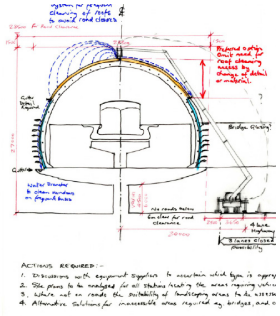
**Key Points**
Details of **sun-shading devices** critical to allow passage of robot. Roof apex robot attachment system, **water supply** and mansafe fall restraint harness system to be developed in detailed design with specialist subcontractors.



Gold metallic curved roof 120m X 30m



Roped access +sprinkler options analysis



Cherrypicker option

Robotic system at top

# Unusual Structures - The Atomium, Brussels

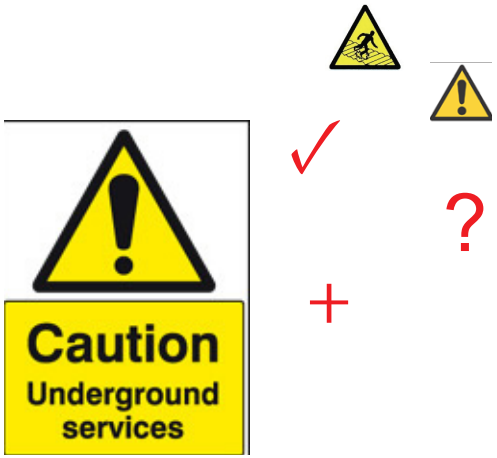
**The Problem/Challenge**
Refurbishing the Atomium externally.

**The Risks**
Safe external access to cladding.

**The Solution**
Early identification of the issues to the client and contractor to encourage off-site prefabrication where possible. Analysis of the access and cranage capabilities of the site are essential to validate the decisions and practicable size of modules.

**The Benefits**
Prefabrication of panels into small manhandlable units was essential.
IRATA trained cladding operatives were employed to carry out cladding refurbishment works.

**Key Points**
Review the buildability and access issues with contractor as early as possible .
Cost benefits may be possible as well as safety benefits.




Scaffolding to be used appropriately

Proprietary scaffolding preferred

Unsafe working methods discouraged

# Strategic Design - Residential Façade Access System

**The Problem/Challenge**
**Landlord controlled window cleaning access** to high value flats with balconies to main elevations. Impractical to use a suspended access cradle due to the need to climb out of cradles and over balconies. Access via flats not acceptable to tenants for security reasons. Access from common parts not possible, and balconies not continuous for security reasons.

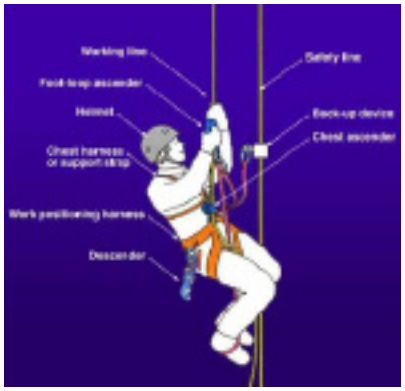
**The Risks**
Falls from height during window cleaning operations.

**The Solution**
Roped access solution for operatives to access each balcony area from which safe cleaning operations can take place.

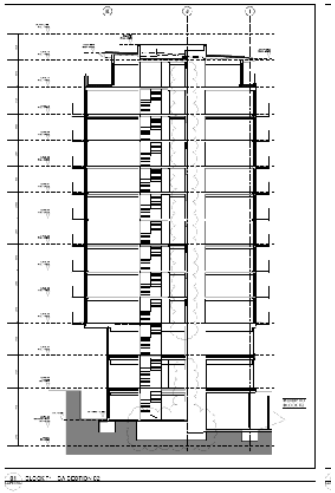
**The Benefits**
Landlord can ensure all **windows cleaned at regular intervals.** Operatives clean most windows from safe balconies.

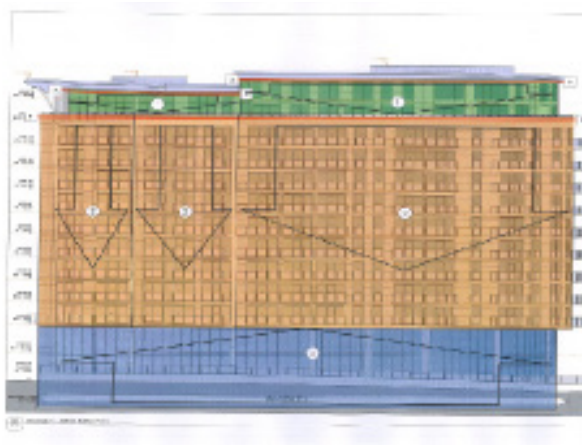
**Key Points**
**IRATA registered company consulted** on rope attachment design and details.
**IRATA trained rope access operatives employed** to ensure safe systems of working.
Highly specific project details justified a roped access solution, which would need to be equally justified if proposed on other projects.

Full length but separated balconies




IRATA guidelines used





Section and Elevations analysed for appropriate systems

# Bio-Diverse Roofs-Maintenance Access Strategy

**The Problem/Challenge**
Roof access fall prevention methods proportionate to the frequency of access requirements for maintenance activities whilst considering other design issues of “green” roofs.

**The Risks**
Falls from height by maintenance operatives or roof workers. Access is unlikely to be entirely eliminated on any flat or green roof due to inspections, clearance of rainwater outlets, etc.

**The Solution**
Collective protection measures should be selected in preference to other methods of protection, especially in areas requiring frequent maintenance. Where other factors prevent the addition of roof edge parapets, balustrading or railings, mansafe type fall restraint systems may be appropriate, set back from roof perimeters. Fall arrest methods using mansafe systems are the least acceptable option and are only workable if fall recovery and rescue systems are in place. Consider adequate means of safe access to roof level for operatives with tools and kit.

**The Benefits**
Facilities managers, maintenance operatives and inspection staff can make low frequency visits eg. for rainwater outlet clearance if properly planned measures and training are in place.

**Key Points**
Early decisions must be made at Initial Design stages considering frequency of access in various roof zones. Detail of the roof access design may require further development at later stages as access increases. Roof lights and fragile roofing materials are economic, sustainable and aesthetically desirable features which should not be eliminated from design projects purely for reasons of safety.

**Multiple access requirements to be assessed**

**Inappropriate design & access**

**Appropriate methods**

# GLASS ROOF CLEANING AND MAINTENANCE STRATEGY – LONDON COLISEUM

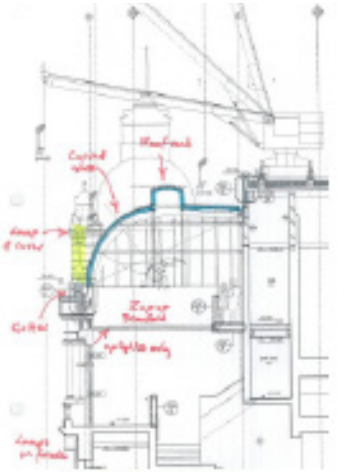
**The Problem/Challenge**
The design team for the London Coliseum refurbishment project needed to establish a how new glass barrel vaulted roof could be cleaned. It was built above the refurbished foyers and was designed to follow the original form. The geometry of the new glass barrel vaulted roof meant that there were difficulties in gaining safe access for cleaning and maintenance.

**The Risks**
Work at height would be required over fragile glass above high internal and external voids.

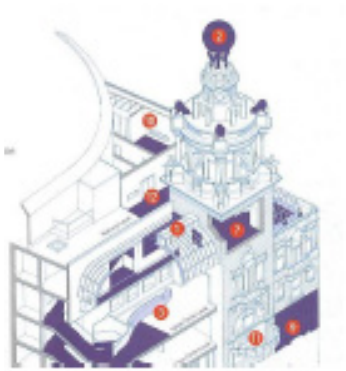
**The Solution**
After consultation with specialist access contractors, a Building Maintenance Unit (BMU) with an 11 metre jib and one man cradle was selected. Planning constraints influenced the rejection of other options, eliminating the initial proposed use of a travelling curved gantry that would have been visible from street level. Increased structural works were required to support and conceal the BMU behind the tower at roof level.

**The Benefits**
The visual, aesthetic and planning requirements were satisfied whilst ensuring that safety priorities for working at height were met. The client received the benefit of the increased flexibility and accessibility provided by a purpose built system.

**Key Points**
- The client, facilities managers, contractors and specialist suppliers of cleaning systems were consulted early in the project.
- The final solution for the project took account of safety, historic constraints and aesthetic considerations.


*Final BMU Design*


*BMU Solution*


*Cut away view of roof*


*Proposed gantry solution*

# Globe Lighting Access - London Coliseum

**The Problem/Challenge**
The existing globe at the top of the tower of the Coliseum Opera House was no longer illuminated and needed refurbishment. The building is Grade 2* listed so replication of original features was essential.

**The Risks**
Falls from height during refurbishment and future maintenance of the 240 lamps.

**The Solution**
A fibre optic design was selected, with projectors at lower, accessible levels of the tower, reducing the frequency of access to the globe required. The tower was scaffolded during refurbishment, and can be fully or partially scaffolded in the future for periodic maintenance and cleaning. Permanent man access was ruled out as impractical on both safety and economic grounds.

**The Benefits**
The hazards associated with access to the globe for lamp changes were eliminated. The fibre optic solution provided the client with an economical method of maintaining full lighting to the globe “sky” sign at all times.

**Key Points**
Consultation between the client/FM team and the design and contractor team allowed early decision making. (The early involvement of the client encouraged acceptance of the increased costs of fibre optics) Survey drawings were labelled to analyse the challenges and to communicate the best available solutions.

**Multiple access requirements to be assessed**

**Inappropriate design & access**

**Appropriate methods**

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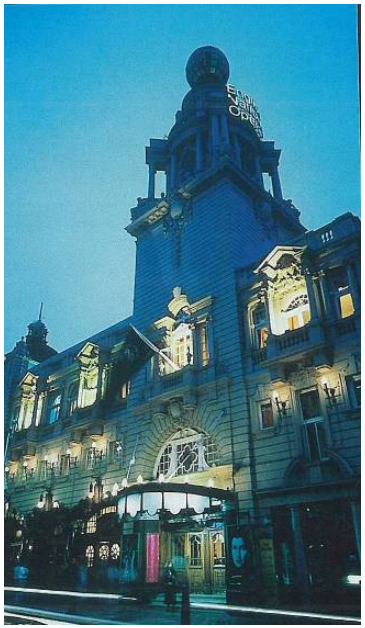
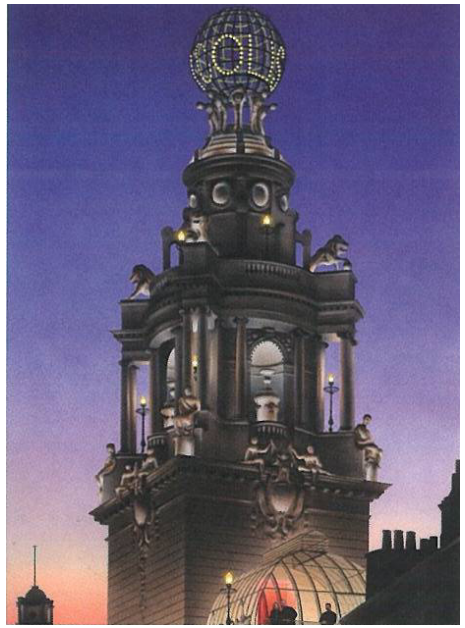
After consultation with specialist access contractors, a Building Maintenance Unit (BMU) with an 11 metre jib and one man cradle was selected. Planning constraints influenced the rejection of other options, eliminating the initial proposed use of a travelling curved gantry that would have been visible from street level. Increased structural works were required to support and conceal the BMU behind the tower at roof level.

**The Benefits**
The visual, aesthetic and planning requirements were satisfied whilst ensuring that safety priorities for working at height were met. The client received the benefit of the increased flexibility and accessibility provided by a purpose built system.

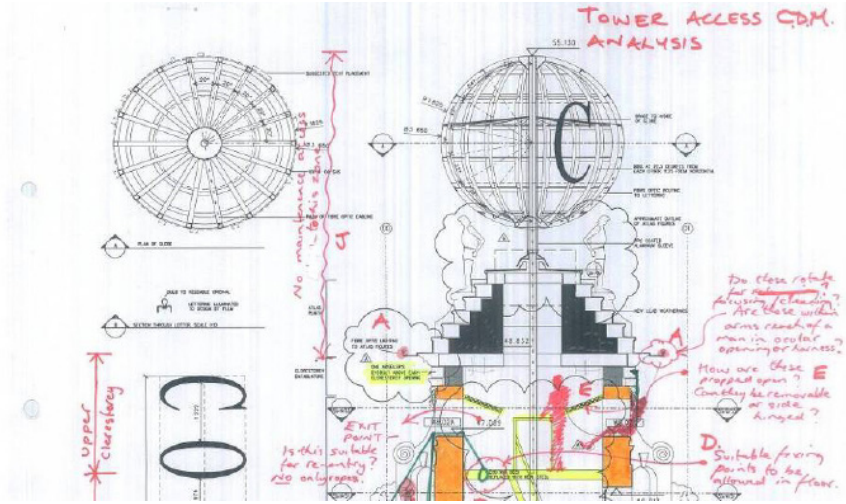
**Key Points**
• The client, facilities managers, contractors and specialist suppliers of cleaning systems were consulted early in the project.
• The final solution for the project took account of safety, historic c
onstraints and aesthetic considerations.



**Existing"dark" tower**



**Proposed "lit" tower**



# Fragile Roof-lights, Wigmore Hall - Scheme and Detailed Design

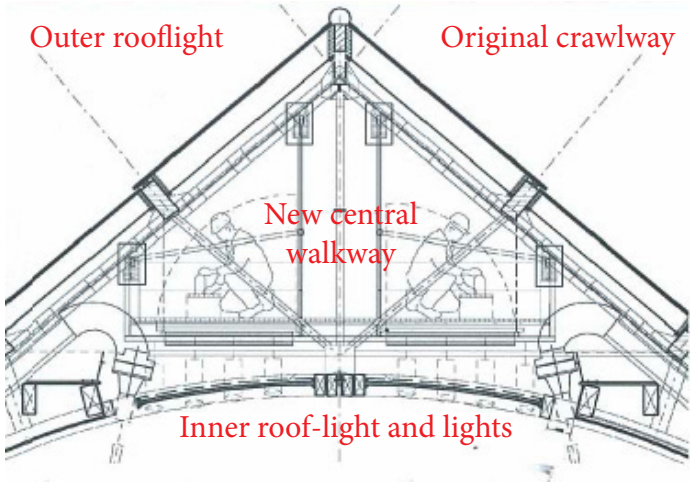
**The Problem/Challenge**
To refurbish and modify existing fragile roof lights in a listed concert hall building whilst enhancing the accessibility for cleaning and lighting maintenance access, with no appreciable effect on the hall acoustics or aesthetics.

**The Risks**
Falls from height during construction and maintenance operations.

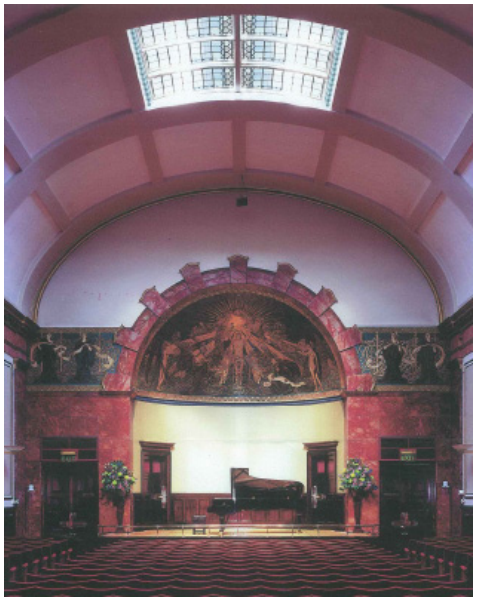
**The Solution**
The hall was fully "birdcage" scaffolded during construction. This allowed removal of existing cramped crawl-ways and the installation of a new lightweight central spine walkway. This facilitated maintenance access to the lights for performances and general hall lighting within the roof space.

**The Benefits**
Significant improvements in accessibility and safety of maintenance operatives.
Retention and upgrading of an historic and fragile roof light feature.

**Key Points**
Early analysis of the structural limitations of the roof truss and walls. Access requirements for A/C services and lighting requirements understood through discussions with users and consultants.
Buildability issues raised at the beginning of the project through specialist consultation.



Roof services, roof light and access analysis


Inner roof light above auditorium


Original roof-space


Revised roof-space

# Fragile Domed Roof-light Refurbishment - London Coliseum

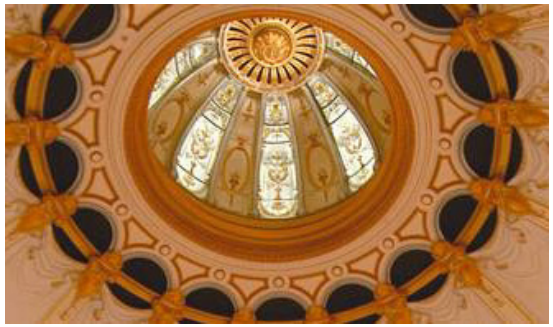
**The Problem/Challenge**
To refurbish the existing stained glass fragile domed rooflight to prevent water ingress and allowing backlit illumination.

**The Risks**
Falls from height during the construction. Falls of people or objects during the maintenance and cleaning of the stained glass panels.

**The Solution**
A glass fibre outer dome was installed by crane for weatherproofing purposes.
The inner glass domed roof-light was repaired from a birdcage scaffold within the auditorium.
Maintenance walkway installed between the two domes with a high level fall restraint cable fixed to the outer dome.
Access to the upper curved areas of glass is via a curved ladder gantry with a slide lock harness attachment.
Easily accessed light fittings fitted at low walkway level reflect off the underside of the outer dome to illuminate the rooflight.

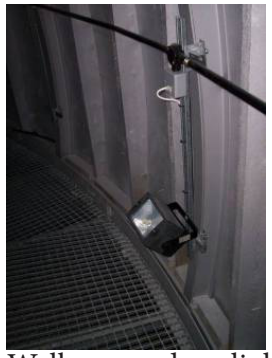
**The Benefits**
The client has been able to reinstate a spectacular roof-light feature whilst over-coming the weatherproofing and significant maintenance safety challenges.

**Key Points**
Specialist design subcontractors consulted early.
Communication with the Client and FM team essential in agreeing strategy and budget at early stage by annotation of drawings.
A combination of fall prevention methods were carefully selected, each justified in respect of the hierarchy of control measures.

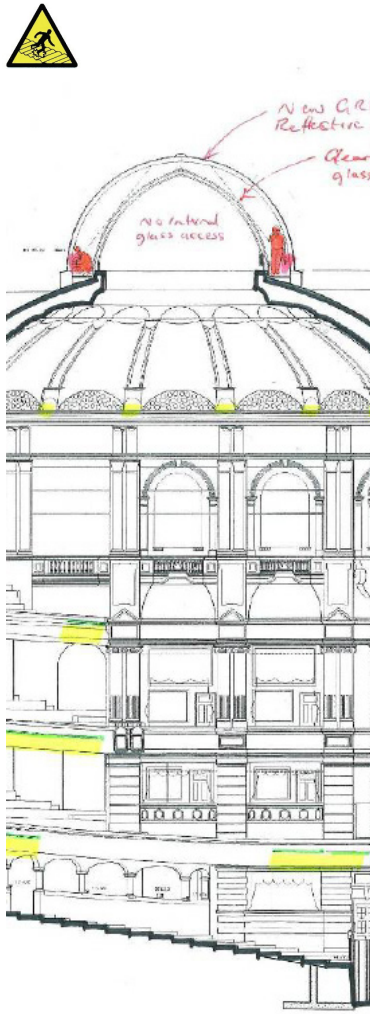


Roof light from below

Curved rotating ladder + slide-lock eg. Glide lock fixed rail ladder climbing system



Walkway and up-light



7-storey high auditorium with dome and roof light at top

# Roof-lights and Fragile Roofing Materials

**The Problem/Challenge**
Roof-lights and fragile roofing materials are economic, sustainable and aesthetically desirable features which should not be eliminated from design projects purely for reasons of safety. Safety associated with demolition of existing buildings, new build construction and long term maintenance all require the identification of fragile roofs and light roofs.

**The Risks**
Falls through fragile roofing materials are statistically high and often highly injurious or fatal.

**The Solution**
Construction, Maintenance and Demolition Phases -Important to identify existing and new fragile roof lights and other fragile roofing materials on drawings and pre-construction information as a method of informing the contractor to control the risk of falls through these materials during construction and demolition.
Contractors to recommend methods of temporary protection in tender or construction phase plan proposals to show their response.
In-use - Additional protection measures are required for the longer term in use condition such as metal railings, barriers, wire mesh or non - fragile walk on type roof lights. Avoid in-plane roof-lights or sheeting.

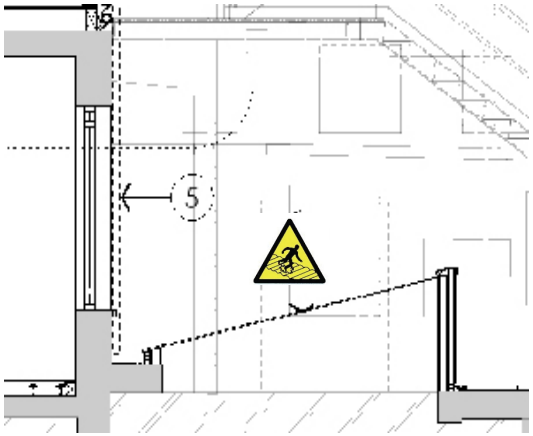
**The Benefits**
Natural daylighting is a human right and engenders healthy and sustainable environments.

**Key Points**
Walk-on roof lights tend to be very expensive so control mitigation measures are necessary. Safe Cleaning methods also need to be considered. Use symbols on drawings and CDM analysis documents.

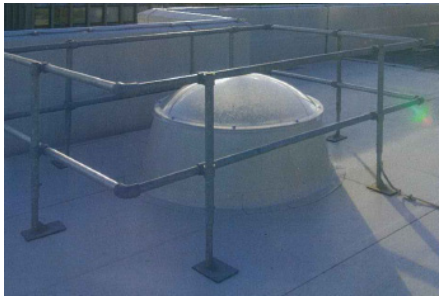
Fragile roof symbol

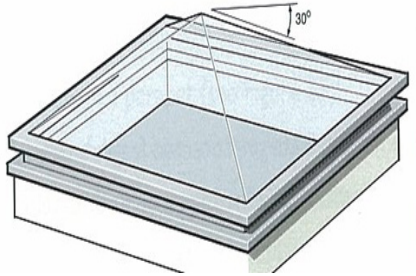
Protection Methods

Mesh fall protection




Fragile roof-lights identified






Fragile and Non-fragile roof-lights can be used

# Fall Prevention Methods - Permanent

**The Problem/Challenge**
To provide collective roof edge protection all around the new building where regular access to roof plant is required. Visual roof edge details were important to the design team and planners.

**The Risks**
Falls from height by maintenance operatives during roof and plant maintenance operations.

**The Solution**
A built-in 950mm parapet upstand design with integral sun shading brise-soliel feature. Ref: HSG - for maintenance areas.

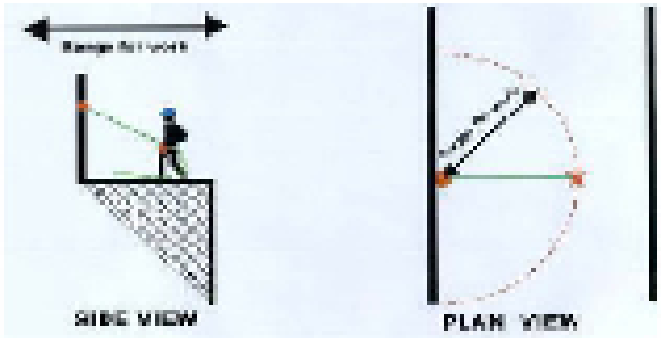
**The Benefits**
No need to assess frequency of access to roof areas.
Edge protection system does not require harness training or rescue arrangements.
No perimeter handrail due to integral parapet.
No need for additional edge guarding.

**Key Points**
Permanent edge protection provides an optimum safety solution and is at the top of the work at height hierarchy as a passive and collective protection system.
Co-operation of client and project team required to avoid being “value engineered” out.
There may be project reasons why this BROADLY ACCEPTABLE method may not be considered proportionate for other project reasons.

Mansafe cable and lanyard system


Fall Arrest

Edge Protection Railings




Fall Restraint protection, prevents falls

# Tender / Contract Stage Design - Temporary Fall Protection Issues

**The Problem/Challenge**
To alert the contractor's temporary works designers to unprotected slab and roof edges where the designer could insert temporary protection works aides instead of a traditional perimeter scaffolding system.

**The Risks**
Falls from height during construction rather than during future maintenance.

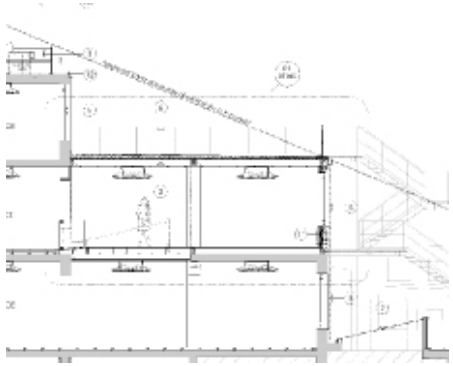
**The Solution**
Designers to highlight typical roof edges and slab edges which need to be considered by contractors whilst pricing for temporary works. Project drawings can be used for site risk identification to all contracting staff irrespective of language and ability to understand drawings.

**The Benefits**
Enables contractor to identify key safety issues that he needs to respond to by traditional methods eg. full scaffolding. Or by means of proprietary edge guarding methods to which designers can contribute eg. sockets in slabs, fixing points in steel, etc.

**Key Points**
Avoidance of unnecessary bureaucracy and utilisation of contractor's advice at the appropriate stage of the project.

Holes in steel for net guards


Sockets in slabs for edge panels



Areas requiring edge guarding simply indicated on drawings

Other methods of fall protection eg. Air bags

# Flat Roof Maintenance Access Options

### Flat Roof Maintenance Access

Permanent ramps, staircases, walkways and platforms with full edge protection are generally by far the safest. Although they may not always be seen as practicable, the reasons for this must be vigorously challenged, as carrying equipment, tools or even notebooks is very difficult. Lateral thinking should be employed to find a way to incorporate them. Typical details are shown in Figure 2.2.

Permanent, fixed ladders (whether vertical or inclined) should be used only rarely, when other options are impracticable or as an escape only alternative. Active consideration should be given to the provision of a permanent latch-way rail to facilitate locking on during use.

Ladders must be limited in length with rest platforms and a platform should be provided where there is a foreseeable need to carry out a task such as operating a valve or opening an overhead trap-door. Each particular scenario must be assessed on its own merits and the specific requirements of the Work at Height Regulations 2005 complied with.

Typical details are shown in Figure 2.2

### CIRIA C686 –Access for Maintenance & Repair

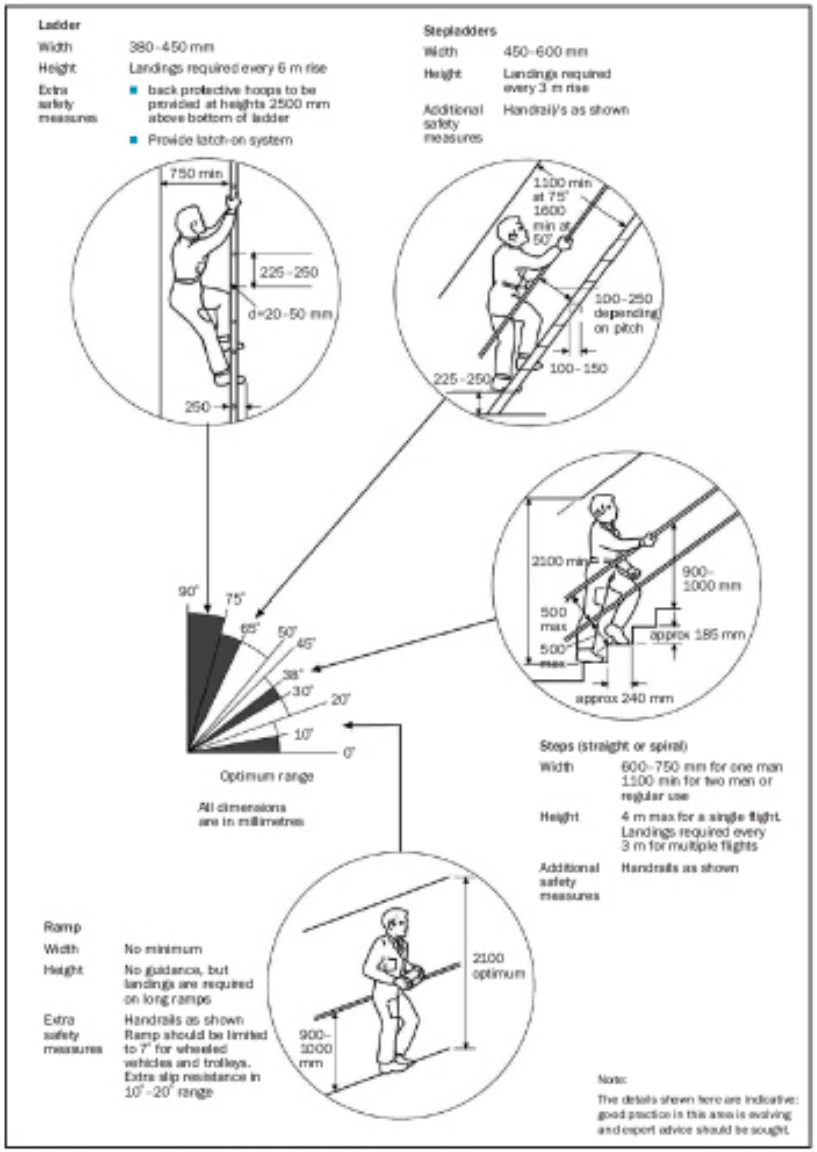



Figure 2.2 *Typical details of ladders, stairs and ramps*

# Domestic Roof Maintenence CSS

**The Problem/Challenge**
Safety measures are often perceived as a barrier to completing a tasks quickly with any job inevitably involving a trade-off between safety and expediency.

**The Solution**
CSS Worksafe have worked closely with the Health & Safety Executive and Confederation of Aerial Industries to provide a safe system of work at height for aerial and satellite dish installers that maintains the balance between speed and safe practice. Designers can identify difficult access issues on their drawings or with related photographs to indicate suitable safe methods of work that may be appropriate for other activities such as gutter, tile or cement flaunching repairs.

**Key Points**
This safe system of work has been accepted by the HSE as 'Good Practice', and can be adopted by a wide range of tradesmen who work from ladders.

Note :-Ladder restraints, ridge and roof ladders and stand-offs, plus harness attachments , strops and helmets


www.cssworksafe.com

# Ladders in Maintenance & Construction

Ladders and stepladders are among the most commonly used pieces of access equipment on site and perhaps the most misused. Where work at height is necessary you need to justify whether a ladder or stepladder is the most suitable equipment compared to other access equipment. This is done by following the hierarchy of control and using risk assessments. Make certain there is no safer means of access before using a ladder or stepladder, even for short-duration work. Many accidents result from using ladders for a job when a tower scaffold or MEWP would have been safer and more efficient.

If the assessment indicates that more suitable equipment is not justified, a ladder or stepladder may be used:
for short-duration work (15-30 minutes in one position depending on the risk assessment); for light work (they are not suitable for strenuous tasks which may involve carrying materials or supporting components, eg guttering); and if a secure handhold is available.

On a ladder or stepladder:
Do not overload it – the person and their equipment should not exceed the highest stated load.
Do not overreach – keep your belt buckle inside the stiles and both feet on the same rung.

Check the ladder is secure. Almost half of the accidents involving ladders happen because the ladder was not prevented from falling or slipping. The options for securing a ladder are as follows:-tie the ladder to a suitable point, making sure both stiles are tied where this is not practicable, use an unsecured ladder supplemented with an effective ladder stability device (eg a ladder stay and anti-slip device).

Such devices must ensure that the ladder does not run sideways, slide away from the wall or rotate about a stile; securely wedge the bottom of the ladder to prevent it sliding, eg against a wall; footing the ladder is the last resort and

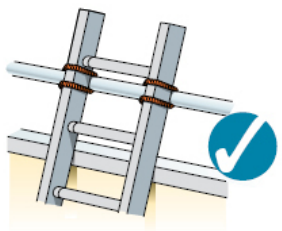


**Figure 18a** Ladder tied at top stiles (correct for working on, not for access)

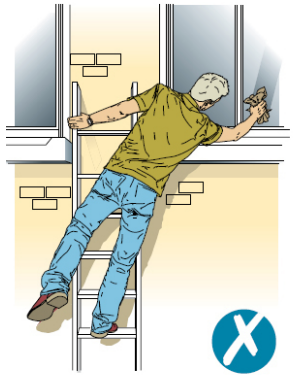


**Figure 17a** Incorrect - overreaching and not maintaining three points of contact

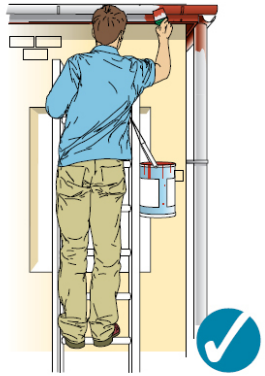


**Figure 17b** Correct position

**Figure 18b** Tying part way down

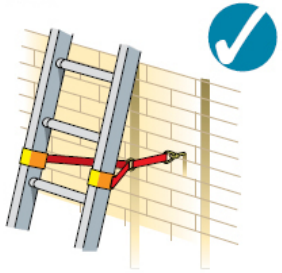


**Figure 18c** Tying at base

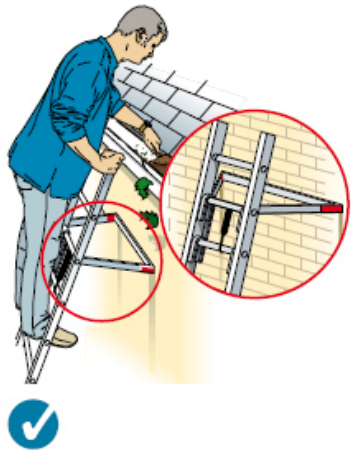


**Figure 9** Stand-off device and working maximum height on a ladder

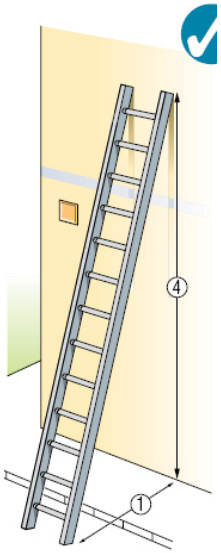



**Figure 19** Ladder showing correct 1 in 4 angle (means of securing omitted for clarity)

Ref Doc:- HSG 150 or Indg 402

# Fragile Roofs- CWCT 2012 Guidance

There are four Classes of roof as described in Table 1. A more detailed description of roof types and requirements for the impact performance of the glazing are given in Technical Note TN66 and a method of test is given in Technical Note TN67. Table 1 Summary of Classes of roof given in TN66
Technical Notes TN66 and TN67 cover both safety from falls through glazed roofs and roofing elements and also robustness of roof glazing.

| Class | Description | Guidance |
|---|---|---|
| Class 0 | Roofs designed for unrestricted access | Out of scope of TN66 and TN67 |
| Class 1 | Roofs which will be walked on for occasional cleaning/maintenance activities and which will therefore need to support both the weight of people on the glass and their equipment. | Refer to TN66 and TN67 |
| Class 2 | Roofs where people are not intended to walk on the glass, but which are required to be non-fragile to protect people in the following circumstances:<br>· Where maintenance personnel walking adjacent to the glass roof could trip or fall onto the glasssurface.<br>· Where maintenance personnel working on the glass roof could fall onto the glass surface from crawler boards or other access equipment. | Either refer to TN66 and TN67,or Refer to TN66 and follow the guidance in this Technical Note |
| Class3 | Roofs which are fragile. | N/A |

# Site Hazard Analysis to facilitate “Strategic CDM Design” decisions

**The Problem/Challenge**
To find the best building location on the site, from the site analysis, and the optimum footprint, orientation, size, scale, geometry and sculptural form?

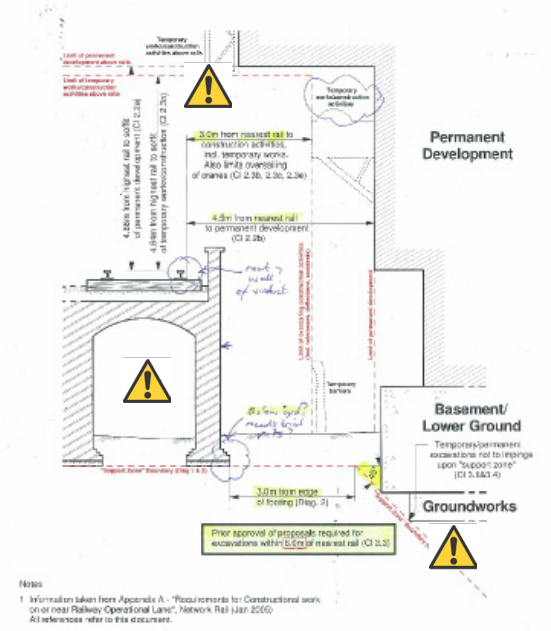
**The Risks**
Hazardous local gas installations, railway structures, tracks, viaducts, roads, etc. below ground services, tunnels and foundations, retained structures etc.

**The Solution**
Drawings were produced that show proximity to the gasholders and railway viaduct. Shows how close structure, temporary works, scaffolding, hoardings, welfare facilities, etc. can be built to the railway.

**The Benefits**
Safe theoretical maximum building envelope “the jelly mould” was agreed early together with safe site set up principles avoiding later costs and changes eg. Roads, access etc. This can include a party wall.

**Key Points**
All such hazards require analysis before the footprint and form of the intended structure can be finalised. The Client should provide survey information to clarify all such site issues but analysis drawings needed especially if scheme revised at later stages.

Site Plan with significant hazards indicated



Boundary section to railway viaduct

Subscan Survey - hazards identified with symbols

# Site Analysis - Underground Services for Initial Design and Construction Phase

**The Problem/Challenge**
The identification and location of existing underground services prior to the positioning of future structures on site to minimise the need for excavations & diversions., and possible services strikes.

**The Risks**
Electrical services and gas supplies are potentially highly hazardous with the ability to cause death and injury if accidentally struck during the construction phase, and all excavations pose potential risks.

**The Solution**
Designers to clearly identify hazardous underground services (eg. gas & electricity) on the drawings and also show other services such as water, fibre optics, and drainage as damage can cause major disruption and costs.

**The Benefits**
The sub-scan survey costs were significantly outweighed by the benefit of avoiding delays, diversions or bridging. Site safety is enhanced and costs reduced through the elimination of earthworks.

**Key Points**
Take account of existing and new services when considering the design footprint on the site. Ask Clients early for adequate survey information.
Service diversions can be planned by the contractor to avoid programme delays.
A competent contractor needs the right information to properly manage the risks on site.
Provide drawings early.


Underground electrical cables Subscan Survey -hazards identified with symbols


Choke Points


Subscan Survey - hazards identified with symbols

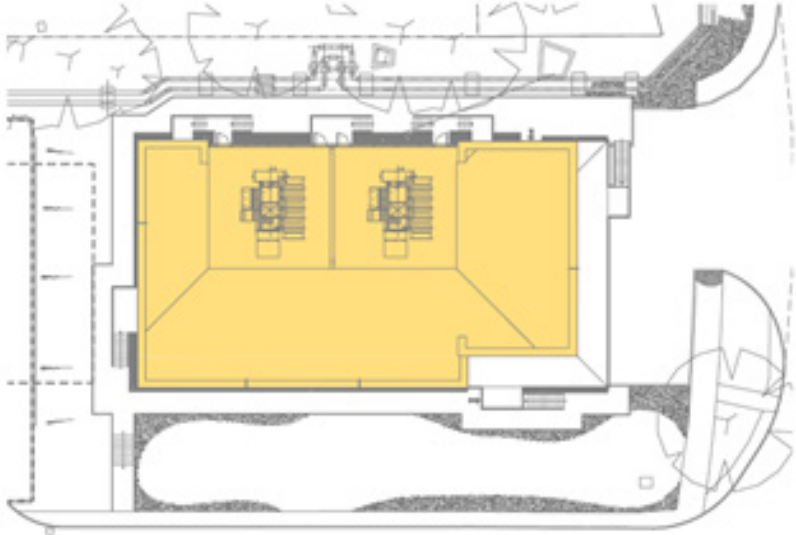
# BUILDING LAYOUT IN RELATION TO UNDERGROUND SERVICES

A new building currently under construction forms the second phase of an Energy Centre Development.

The building is located in an area with a large number of existing underground services including high voltage electricity supplies and sensitive data and comms cables. The very tight site is bordered by a road to two sides and over ground high-pressure pipe work along its western boundary.

At the start of the detailed design layout the method of construction of the building was challenged in relation to Health and Safety issues relating to excavation near to services.

The building layout went through a vigorous re-planning exercise to reduce the internal floor area and overall width of the building to the minimum possible in order to reduce works adjacent to underground services. The scheme was resubmitted for an amendment to the original Planning Permission, once the layout had been frozen.



**Key Points**

• Layouts should be challenged especially in relation to Health and Safety issues during construction. Planning permission's are not cast in stone and Local Authorities are willing to amend layouts for good reason, as part of the original approvals (within reason).

• As with most design work the more information and time taken at the outset to provide as detailed survey information as possible will have benefits in the long term.

• Avoidance of services by design layout is an important strategy to avoid service strikes which can cause injury and death, but also commercial and reputational risks.

# Underground services

Designers can identify all relevant services on drawings which show their adjacency to other features such as foundations, piles and excavations. However, exact locations cannot always be guaranteed without site investigation or surveys. Consideration of existing and even proposed services at concept design stage is important from a strategic perspective.

When carrying out works where there is a risk of underground services which cannot be isolated or diverted, principal contractors and their sub-contractors must therefore, at later stages:-

- Obtain layout drawings from the statutory Authorities.
- Consult the statutory authorities/service owners and follow any advice given.
- Complete permit to dig/break ground.
- Ensure only a competent person uses cable and pipe locating devices.
- Mark and identify route of services.
- Dig carefully by hand to establish and confirm position of buried services.
- Hand held power tools, mechanical excavators; etc. Must not be used within 0.5 metre of the indicated line of a buried service. Ensure that once services are exposed and identified, they are clearly marked using appropriate signage/ marker tape at least every 2m.
- Stop work immediately if an unidentified service is located, and the safe system of work reviewed.
- Ensure exposed services are adequately supported once surrounding earth has been removed.

The PC's Project team must ensure an up to date drawing showing the position of all existing, new and temporary services on site is maintained and made available to all Subcontractors

# Contamination on construction sites

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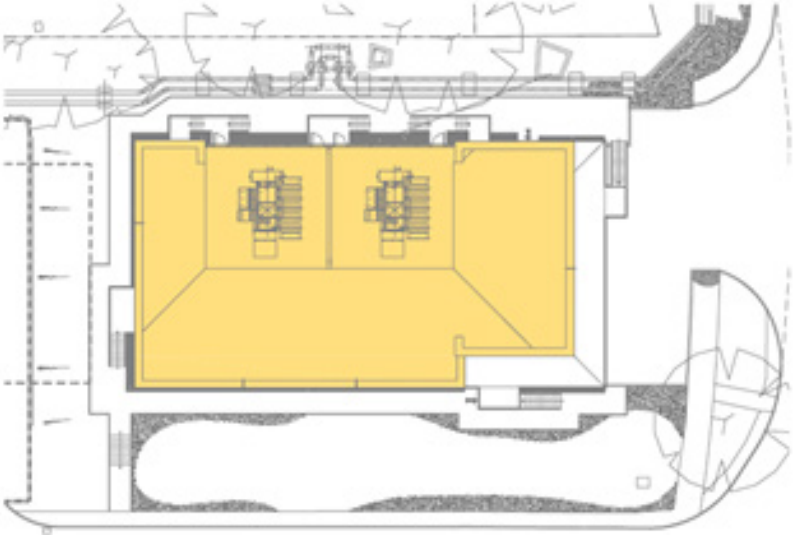

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• Avoidance of services by design layout is an important strategy to avoid service strikes which can cause injury and death, but also commercial and reputational risks.

# Contamination on construction sites

PD's and Designers should ask the client to provide all suitable contamination surveys on sites and any other pre-construction information. Otherwise the PC will need to obtain them which can delay projects, at the client's expense. Such PCI and Principal contractor actions and information should include:-

• undertaking exploratory investigations of the site to characterise contamination on site in terms of: type; concentration; extent and location.

• Ensure relevant permits are in place for any remedial works required.

• Agree the remediation strategy with the local planning authority.

• Do not stockpile contaminated soil unless it cannot be avoided

• If it is necessary, stockpile only on a hard standing area to prevent contamination of underlying ground.

• Take care when handling, storing and using oils and chemicals.

• Consider additional welfare requirements such as showers if dealing with contamination (e.g. asbestos, lead.)

• Agree what additional PPE is required for decontamination and/or working in contaminated ground.

• Cover stockpiled material to prevent windblown dust (potentially contaminated) and to prevent ingress of rainwater.

• Ensure a protocol is in place for managing 'hotspots of contaminated ground if they are discovered.

• Control surface drainage from stockpiled area.

# Tree protection on construction sites

Many projects have Tree Preservation orders or the… to retain existing trees for design purposes. Their integration during construction is crucial to successful retention.

**The problem/challenge**

Preserving existing trees, bushes/vegetation on construction sites to prevent damage to trunk, roots and canopy. This takes up valuable site area.

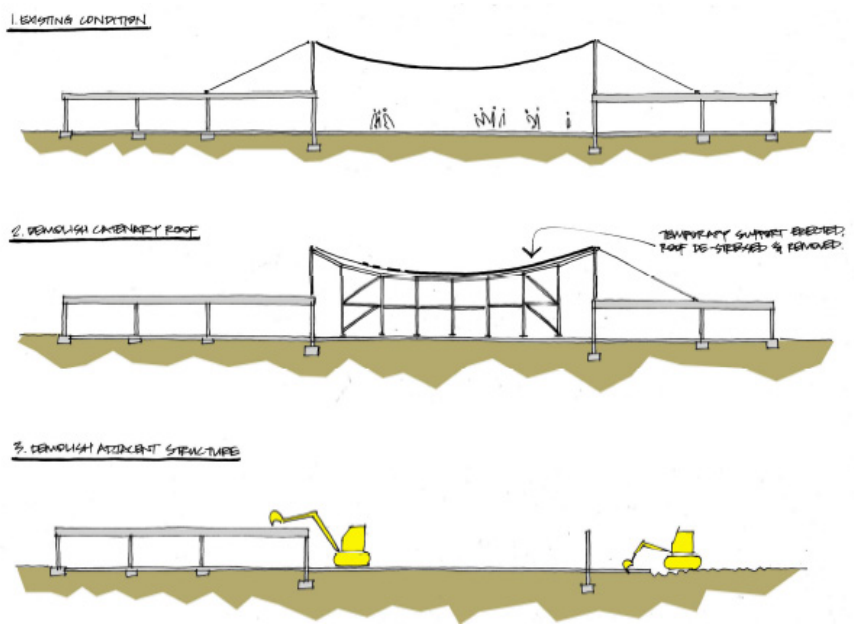
- Check whether any trees on site are covered by a tree preservation order and liaise with local authority.
- Keep vehicles and plant away from protected trees.
- All protected trees must have temporary fencing to mark out area that need to be protected. Signage must state ‘Tree Protection in Place’.
- Do not cut or damage any roots greater than 25 mm in diameter within the protected area.
- Wrap protection around any exposed roots until ready for backfilling.
- Backfill holes with care, to ensure that roots are not damaged, and compact backfill lightly.
- Do not store spoil or building materials within protected area or under tree canopy.
- Keep toxic materials such as diesel and cement well away.
- Always avoid damaging bark or branches.

# SEQUENCING AND DESIGN CONSIDERATIONS FOR DEMOLITION

**The Problem/Challenge**
The existing structure to be demolished was a reinforced concrete framed single storey building with an exposed concrete colonnade around the perimeter. The internal walls were of brick construction. A steel framed roof extended above the reinforced concrete podium in the form of a catenary shape with post-tensioned steel ties connecting back to the adjacent concrete roof.

**The Risks**
Demolition of the roof required careful planning, sequencing and management to avoid unintentional collapse and major project delays.

**The Solution**
Early consideration was given to methods of demolition, it was envisioned that the roof would be propped from underneath, the roof covering and rock wool panels removed. The roof ties could then be de-stressed and be cut and the roof beams removed. The main concrete roof and wall could then be demolished in the usual way. The proposed method was sketched and included in the Concept Stage report.




**The Benefits**
- The unusual nature of the existing building was communicated.
- The likelihood of an unplanned collapse was reduced.
- A workable demolition methods was established and communicated.
- Contractors tendering for the work were able to allow sufficient cost and time

**Key Points**
- Demolition may be an important consideration for designers.
- Where there are unusual risks, these need to be communicated.
- An early assessment of the structure is essential and enables pre-planning
- There is a need to obtain as-built and survey information for the existing structure (the existing CDM health and safety file should be obtained – if there is one).

# EXCAVATIONS INCLUDING ACCESS

Excavations are a cause of many accidents on sites and should be minimized but where they are necessary designers should be aware of:

•The type of support for excavations must be suitable and structurally designed if necessary.

• The position of all buried services must be made known to all machine operators and ground workers. Drawings are essential to complete this.

A permit to dig must be in place for all operations involving breaking ground.

• Access into excavations, via suitable ladders (or stairs in large excavations) should be available and located in the supported section of the excavation.

Where it is possible for persons or plant to fall into an excavation, effective barriers must be erected at each accessible face. Barriers should be at least 1m high and set 1m back from the edge if not rigidly fixed. On the edges where vehicles work, stop blocks must be positioned to prevent vehicles from falling in.

• Ladders must be secured and extend 1m past the landing place, or another handhold made available.

• Spoil and materials should not be placed at the edge of the excavation, where they will add to the effective depth of the excavation.

Material such as pipes should not roll into the excavation and heavy material such as concrete manhole rings should not place an undue strain on the sides of the trench.

• Spoil and materials should be stored the same distance away from the edge of an excavation as the depth of the excavation.

Where the sides of an excavation are battered or stepped, ensure the correct angle of repose for the type of soil. No attempt should be made to increase this angle.


# FAÇADE RETENTION TEMPORARY WORKS - A PROPOSED DEMOLITION SEQUENCE

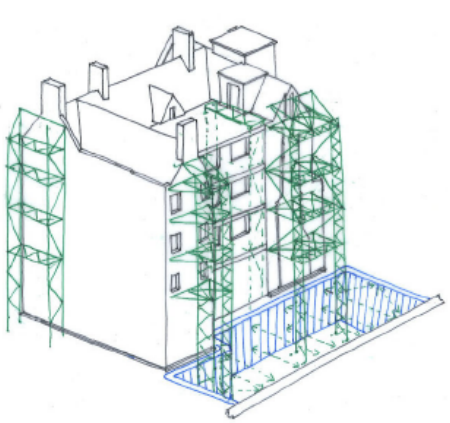
**The Problem/Challenge**
The roof and most of the floors and some internal walls were to be removed whilst the façade of the building was to be retained. This meant that complex sequencing of the demolition was required.

**The Risks**
- The unplanned collapse of the structure.
- Movement of steel within the structure.
- The failure of contractors to account or follow the required sequence.

**The Solution**
- The scheme designer communicated his anticipated sequence and understanding of the building to the contractor's temporary works designer.
- The sequence could be understood and agreed by all parties.
- A sequence of sketches was developed with explanatory notes,

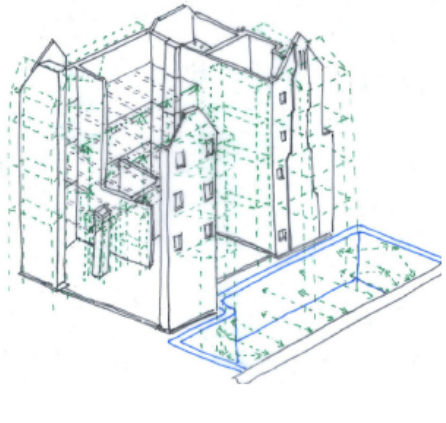
**The Benefits**
The sketches formed a sound basis for the initial discussions with the temporary works designer, helping to develop the temporary works scheme. Pre-planning provided reassurance of maintaining the integrity of the building during the work.

**Key Points**
The survey information was collected and provided to the designer and assisted him in understanding the structure. Important and relevant information was communicated to other designers.



- TRENCH DOWN TO INSTALL TEMPORARY PROPS TO SECANT WALL AND EXCAVATE FOR PROPOSED BASEMENT.
- INSTALL TEMPORARY LATERAL SUPPORT TO FULL HEIGHT OF RETAINED WALLS. TEMPORARY LATERAL SUPPORT TO HAVE OWN FOUNDATIONS INDEPENDANT OF THE EXISTING STRUCTURE. LOCAL OPENINGS THROUGH EXISTING FLOORS MAY BE REQUIRED.

STEP 2: EXCAVATE AND PROP



- FLOOR STRUCTURE SHOWN RETAINED ON DRAWINGS TO BE PROPPED DOWN TO GROUND, LOCALLLY THROUGH EXISTING FLOORS, PRIOR TO REMOVAL OF EXISTING SUPPORT.
- LATERAL SUPPORT PROVIDED TO RETAINED WALLS BY PROPPED FLOORS SHOULD BE CONSIDERED NEGLIGIBLE.
- WALLS SHOWN TO BE DEMOLISHED ARE TO BE CAREFULLY TAKEN DOWN FROM SECOND FLOOR TO FIRST FLOOR LEVEL.
- RETAINED WALLS AT GROUND TO UNDERSIDE OF FIRST WILL REQUIRE TEMPORARY LATERAL SUPPORT.

N.B. NEW FLOORS TO BE IN INSTALLED PRIOR TO TAKING DOWN ANY TEMPORARY LATERAL SUPPORT.

STEP 6: DEMOLISH FIRST TO GROUND

# Crash Mat Over Station Roof, Cannon Place - Designer Guidance

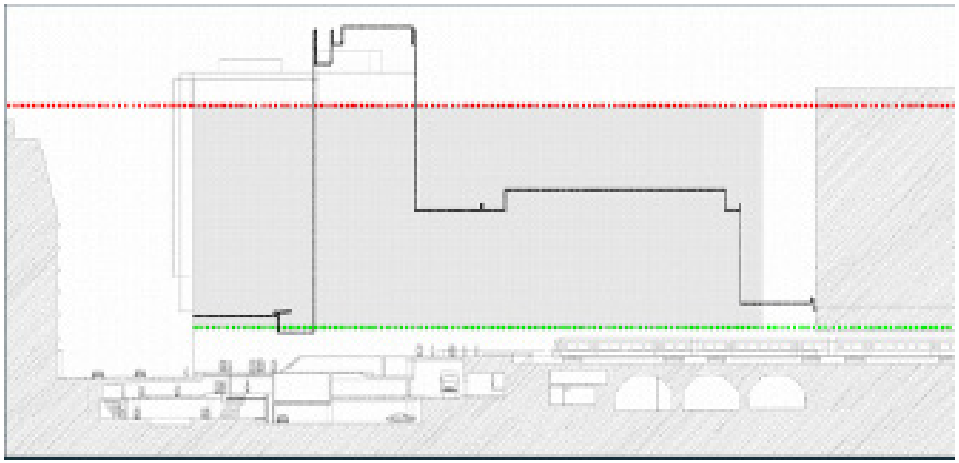
**The Problem/Challenge**
Protection of public and workers using the station during demolition andconstruction works of offices above.

**The Risks**
Materials accidentally dropped and puncturing the existing retained concrete slab deck.

**The Solution**
Two layers of 300mm plywood, on a 150mm RC slab, designed to withstand a 3 Ton column falling 40 metres end on.

**The Benefits**
Cost effective temporary protection.

**Key Points**
Heavy lifting installation and removal of plywood by tower crane.
Method of demolition to respect this level of overhead protection.



Foggo Associates with Laing O'Rourke

# Demolition Dust Suppression

**Dust Creation from Demolition**

ELIMINATE the significant risk of inadvertent exposure of the public to respirable crystalline silica (RCS - causing respiratory illness such as silicosis, asthma and COPD) from construction activities by water suppression techniques.

**Wind Effects**

**Water Suppression of Dust**

# Traffic Management

Designers can help PC's to organise their sites in a safe way by suitable building location and pavement and road need setting out (starp) :-

• Works on footways and pavements must leave at least 1.5m unobstructed width where possible and 1m minimum.

• Where 1m minimum unobstructed width is not obtainable, an alternative safe route for pedestrians must be provided.

• Temporary pedestrian walk ways should never be less than 1m wide and, where possible, they should be 1.5m or more in width.

• Rigid barriers must be used to mark any temporary footway and to protect pedestrians from traffic, excavations, plant and materials.

• Road danger lamps must be placed at the ends of the barriers at night.

• Hand rails should be between 1.0 and 1.2m above ground level and tapping rails should be fixed with the lower edge approximately 150mm above the ground.

• If the temporary footway is in the carriageway, signing will be necessary for both pedestrians and drivers as shown in the illustration (overleaf). The provision of kerb ramps (GRP only) or raised footways may also be necessary to help blind, elderly or disabled persons, or for those with prams or wheelchairs.

•All work activities including delivery of materials outside the site boundary in public areas must be completely segregated and barriered off. The risk to the public from the use of hot substances, noise, dust, flying objects and holes and trenches are adequately considered and controlled.

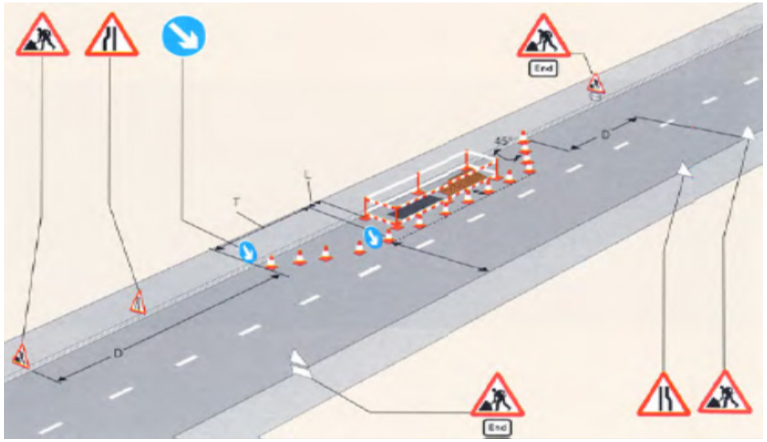
• No material, waste or arisings must be left in the street.

• No skips to be sited in the street without Highway Authority permission.

• No puddles or running water from site activities to be allowed to accumulate on/or across footpath.

• Any temporary fencing and hoarding must be correctly erected and checked daily.

Only GRP type trench covers and ramps with anti-slip finish are to be used on pavements.Road plates must not be used on pavements to cover trenches or excavations without some form of anti-slip coating being applied to the road plate.



- Typical Arrangement
- Single carriageway 30mph road

# Traffic routes for pedestrians and vehicle on sites-Guidance

**Main Pedestrian Routes**
Design of all routes to be set out to provide early visibility of oncoming construction and in use vehicles sfarp.

- Keep routes separated from reversing areas, loading bays and high risk construction operations.
- Routes expected to be maintained in good condition; clear of obstacles, debris, litter, mud, snow and ice etc. by the contractor.

**In concentrated areas**
(eg. welfare facilities), suitable means of controlling the risks should be in place, including:

- Pedestrian crossings.
- Increased visibility and number of warning instruction signs.
- Increased lighting.
- Reduced speed limits for construction vehicles.
- Where it is not possible to segregate pedestrians and construction vehicles, safe systems of work, such as trained traffic marshals should be in place.

**Client, Principal Designers and Principal Contractors to liaise on all site traffic route issues.**

# Traffic routes for pedestrian and vehicle on siles.

**Crossing Points**

• Access to crossing points must be defined eg. by red crowd barriers at either side unless other demarcation (such as chain link fence) is in place.
• All crossing points must be clearly signed for both drivers and pedestrians.
• should allow easy access to work areas from main access routes.
• must be free from obstructions and trip hazards.
• must provide pedestrians with a clear view of traffic movements.

Main Crossing  Points where large numbers of pedestrians cross busy vehicle routes, eg near site welfare facilities, entrances, etc. additional traffic control measures must be implemented, such as traffic control systems, or traffic marshals, or vehicle movements may need to be restricted to specified times.

# Site setup and information boards

•An overall site plan showing site layouts, access routes for vehicles and pedestrians and escape routes. Designers can help contractors to provide this plan.

• Samples of required PPE to demonstrate standards expected of all visitors.

• Is information on key project hazards and controls in place and clearly visible?

• Only relevant posters and SHE information arranged in a coherent way.

• A spare fire alarm call point available to demonstrate the sound of the alarm.

• Photographs of project team, identifying their key roles – could include the design team members.


# Site entrance, set up and welfare on small sites.

Even smaller projects (such as those in existing buildings) must have a signing in point and some form of access control.
Current SHE hazard information for the project is displayed at the site entrance to be utilised for visitors briefing – such as Risk of the Day.
Adequate welfare facilities should be established relative to the potential size of the workforce with:

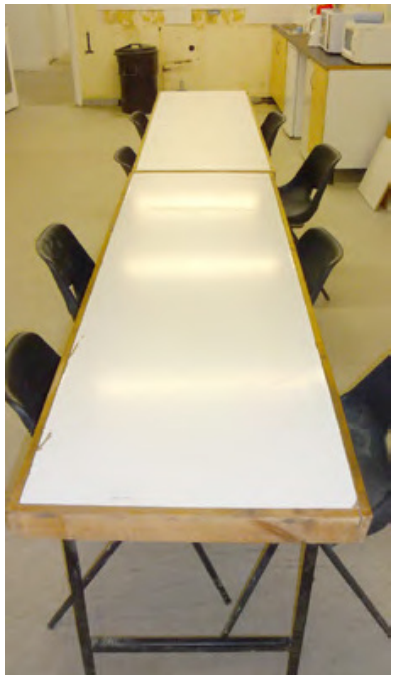
- Drinking water (marked as such) and cups provided.
- A means to heat/prepare food and boil water.
- Clean and adequate fridges.
- Seats with backs and tables.

# Site setup, welfare offices & meeting rooms

**Well managed site set up indicates a well organised contractor.**
• Good ambient lighting and temperature.
• Kept clean and tidy.
• Adequate toilets relative to workforce on site (refer to Welfare Minimum Standard).
• Warm water, soap and means of drying hands to be available.
• Showers provided (if required) due to special activities.
• No graffiti visible.
• Facilities to be kept clean and maintained to a high standard. These should reflect reasonable standards. – The absence of the above should alert design teams and clients to poor site practices in all respects.

Good order in offices and meeting rooms reflects a professionally organised project:
• Is the project SHE noticeboard displayed and correctly maintained?
• Are electrical and fire installations certified and maintained?
• Are desks and workspaces organised and clean and tidy?
• Are computer workstations correct with proper seating etc. (Refer to VDU section)?

**Design Issues**
These facilities are key to well organised and facilitated site and design development meetings. Size of Meeting room, sound isolation, confidentiality and convenience are all essential. Visual display capability is also essential for example a screen or projector.

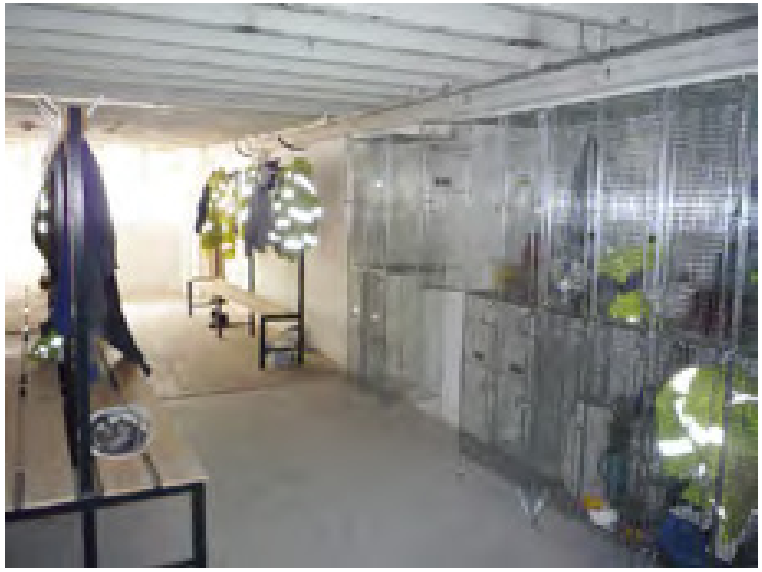


# Site setup, welfare and changing facilities.

**Drying Rooms**

It is expected to have:-

- Adequate space provided for the size of the workforce.
- Lockers provided for storage of non-work clothes and valuables.
- Designers to have lockable access if necessary.
- Hanging space for work clothes to allow them to dry.
- Thermostatically controlled heating that is covered with grilles and is sufficient to dry wet work clothes.
- Adequate lighting and ventilation.
- Kept clean and tidy and well maintained.
- No rubbish or old work clothes allowed to accumulate.
- Periodic removal of unwanted or unused clothing and footwear.
- Adequate fire detection system in line with project fire risk assessment.



# Wehicle/ Traffic routes

Accidents involving site vehicles are commonplace. Vehicle/traffic routes must be clearly signed, indicating routes, hazards and warnings, speed limits, and including road markings where possible. They should also be of sufficient size/ width to accommodate the largest required construction vehicle and peak construction vehicle traffic movements.

Routes must be:
• Planned and designed to ensure a one-way flow of traffic (if possible).
• Set out to reduce the need for reversing manoeuvres.
• Kept a sufficient distance away from any excavations.
• Set at a suitable gradient for the construction vehicles to operate safely especially on steeply sloping sites.
• Constructed with speed control measures such as speed ramps incorporated as necessary which are suitable for the construction vehicles in use.
• Suitably constructed to ensure the safe movement and operation of any construction vehicle likely to use the route.
• Maintained in good condition, of an even surface and free of hazards. Where hazards
cannot be removed from the vehicle route, they should be signed, barriered and, if necessary, lighting provided.
Designers can consider the existing and permanent site road layouts with re-gards to the above. Temporary road finishes are better than temporary roads. Utilities in the site roads can lead to considerable disruption and safety hazards when access trenches required.

# Site entrance, setup and public protection.

First impressions on entry to site sets the tone. The entrance must send a clear message on the Health and Safety standards including induction requirements.

- No rubbish or equipment such as PPE left around the project entrance. Visitors Safety, Health and Environment information should be displayed and a signing in procedure in place.
- Adequate lighting should be provided.
- PPE free routes should be established from the entrance to the welfare area and these should be clearly indicated. All visitors should keep to these unless inducted and wearing full PPE.



# Designing for community safety and construction logistics

**The Problem/Challenge**
Without good design and mitigation, vehicle movements, particularly HGVs, present disproportionate risk of fatal or personal injury collision with pedestrians, cyclists and motorcyclists. In 2018 alone, 5,514 people were killed or injured in collisions with vehicles commonly used in construction.

**The Risks**
To prevent death or personal injury, or withholding of planning consent, designers must visibly consider and minimise the risk of harm (collision, emissions, congestion) to the community arising from construction and post-construction vehicle movements.

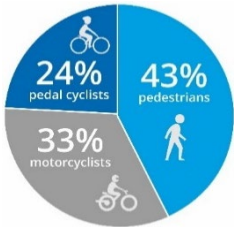
**The Solution**
Early stage discussions between the client, design and construction teams (or representative) are essential. They must consider significant material and component choice, site layout (permanent and temporary), vehicle movements, cycle traffic and pedestrian flows for during construction, building operation and demolition; fire brigade access is already a statutory requirement. The site plan should highlight key risks and mitigation measures to prevent misunderstanding or ill-considered removal later in the project.

**The Benefits**
Good design and construction logistics plans collaboratively considered by clients, designers and contractor representatives at outline and detailed planning stages significantly reduces collisions, complaints, emissions and congestion. Communicating the risks and mitigations is hugely important too.

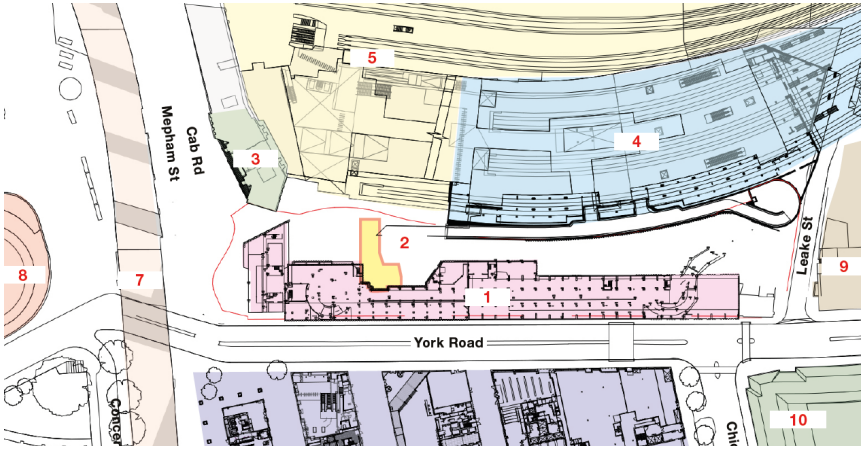
**Key Points**
Identification and mitigation early in the design process embeds solutions into the master-planning or planning application site and buildings layout. Use of CLOCS aware representatives or construction logistics consultant will help identify key constraints and avoid or eliminate the risks right from the start of the project. This is a key component of the "principles of prevention" at design stages and NOT just something left to material suppliers / fleet operators to address.

CLOCS | Construction Logistics and Community Safety

**Ensuring the safest construction vehicle journeys:**
Every year, 500 people are killed or seriously injured in collisions with HGVs




**The CLOCS Standard places responsibilities on key stakeholders in a construction project**
including the operator of any vehicles servicing that project: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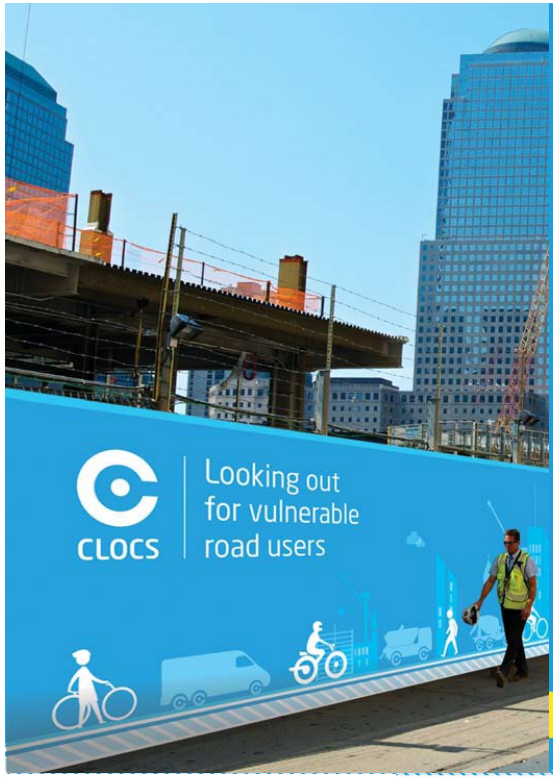
# Designing for community safety and construction logistics


**Planners welcome considered designs and safe plans**

## Consider using hoardings to inform and involve the community


A1 public engagement poster




Example site hoardings


Vinyl banner – 240cm x 60cm

# Catastrophic Events in Construction - What is the worst that can happen?

**Examples of catastrophic events would be:**

- Structural collapse of permanent structure
- Collapse of temporary works
- Collapse of plant such as cranes
- Major fire
- Tunnel collapse
- Disruption of underground services

**Catastrophic events would be those having the following potential consequences:**

- Potential for multiple deaths and serious injuries in a single incident
- Serious disruption of infrastructure (eg. road, rail) and/or services (eg. power, telecoms)

**Also, such events may well have the following features:**

- Ability to damage or even destroy organisations commercially, either directly or through loss of reputation.

**Key Points**

- Identify potentially catastrophic features of a project and consider risk management design methods with the team in a proportionate manner.

*Dean Farrar Street building collapse (street view)*

**Research Report RR834**

HSE

# Unusual construction sequences

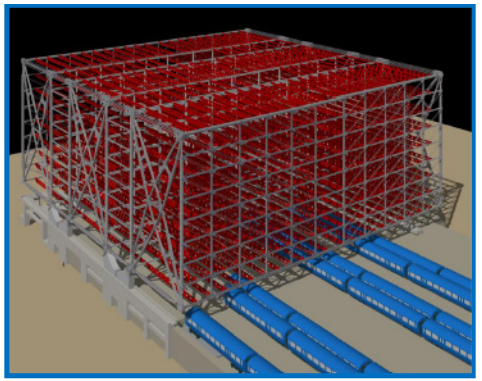
**The Problem/Challenge**
Intelligibility of unusual construction sequences and ensuring that all the necessary people know how to build the structure safely.

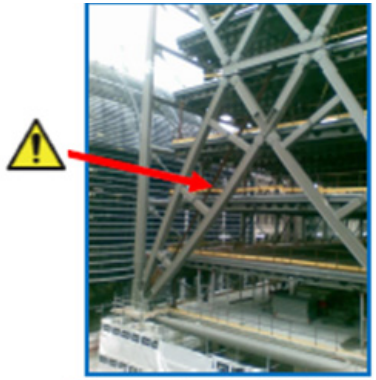
**The Risks**
Collapse during construction due to asymmetric loading and unbalanced cantilevers.

**The Solution**
Graphic presentation of the proposed sequence for contractors to understand the structural and constructional design intentions of temporary tension cable restraints.

**The Benefits**
• Information sharing of proposed assembly strategy with the construction team at early stages of the project.
• Reduced chance of things going wrong.
• Opportunity for additional input from stake holders before design progresses too far.

**Key Points**
• Simple 3-D drawings overlaid in an animated PowerPoint, showing the site constraints and proposed significant sequences.
• Ensure any specialist subcontractors are engaged early in the design process.
• All temporary bracings should be easily identified with any key removal stages known by all parties.


*Design Stage 3D View of Structure*


*Temporary Bracings Highlighted*


*Cannon Place Bridge Structure*

# Temporary Works

Temporary Works are defined in BS5975 : 2008 as :-
“parts of the works that allow or enable construction of, protect, support or provide access to the permanent works and which might or might not remain in place at the completion of the works“

What has this got to do with you ?
•Surely this is a contractor thing
•Yes •BUT

The role of the Principal Designer is not to:-
Get involved with day to day site design and management of temporary works.

But to understand :-
The Temporary Works Design Brief
•Purpose of temporary works.
•Required dimensions and any known constraints.
•Particular loads including impact loads
•Ground conditions.
•Site conditions, including services, adjacent structures and access.
•Available materials and equipment.
•Construction sequence and loading stages.

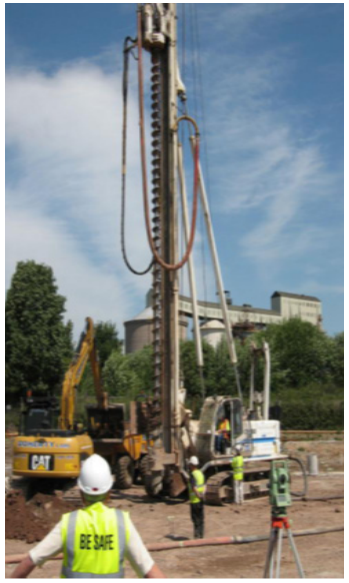
Principal Designers should ensure
•Permanent work designers minimise the need for temporary works
•The permanent design considers the design and erection of TW
• Provision of information about the permanent design to inform the TW designers.
• Competence of PC’s TW Systems
• Construction phase plan includes arrangements for controlling significant site risks such as temporary works
•Adequate designer coordination and cooperation where there is interaction between temporary works and permenant works

Why are temporary works important?
GOOD temporary works can bring….
•Better safety
•Enhanced efficiency, quality, productivity
•More certainty on completion times and cost
BAD temporary works increase risk of….
•Injuries and/or fatalities
•Failure/collapse of permanent/temporary works
•Damage to adjacent properties/premises
•Delays and increased costs

**Framework & Falsework**


**Framework (Shuttering)**

**Loading platform**




**Completed piling platform**

# Scaffolding

Scaffolding is a PC responsibility but sufficient space and access should be allowed on site drawings and layouts of buildings to enable adequate scaffolding and erection processes. Other issues to be aware of are:-

• All scaffolders must be competent and hold a CISRS card (or in the case of trainees, supervised by a competent person) for the erection of either tube and fittings or system type scaffolds.

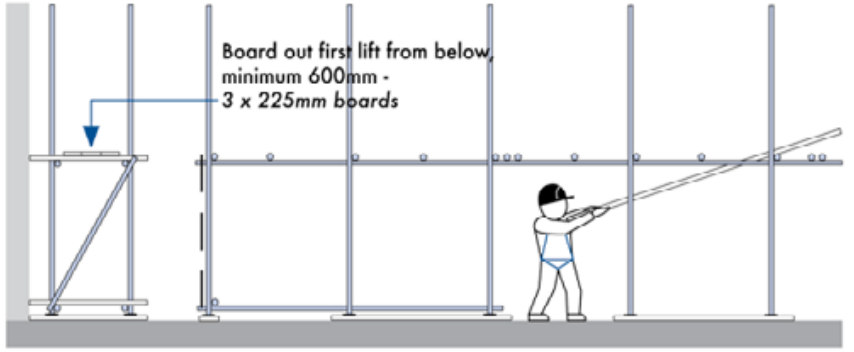
• An advanced Scaffolder must be on site to oversee the erection of any designed scaffold.

• All those involved in scaffolding operations must wear and use a full body harness fitted with a lanyard, shock absorber and a scaffold hook for one handed operation or suitable proprietary anchoring attachment.

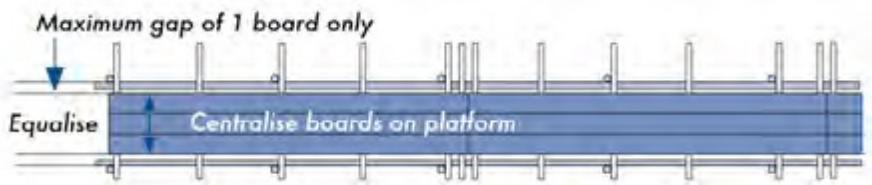
•A 3 board lift with a single guard rail, an advanced guard rail or alternative platform such as Scaffstep must be utilised for erection.

• Collective measures must take priority over the use of a harness. Scaffolders must not traverse unguarded lifts or climb on scaffold. Lifts should be boarded out from below.

**Erecting, Altering and Dismantling Scaffold**: Please note that the drawings incorporated below are not for construction purposes but for demonstrating the use of fall arrest equipment.







# Scaffolding

When raising or lowering materials scaffolders must be clipped on at all times or work within a safe
handling platform with a double guardrail.

• Tube and fitting steel scaffolds will provide a safe anchor point for any scaffolder wearing a full body harness as a last resort when other protective measures, such as guard rails are not suitable.

• Temporary stairs or ladders should be included as early as possible in the erection process and removed as late as possible during dismantling,
removing the need for scaffolders to climb the
scaffold

• The opening for ladders must be protected with a trapdoor or a proprietary gate.

• A rescue kit must be kept close to the workface for works on scaffold where a rescue provision is
required.

• All standing scaffolds must be tagged to indicate inspection status and updated every 7 days. Tags should be located at the lowest access point on the scaffold.


# Scaffolding protection over a live building

During the construction of a new production facility PM group were faced with a new challenge to ensure that an immediately adjacent office facility remained fully operational and safe.

The office was a single storey modular construction which required access at all times. It was located within 2m of the new facility so consideration of potential damage to the building also had to be considered.

To meet this challenge the building was protected with a specifically designed scaffold system (Crash Deck) that not only protected the building from falling materials but extended to provide a protected walkway around the building to ensure safe access at all times.

As well as being designed for impact the structure had to withstand very high wind loads due to the proximity of a local estuary and the wind tunnelling effect caused by nearby existing structures. The design was completed using the temporary work standard BS 5975 & erected in accordance with SG4 with regular inspections taking place to ensure integrity of the scaffold.

The construction works included forming bases, erecting the steel frame and cladding of the finished structure and all of these activities could take place during normal working hours. As the steelwork erection required the use of a crane the method statements ensured that whenever possible the existing offices were not over flown by the crane. The exceptions to this were the columns adjacent to the offices which were erected during a weekend when the office was not occupied.

The original plan for the work was to construct the new facility outside of normal hours mainly on the weekend. The introduction of the crash deck scheme meant the overall programme was dramatically reduced offering savings that more than covered the additional costs of scaffolding. More importantly all the work was completed ahead of schedule withoutany safety incidents.

**Key Points**

• Adding specific safety features to tight access construction can improve the programme.

• Ensuring the safety of people in an adjacent building is paramount on any project.

• Ensure than any high risk activities take place when adjacent buildings are not occupied.

*Design Scaffold Over the Office*

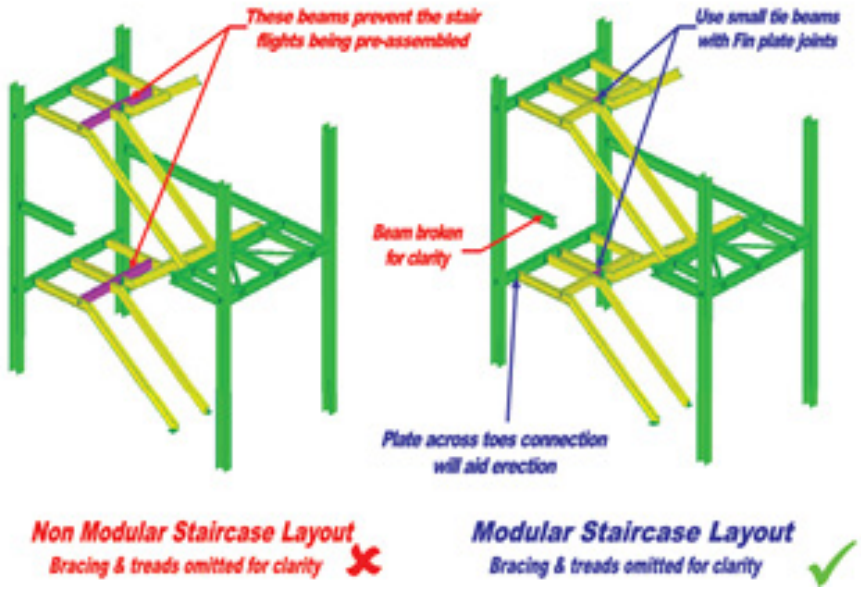
*Completed Adjacent Structures*

# Staircase construction framing to aid erection

The framing of a staircase will decide if a flight of stairs can be pre-assembled at ground level for modular lifting or if the stairs need to be assembled piece meal at height.

**Disadvantages of a Non-Modular Staircase:-**

1. Staircases being erected piece meal will require the steel erector working at height for longer making them more exposed to risk of accidents.
2. Erecting stair treads at height is a dangerous practice and should always be avoided.




**Advantages of a Modular Staircase:-**

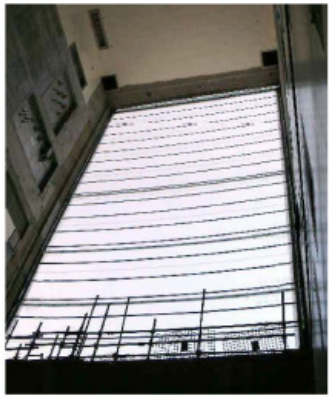
1. Modular stairs can be assembled at ground level which reduces the erecting time at height making it quicker, easier, safer and more economical.
2. The bulk of the handrail can be already in place so the stairs can be used quicker helping with access for construction.
3. Connecting the stair stringers to the main beam using a plate across the toes type connection means the flight of stair can be lifted and dropped into position vertically making erection quicker, easier and safer.

**...Therefore, always frame a staircase to allow for modular erection!**

# Temporary protection to construction access openings

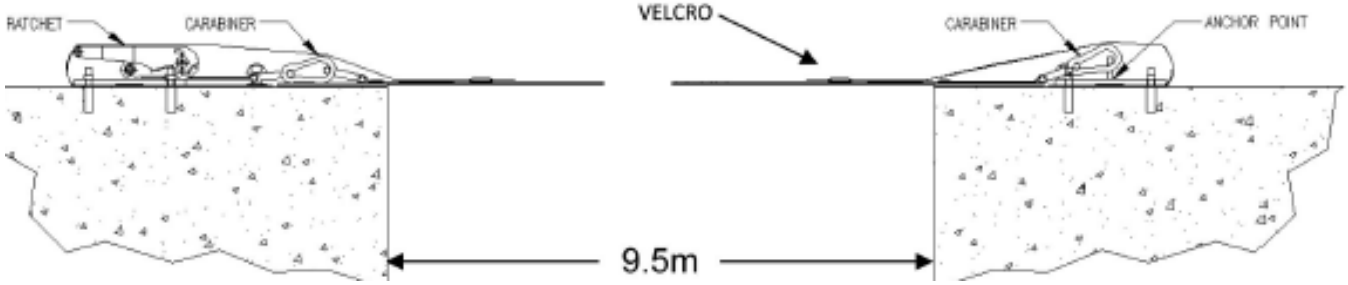
Providing temporary weather protection to five large cell rooms during the construction process. As part of the clients brief the cover needed to be easily taken down and reinstated to allow for multiple key kit installation dates with extremely tight time slots.

Ten different solutions were investigated ranging from cladding panels to roller shutter doors and roman blinds. The final design was similar to that seen on the side of a conventional side loading wagon but using much more heavy duty materials. The make-up of the covers were 5.0T SWL horizontal nylon straps at 750mm centres sewn into Panolite (Nylon reinforced PVC) covers. Each nylon strap was anchored at each side of the opening with a base plate and a tightening ratchet to one side to create the required tension across the strap.



**Key Points**

- Covers are quick and easy to erect and take down.
- Minimal equipment needed due to the normal weight of each (Largest cover was 26.0mx7.5m and weighed only 235Kg)
- Each cover was split into manageable sizes to aid fabrication and erection, this also allowed smaller pieces of kit to be installed without the whole cover being taken down.
- Each edge of the covers were sealed from the elements with sheets of the same PVC material that were fixed under base plates and attached to the covers by Velcro. These sealing sheets are tied back away from the opening during kit installation.
- Covers were designed to resist wind speeds of up to 110mph.



# The architectural designer's viewpoint (DIOHAS)

What IS a Significant Risk Management as opposed to a Trivial Risk Management?

Lack of understanding by CDM Advisors and others about what "Designers" really need to know about Health & Safety i.e. As against what can reasonably be addressed by the competent principal and trade contractors.

Expectations of CDM Advisors and others of Designers' Health & Safety knowledge is often excessive e.g. Engineers, Architects, Interior designers etc. all have different requirements and levels of knowledge.

Designers can only consider so much with regard to Health & Safety but how much? Significant, project specific, unusual issues only and not everything.

Written Design Risk assessments have proven to be a tedious waste of time adding no value. They have even caused "Designer disenchantment" with CDM.

Designers have to deal with CDM documentation within the myriad of other design considerations but often too much unnecessary bureaucracy is still expected by CDM Advisors and others causing a further Design Stage Disconnect within the industry.

Architectural designer competence defined by HSE as sufficient skills, knowledge and experience and provided by the RIBA.

Project pre-qualification H&S paperwork is often unnecessarily excessive. A sample PAS 91 process has been recommended by the HSE.

# Temporary protection to construction access openings

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*Dean Farrar Street building collapse (street view)*

**Research Report RR834**

# Unusual construction sequences

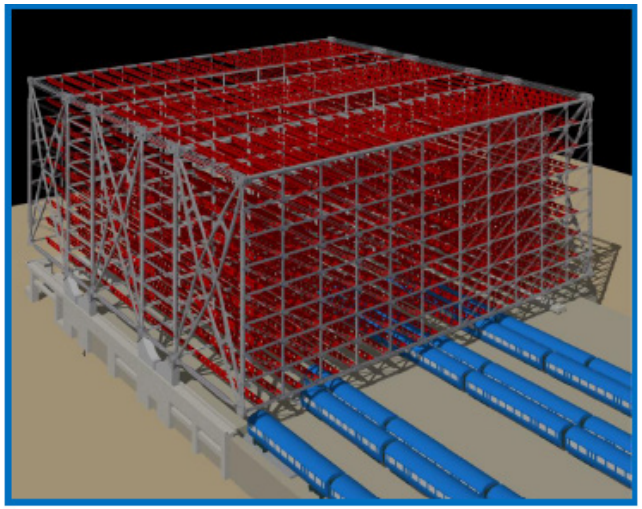
**The Problem/Challenge**
Intelligibility of unusual construction sequences and ensuring that all the necessary people know how to build the structure safely.

**The Risks**
Collapse during construction due to asymmetric loading and unbalanced cantilevers.

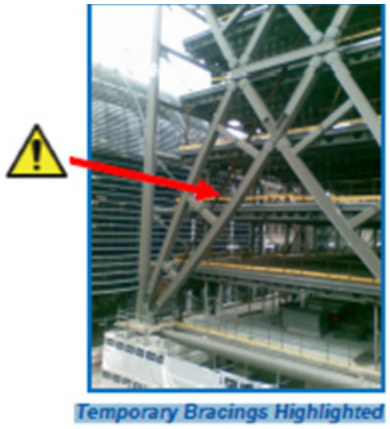
**The Solution**
Graphic presentation of the proposed sequence for contractors to understand the structural and constructional design intentions of temporary tension cable restraints.

**The Benefits**
- Information sharing of proposed assembly strategy with the construction team at early stages of the project.
- Reduced chance of things going wrong.
- Opportunity for additional input from stake holders before design progresses too far.

**Key Points**
- Simple 3-D drawings overlaid in an animated PowerPoint, showing the site constraints and proposed significant sequences.
- Ensure any specialist subcontractors are engaged early in the design process.
- All temporary bracings should be easily identified with any key removal stages known by all parties.



*Design Stage 3D View of Structure*



*Temporary Bracings Highlighted*

*Cannon Place Bridge Structure*

# Unusal construction sequences

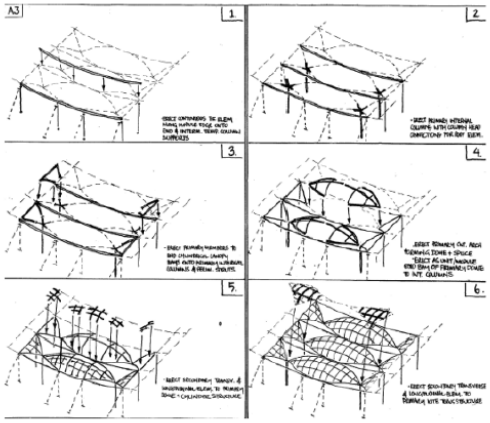
**The Problem/Challenge**
A complex steelwork roof design needed a workable construction sequence from the structural engineers for the project. The sequence needed to be communicated to and understood by the contractor, specialist steelwork fabricator and the erector who would put the structure together.

**The Risks**
A failure to understand the forces acting within the structure during the build could have led to errors in the construction sequence, resulting in dangerous and temporary instability and potential collapse. Confusion over the correct construction sequence would have caused significant programme delay.

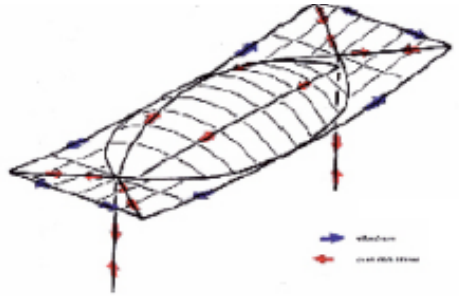
**The Solution**
Sketches of a possible construction sequence were developed and included in the tender documentation. This meant that the contractor could manage the phased erection of the structure and understand where additional temporary support and restraint would be required.

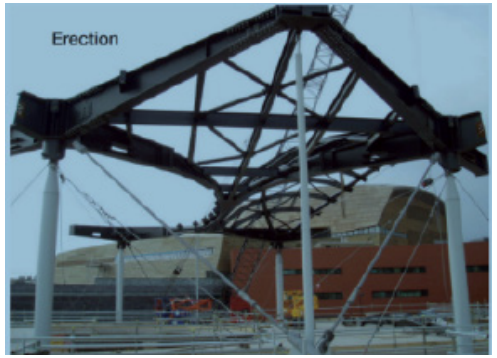
**The Benefits**
• There was clear communication of the construction sequence avoiding site "fire fighting" and improvisation.
• All of the contractor tenders were equally and fairly based as they understood the challenges that they faced (i.e. a level playing field).
• The proposed sequence provided a sound basis for the steelwork contractor's own designer to develop the final sequence and detailed method statements.

**Key Points**
• It was recognised early in the project that there were significant challenges associated with the steelwork design, which allowed sufficient time and resources for planning.
• The proposed sequence was conveyed simply and clearly through step by step drawings.



*Extract from the proposed construction sequence*


*Simple Drawing showing the forces acting within the structure*



# Prefabrication and Off-Site Manufacture

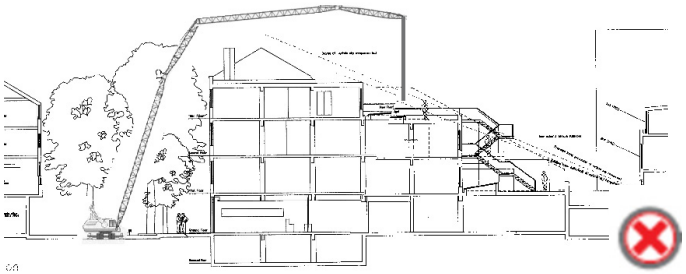
**The Problem/Challenge**
Identification of construction issues involving working at height in difficult or dangerous conditions to encourage safer working.

**The Risks**
Falls from height and injuries or ill-health due to working in the above conditions.

**The Solution**
Early identification of the issues to the client and contractor to encourage off-site working where possible. Analysis of the access and cranage capabilities of the site are essential to validate the decisions and locations of large modules.

**The Benefits**
Prefabrication reduces work at height and on cold wet sites allowing off-site fabrication in factory conditions but it increases hazardous heavy lifting, access and transportation issues.
Prefabrication can be advantageous to CDM but is not always the answer.

**Key Points**
Review the buildability and access issues with contractor as early as possible.
Cost benefits may be possible as well as safety benefits.



**Sectional analysis for crane access**


**Road closures and traffic issues**

**Vaults, trees and crane size issues**

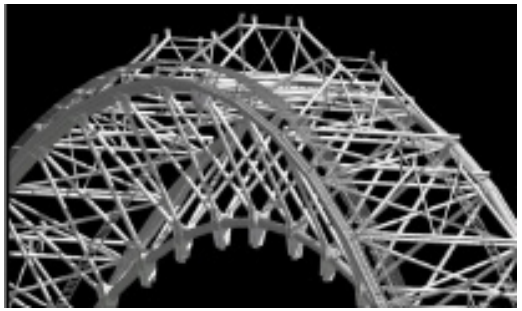
# Prefabrication - Building the London Eye

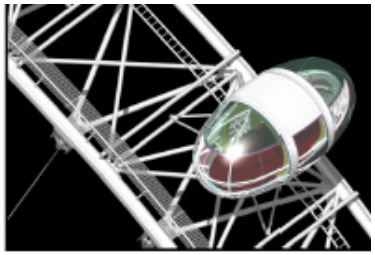
**The Problem/Challenge**
Falls from height, drowning and working next to the Thames.

**The Solution**
Early identification of the issues to the client and contractor to encourage off-site working where possible. Analysis of the river access and craneage capabilities of the site were essential to validate the decisions and locations of large modules.

**Key Points**
- Prefabrication reduces work at height
- Off-site fabrication in factory conditions offers more control and quality
- Heavy module lifting can be hazardous but requires less lifts
- Off-site fabrication can cause access and transportation issues
- Review the buildability and access issues with the contractor as early as possible
- Cost benefits may be possible as well as safety benefits
- Fall arrest with bots recovery strategy was used
- Prefabrication can be advantageous to CDM but is not always the answer.

Building the London eye was a real challenge and the result was a impressive structure which had great solutions to both engineering and safety problems.





# Design for avoidance of Working at Height by Prefabrication

**The Problem/Challenge**
Avoiding working at height by craning in large pieces of structure eg. Pod constructions, roof plant modules and dormer windows.

**The Risks**
Heavy lifting of large pieces of structure with associated personal risks and damage to the building. Future replacement access problems after hoisting capacity removed. Usually some residual working at height issues to be resolved.

**The Solution**
Early identification of the issues to the client and designers . Off-site manufacture as much as possible. Use low maintenance materials wherever possible to minimise future work at height, but remember quality of materials in relation to societal expectations of building eg. High end residential as opposed to worker housing.

**The Benefits**
Future replacement of large pieces of equipment can be facilitated in an easier manner. Alternatively scaffolding or other access strategies necessary.

**Key Points**
Review the hoisting, lifting and access issues ideally with the principal contractor as early as possible. Economy of scale of repeat design to be considered. One off elements are rarely economic with prefabrication.


# Mock-ups used to verify a complex structure

**The Problem/Challenge**
At Heathrow Terminal 5 (T5), the complexity of the roof abutments was seen as a source of risk to the project. The unusual design created a challenge to ensure that the roof design could be realised safely and on programme.

**The Risks**
There was a concern that a complicated and unfamiliar construction sequence could lead to reactive problem solving on site. This in turn could lead to work at height being inadequately controlled. There was a commercial risk if there was a delay to the project caused by the ineffectiveness of the proposed construction sequence.

**The Solution**
For T5, small scale models were constructed and considered in the design office. The scale of the abutment was part of the risk, so a full scale mock-up was built off site. This provided the project team with the opportunity to explore the challenges of erecting the abutment and curtain wall in a controlled environment.

**Key Points**
•Even carefully considered designs and proposed construction sequences can benefit from models (or if the risks are big enough, a full scale mock-up).
•There can be a strong commercial as well as health and safety argument to support mock-ups.
•At T5, the mock-up enabled the steel fixers to gain valuable experience, providing feedback and suggesting improvements.

**The Benefits**
•There was greater confidence in buildability and the proposed construction sequence. Over one hundred improvements to the erection methodology and safety were identified, including:
• The improved means of gaining vertical access (a bespoke gantry system was commissioned for installing the cladding system externally which had the additional challenge of a negative incline)
• Unsafe working platforms, which had not been identified during the pre planning exercise, were corrected.
•The method statements were amended to accurately reflect the on-site conditions.

In addition to the safety benefits, the client also profited:

•Through the improved speed of erection – approximately 100 site days were saved.
• There was a reduced risk to the programme in terms of any consequential over-run of associated critical path elements.
• There was a considerable overall cost benefit. Whilst the mock-up cost £1m it is estimated that it saved in the region of £4m, had the issues that needed to be resolved been repeated across all the abutments.

# Heavy Glass Buildability - Sketch sequencing drawings guidance

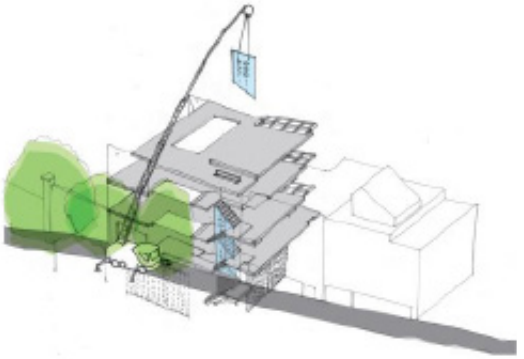
**The Problem/Challenge**
Building with heavy glass elements.

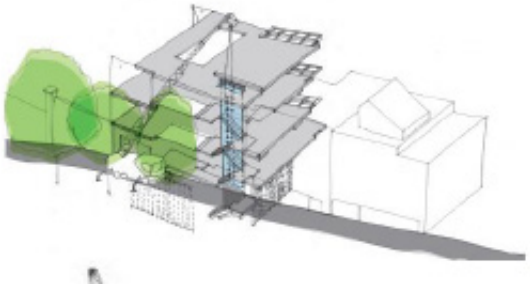
**The Risks**
Avoiding heavy manual handling operations.

**The Solution**
Early identification of the issues to the client and contractor.
Analysis of the access and cranage capabilities of the site and structure are essential to validate the decisions and locations of large elements.

**The Benefits**
Sketch analysis of the building and likely lifting operations allows anticipation of the issues involved. The design can then be modified if obvious problems are likely.
Large units can be advantageous to CDM if mobile or static cranage is possible.

**Key Points**
Review the buildability and access issues with contractor as early as possible.
Cost benefits may be possible as well as safety benefits.





# Modular Staircases

The designers were contracted to design and supply 4No 19m high staircases to the perimeter of a waste water treatment plant. The main challenges were limited time on site, lack of site room, a change of direction and the staircases being located over a moat.

To resolve these challenging aspects. It was decided to design the structure as a modular scheme allowing the stair units to be pre-assembled off-site and then transported to site. This allowed the modules to be erected on site in a single day giving the client immediate access to the waste water treatment plant. A further challenge was that the two staircases facing a new property development had to be aesthetically pleasing so elliptical perforated aluminium panels to represent a ships funnel were used. Again erection of these panels at site needed consideration due to time and access restrictions so it was agreed with the cladding contractor to use a Rain screen system. This consisted of a grillage support frame fixed to elliptical rails ready to accept the simple hanging of 280 Lightweight Aluminium Panels.

**Key Points**

- Staircase Pre-Assembled Offsite with handrail, flooring and treads to reduce on-site working time.
- Modules built up vertically on temporary steel frames (Concrete foundations not required).
- Detailing Lifting and Transport documents were produced by the designer for the Modules.
- Modules top & tailed with 2No Cranes to lie I on its side on a trailer for transport to site.
- Staircase Erected at site in Modules in a Single Day providing instant use as an Access Stair.
- Rain screen-Lightweight Aluminium Panels fixed to support steelwork for quick and simple erection.

*Offsite Assembly*

*Topping and Tailing*

*Loaded on the Trailer*

*Erected Stair Units*

*Cladding Grillage*

*Fixed Panels*

# Manual Handling

Inappropriate manual handling causes many accidents and long term injuries which designers can assist in preventing. Identifying large or heavy elements, if they cannot be avoided, on the drawings allows PC's to plan their lifting and handling strategies.

Other issues to be aware of are:-

• Mechanical handling aids must be utilised where possible to eliminate the need for manual handling in work activities.

• Proprietary aids such as the Gorilla Gripper should be considered for handling sheet material which is the cause of many common musculo-skeletal injuries.

• Consideration must be given to the use of handling aides or how material is packaged to reduce manual handling risks.

• The weight of items must be known by all involved in the task or be displayed on material being handled.

# Heavy element handling - Masonry

**The Problem/Challenge**
To eliminate musculo-skeletal injuries in the construction industry as a result of repetitive handling of heavy masonry units requiring a fundamental change in attitudes throughout the industry.

**The CDM Risks and Issues**
Lifelong musculo-skeletal injuries to operatives causing time off work, early retirement, loss of skilled workforce and loss of income/earnings for individuals and families.

**The Solution for Designers**
NBS Specification Clause 13.2 Design. Apart from general construction hazards, such as working from scaffolding, the main risks associated with brick/ block walling are:

**Manual handling**
The Construction Industry Advisory Committee (CONIAC) has concluded that there is a high risk of injury in the singlehanded, repetitive manual lifting of building blocks heavier than 20 kg, and this should be taken into account before specifying heavy units.
For detailed CONIAC guidance see HSE Construction sheet number 37.

**The Solution for Contractors**
Change in traditional manhandling attitudes to provide or use mechanical aides or less heavy units whilst being competitive in the marketplace.

**The Benefits**
Retaining a skilled workforce long term by showing respect for their health and welfare.

**Key Points**
Increased plant-hire costs can be off-set by faster construction periods but can only be introduced by industry-wide change in attitude to create an even playing field for all.


*Traditional Approach*


*Weight of Units Significant*


*Mechanised Approach*

# Heavy Element Handling - e.g.Glass Screens

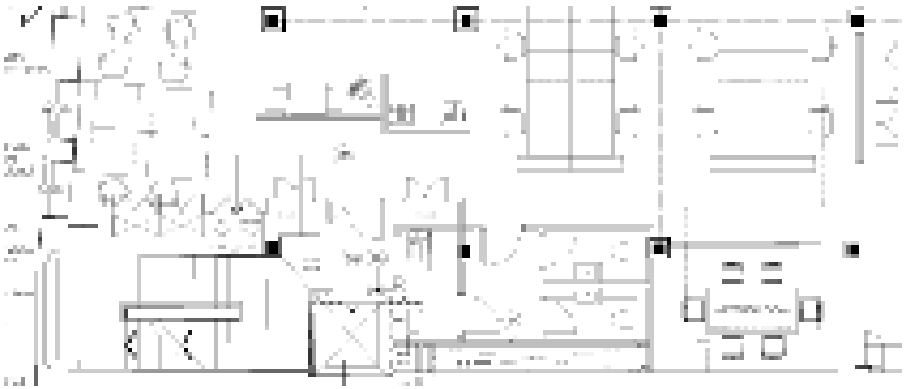
**The Problem/Challenge**
To install heavy glass screens that are specifically required by the designer and client and need to be brought into the building and located by other than manual handling methods.

**The Risks**
If these heavy elements are not identified or eliminated early the installation methods may not be adequately planned or costed. Higher risk manual handling may occur. Alternatively expensive additional hoisting methods may have to be added to the contract costs at a late stage.

**The Solution**
The team investigated the feasibility of substituting lighter materials, for instance smaller components that can be demounted and re-assembled on site. This was not acceptable to the client. The position of the heavy elements was identified at tender stage and their access route indicating vertical and horizontal transportation routes and methods.

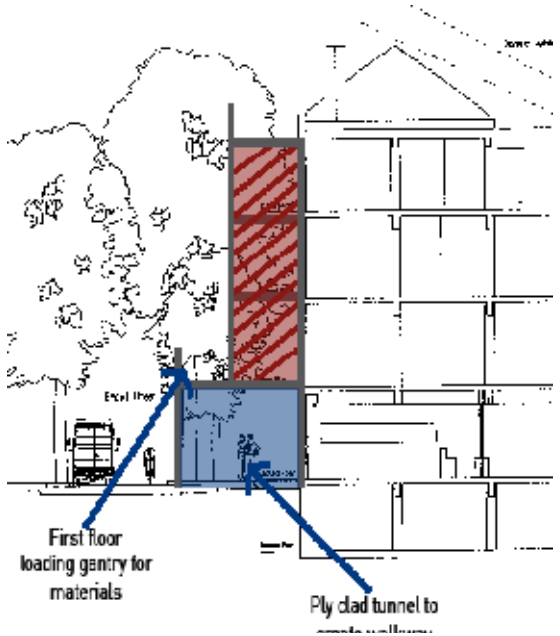
**The Benefits**
This allowed the contractor, client and designer to recognise and react to the key heavy lifting issues. Mechanical aides used to transport the screens.

**Key Points**
Consider substitution for lighter or smaller elements.
Use drawings to identify areas where heavy components are located by simple symbols. Look carefully at component access routes.
Consult contractor or specialist lifting and equipment contractors and request proposals at tender. Think about future replacement access.



**Acceptable access route shown and final locations**

**Mechanical aides**




**Vertical access route**

# Guidance - Heavy Lifting Strategy for Furniture, Carpets, Equipment etc

**The Problem/Challenge**
Bringing large pieces of equipment eg. Fridge freezers, stone baths, worktops or large carpets into existing or new buildings.

**The Risks**
Musculo-skeletal injuries to operatives and damage to the building. Future replacement access problems after hoisting removed.

**The Solution**
Early identification of the issues to the client and designers to encourage smaller modules or bigger goods lifts with a top hat where possible. Analysis of the access and hoisting capabilities of the site are essential to validate the decisions and locations for large modules.

**The Benefits**
Future replacement of carpets and large pieces of furniture or equipment can be facilitated in an easier manner. Alternatively smaller carpet rolls, tiles or equipment should be specified.

**Key Points**
Review the hoisting and access issues with contractor as early as possible.

# Plasterboard Handling Methods - Musculoskeletal Injuries

**The Problem/Challenge**
Lack of information about board weights for operatives. Wide range – from jobbing builders to specialist drylining contractors but mainly sub-contract site operatives injured. Sites driven by cost – not by considerations of Health and Safety – speed rules! Board handling is part of the project delivery, and to be considered by all stakeholders.

**The Risks**
Operatives are taking excessive risks lifting boards. Operatives treat musculoskeletal injury as a risk that you take and can't be avoided. Musculoskeletal damage is occurring without being identified. Operatives have a shortened working life, and families suffer.

**The Solution**
Boards to have heavy lifting symbols or weights attached, specifically can highlights the key issues to contractors. Progress through working together to find approaches that work. The designer can encourage good working practices and mechanical moving and lifting aides, hoists, goods lifts, in drawings, specifications, and red, amber, green lists, etc. This is a generic industry issues that needs a collaborative reposnse by all duty holders and worker engagement.

**The Benefits**
Better plasterboard installations with more motivated operatives, and increased productivity. Longer working life of operatives and skills retention.
Reduces risk to companies against future injury claims.

**Key Points**
Work with the stakeholders to jointly develop an approach to reduce the risk of musculoskeletal injury. Safeguard the health of individuals working with boards by mechanical aides or good lifting practices.

Half boards and Equipment

# Modular design & offsite manufacture

A recent £120M pharmaceutical installation, was technically demanding and one of the key drivers for the project was speed of delivery. The potential of offsite manufacture and modular construction were recognised early in the project, with opportunities being identified and evaluated. They were then developed through concept and detailed design through to installation on site.

**Key Opportunities**

To attain the fast paced schedule required to deliver the project, the plant desk service pipework was identified to be integrated, modularised and prefabricated offsite. This resulted in the design of 9 modules each weighing up to 5 tonnes.

**Key Points**

- Improved safety performance – reduction in hours working at height and risk levels, as construction was offsite at ground level.
- Speed of construction – module fabrication and shell construction ran in parallel (22 weeks from breaking ground to module install – highly serviced 5400m2 building) delivering and estimated saving of 1 month against the overall schedule.
- Reduced on site workforce – less on site resource required = lower on site welfare and provision costs.
- Enables additional work faces – the fast paced module installation freed up on the area below to allow early access to additional work faces.
- Accelerated design.

*Module delivery and installation*

# Lifting operations exclusion zones

Designers should be aware of the implications of lifting heavy and large objects over or adjacent to regulated or trafficked areas. Access within the immediate lifting zone during lifting operations must be restricted to those involved in the work.

- The work area should be clearly marked/defined by;
- Crowd control barriers around the crane and any laydown area. (Bunting is not acceptable).
- Signage to indicate hazard 'Lifting Operations Do Not Enter Exclusion Zone' must be displayed. The lifting zone must be controlled by a dedicated person where possible.

The persons responsible for this aspect of the work must be identified in the Lifting Plan, together with the means of communication/signalling.

- The path of the load to its final position must be considered and the workforce must be excluded from any area where loads pass overhead.
- A 10m exclusion zone must be clearly defined and maintained around the base of any tower crane being erected.
- When lifting operations take place outside the site boundary, traffic/pedestrian controls must be in place to stop vehicles/ the public passing under slung loads being lifted.
- Road closures must be properly permitted and managed to prevent any risk to the public.
- Special measures need to be agreed in proximity of railway lines.


# Lifting and slinging

Lifting plans should be in place – prepared by a trained appointed person.

• A crane supervisor must be on site at all times to oversee the work.
• Any person involved in Lifting Operations must have read & understood the lifting plan, and the relevant risk assessments for the lifting activities.
• The Appointed person must have ensured correct selection, use and storage of lifting accessories.

There must procedures to ensure maintenance, examination and testing of lifting equipment and accessories is in place.

• Only agreed/safe slinging methods must be used
• Only trained personnel must attach and detach loads.
• Loads must be secure when lifted and the weight of loads/SWL of equipment must be known.
• Defective equipment must be taken out of use.
• All accessories must be stored in clean and dry storage.
• Slung loads must not pass over otherworkers.
• The path of the load must be considered.

# Pre-fabricated services and air conditioning modules

**Advantages are:**

- Better services co-ordination
- Reduce time on site, thus reduction in programme and prelims
- Made in factory environment
- Cheaper than traditional build methods
- Less waste
- Less people installing on site
- Safety and environment benefits

Fitting 200 pre-fabricated multiservice spines 6000mm long x 1500mm wide.

Each spine is made up of unistrut frame housing ductwork, various piped services and electrical contamination systems.

The frames of the spines were also designed such that the electrical bus-bar could be fitted into the frames in one position

More information contact:
Phil Ramshead on 01457 842741
Thermal transfer

# Large structure elements - conversion to modular construction

Whilst working on a new Gas Heater Structure, the erection was reviewed by Peers project team. Programme was tight and the top section was 25m high above ground.
It was viewed that although the steelwork had not been designed as modular it would be beneficial to the project to construct the top section at ground level and lift it into position as one complete unit; including handrail and flooring. The total lift was 21m long, 17m wide, 10m high and 137 tonne.

Key Points

- Working at a lower height reduces the risk of accidents and makes the use of access equipment easier and much more cost effective.
- Cable trays were fitted prior to lifting reducing working at height.
- The structure was built on temporary steel bases adjacent to the main structure to reduce the lifting radius and giving optimum crane economy.
- The structure was re-analysed to ensure that all connections and members were acceptable during lifting. Simple plan bracing was added to keep the structure square and spreader beams kept transverse forces to a minimum.
- Building the top section at ground level meant that work could start before the main structure was completed. This saved 4 weeks in the overall programme.
- Even if it has not been a specific design requirement, modular lifting can still be achieved with the addition of few simple temporary bracings and completion of the necessary design checks.

# Large span composite roofing sheets

Composite roofing panels were used on a project as opposed to the traditional built-up system. This
product can be manufactured in sheet lengths of up to 25m (though transport of the sheets will be a limiting factor). By using this product in 12m lengths it was able to cover the full span of the roof with no lateral joints.

Installation required the use of a crane to lift the panels but was very rapid and produced a weather tight shell in approximately half the normal installation time.

**Key Points**

- Fixing & detailing is made much simpler by having larger sheets with no end laps or intermediate joints
- Fewer joints reduced the likelihood of leaks
- Sit installation time cut in half compared with traditional built-up systems.
- Meter wide module and standard fasteners simplifies site installation and handling.
- Cost of crane was additional but composite panels are now getting very heavy (due to ever increasing requirements for better u-values) such that manual handling is getting to be a real problem even with traditional built-up panels.
- Need to consider transportation limitations for buildings with longer spans.

# Roped access - to unusual structures

**The Problem/Challenge**
Design of landmark or unusual feature structures requiring difficult cleaning andmaintenance access to windows and light features and for painting or inspection activities where methods such as cradles or access from the ground level is not possible.

**The Risks**
Prevention of falls by methods that respect the Working at Height Regulations hierarchy but provide the necessary and reasonable access requirements whilst facilitating the aesthetic and safety aspirations of the design.

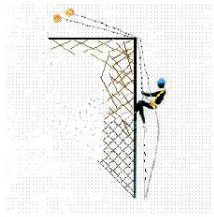
**The Solution**
A roped access work positioning system in accordance with HSE and specialist IRATA installation and operating procedures.

**The Benefits**
Spectacular and essential structures can be designed with the incorporation of safe access enabling features and management systems.

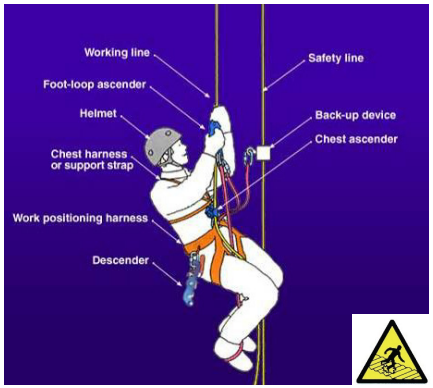
**Key Points**
Early design team and client agreement that design expectations exceed the more common working at height prioritisation strategy.
Specialist roped access installation advice with be required to inform the integration of rope attachment fittings and features.

**Question 22 What are rope access and positioning techniques?**

Rope access is a personal fall-protection system using two ropes each secured to different anchors. One rope is connected to a harness and the other acts as a safety back-up. Rope access is often used to access cliff faces or the sides of tall building when cradles are not suitable.



**The HSE's description of roped access**




**Spinnaker Tower**

**Terminal 5 Heathrow**

**Roped access IRATA guidelines**

# Access to Tower Lighting - Coliseum

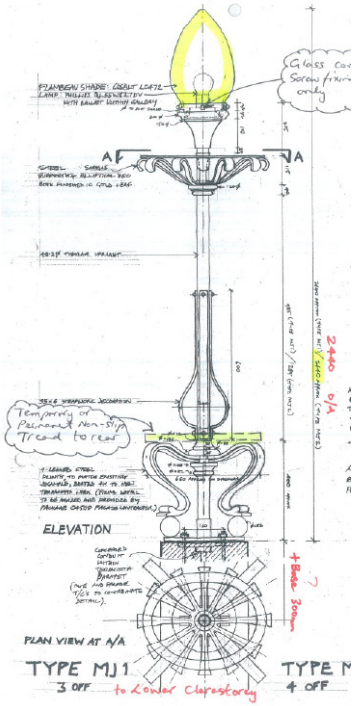
**The Problem/Challenge**
Existing historic freestanding light fittings to be refurbished and replace those missing. These are located on unguarded parapets to the tower and façade. The light fittings vary between 2.5m and 3.5m and cannot be safely reached unaided.

**The Risks**
Falls from unguarded parapets during lighting maintenance access.

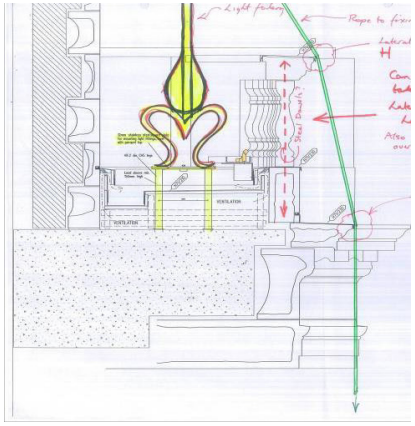
**The Solution**
Powered access equipment, and scaffolding were discounted after careful assessment as unsuitable.
A rope access system, allowing safe work positioning and fall restraint, agreed after detailed client, design team negotiations and specialist consultations.
Rope attachment anchors were built into the structural steel and terracotta cladding by design team integration.
Long life lamps were chosen to also minimise the frequency of access.

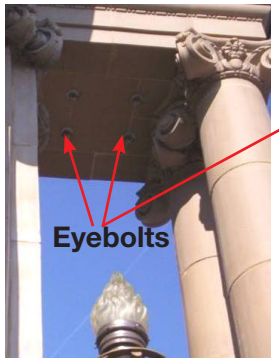
**The Benefits**
Provides safe and economic lamp replacement at short notice using “Working at Height” trained theatre maintenance staff.

**Key Points**
Lighting design drawings were annotated to communicate the risks and solutions to entire team.
The annotated drawings were used by the construction team as the basis of the construction details.

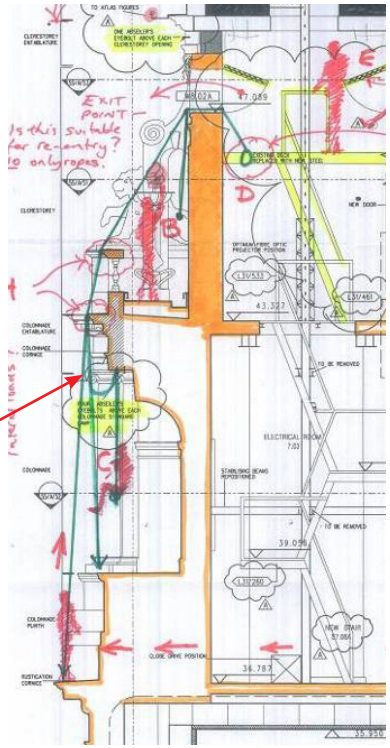


Historic Light


Parapet detail



Eyebolts installed

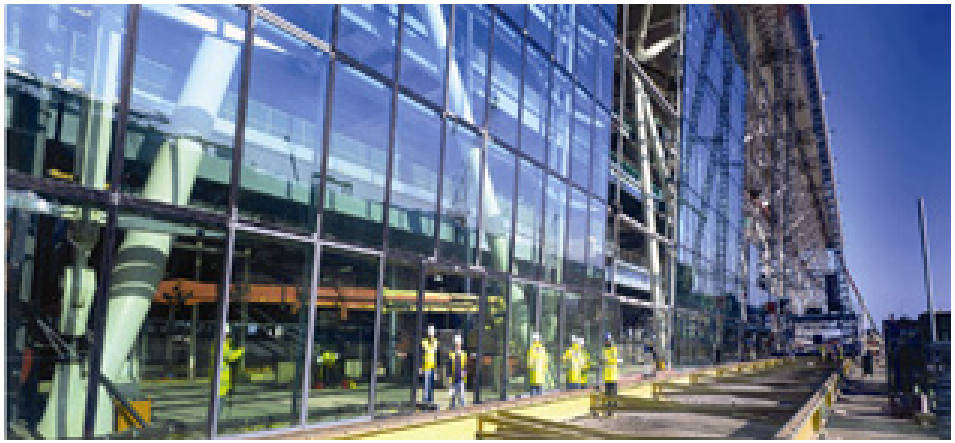

CDM analysis

# Facade installation - Specialist access equipment design - Heathrow T5

**The Problem/Challenge**
A major project requiring the installation of an inclined glazing system along a considerable façade length. The building overhang and restrictions on crane usage on site meant that the use of cranes was not practicable.

**The Risks**
The work involved work at height with the consequential risk of falls or fall of material during installation. There was the potential for damage to the units through the use of traditional powered access equipment because of the reliance on the operator's skill to avoid collision with the façade.

**The Solution**
The cladding designer proposed a gantry installation system with a runway installed in front of the building, for the gantry to travel along its entire length and height. This system provided a controlled means of lifting the glazed units and personnel. The client recognised that the costs of this system were largely offset against improved productivity and reduced damage.



**The Benefits**
A safe working platform was established. The programme was completed on time with significantly reduced vehicle movements. The quality of the finished product was enhanced. There was a significantly reduced number of damaged units.

**Key Points**
Early involvement of the specialist curtain walling contractor was essential. It reflected the fact that the installation process would be challenging and that a bespoke access system would be required. An early cost/benefit analysis demonstrated ta the investment in the travelling gantry was worthwhile.

# MEWPs and Ground Conditions

Working at height issues can often be resolved by use of MEWPs, but the environment in which they are used is important.

Ground should be level, firm and the machine not over any drain, basement. Where rough terrain equipment is used, the manufacturer's requirements on ground conditions must be followed and engineered ground may be required.
• Outriggers/ stabilisers should be fully deployed and rigger pads used as required.

The safe wind speed and safe operating gradient is displayed on the machine.
An anemometer must be held on site by all sub-contractors using MEWPs.

# Safer use of MEWPS

MEWPs (Mobile Elevated Working Platforms) are used by many trades to provide safe working at height. Often this can be hindered when the operator is required to use powered equipment such as drills or impact wrenches.

Trailing leads can be a real risk, especially if the MEWP is required to move location during the work. There are MEWPs available which have on-board power which enables the operator to connect tools in the basket as opposed to trailing leads down to a static generator at ground level.

This neat and simple solution to a long running problem has proved such a benefit that many contractors now insist that all MEWPs used on their sites have on-board power when required.

**Key Points**

1. Trailing leads are a hazard which should be avoided.
2. On-board power means more efficient working.
3. MEWP's are available with 110V power to the platform.
4. MEWP's are available with air lines to the platform and some are available with welder ready packages.
5. An example of MEWP's with on-board power can be found at www.genieindustries.com
6. Sites and design teams can insist that MEWP's are equipped with power supplies.

# Work restraint & fall arrest harness

All Designers or Principal Designers should be capable harness users and must understand its use and limitations as PPE especially if they have to inspect roof, façade or high level instabilities;-
Harness training should be provided to all designer site personnel.

• Ensure the harness is put on like a jacket, and adjust the chest strap, so it is tight but comfortable.

Stepping into a full body safety harness is extremely bad practice.

Not only does it increase the risk of slips trips and falls if the harness is placed on the ground, but it could pick up all kinds of dirt and contamination.

Check the chest strap is located correctly so the wearer cannot be struck in the face in the event of a fall.

**Harness/Lanyard checks**
Equipment should be checked by the user for the following;
• Cuts.
• Abrasions.
• Broken stitching.
• Swelling.
• Unusual patterns.
• Fraying.
• Burns.
• Chemical damage.
• Weld spatter.
• Discoloration.
• Deformed and damaged hardware
including distortions, cracks, corrosion and pitted surfaces.
If any of the above are apparent do not use the harness and make sure it is suitably removed from use. Fall arrest harnesses are not to be confused with Rope Access Full Body Harnesses.

# Rope access harness

• A full body harness is used for rope access work positioning and is suspension work equipment as opposed to simple PPE. This is a much superior harness to the personal protective equipment fall arrest harness which is only designed to catch an operative in the event of a fall and which only allows some 25-30 minutes in suspension before trauma sets in. The full body rope access harness allows work positioning for considerable periods of suspension time due to its ergonomically superior design.

• Whilst this is a one person piece of equipment it is not “PPE or Personal Protective Equipment” in the usual sense but provides suspension equipment in conjunction with the twin-roped IRATA methods and anchorage installations of Rope Access for relatively lightweight maintenance operations on buildings.

• In conjunction with suitable training and controls this provides equally acceptably safe methods of cleaning access as BMU’s and cradles which only offer their occupants fall arrest protection in the event of a fall occurring.

• However, the WAH regulations suggest that cradle awareness is higher on the hierarchy of safety for site activities, if possible.

# Tool Tethering

Designers can design to reduce the use of the tools at high level or over public or peopled areas but often this is unavoidable .
Any tools being used at height need to be anchored against dropping.

• Lanyards, tethers along with connectors must always be used in between the tools and belt or bag.

• There needs to be a safety provision in between the tool and tethering system on the belt or bag.

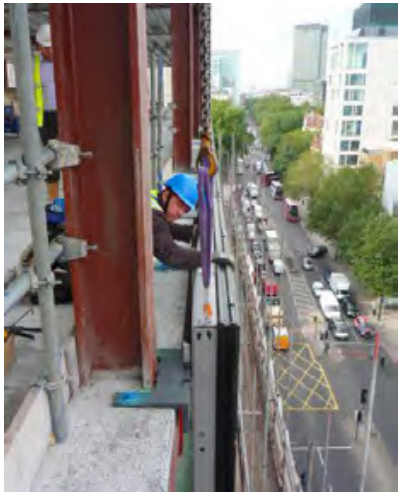
• Wrist straps should only be used if they provide protection against injury caused by de-gloving.

• When there is a need for more tools, a tool bag / belt with structural anchorage loops must be used.

• If required, log tools in and out on a tool register, to make sure that no tools are left at height. Ensure barriers are in place below the work area and make sure the extent of the barrier area is appropriate for the work being done at height.

• Make sure that any grating is safe and make use of mats and temporary covers where there is the possibility of small items falling through gaps.

• Wherever scaffolding must be used, make sure toe-boards are fitted.



# TETHERED TOOLS – CONSTRUCTION KNOWLEDGE FOR DESIGNERS

Tethering tools at high level has become common throughout certain construction and maintenance sites. The technology ensures that the tethered tool does not lose integrity and that even the most robust and awkward tool can be securely tied without restriction on its use.

Spanners falling from height is a far more regular occurrence than is reported. Similarly scaffolders often drop spanners during their work process and even if there are other robust control measures such as netting the loss of tools at height is unnecessary and dangerous.

This particular Safe System of work is of great benefit when working in densely populated areas, particularly city centres or in existing or populated buildings such as airports or shopping centres. Some tools such as battery operated drills and mag drills appear to be too cumbersome to warrant tethering but there are proprietary solutions to ensuring that all tools can be secured.

**Key Points**

• Falling objects however small pose a serious threat on site.

• Preventing objects from falling reduces serious accidents and saves lives.

• Lanyards should be a suitable size which enables easy use whilst not posing a trip hazard. Retractable lanyards are available.

• Tethering tools when working at height is a common sense safety solution.

• Designers need to be aware of such methods but were possible design fixings that require minimal use of tools at high level.

Hand Strap

Retractable Lanyard

Typical Tool Belt

Socket with Lanyard

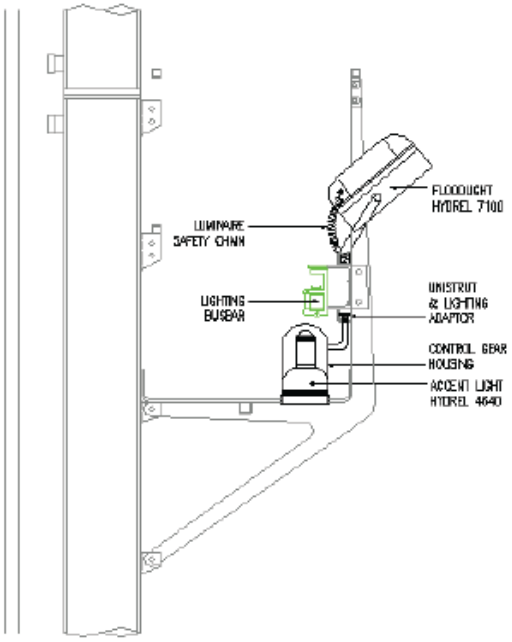
Hammer with Eye Ring

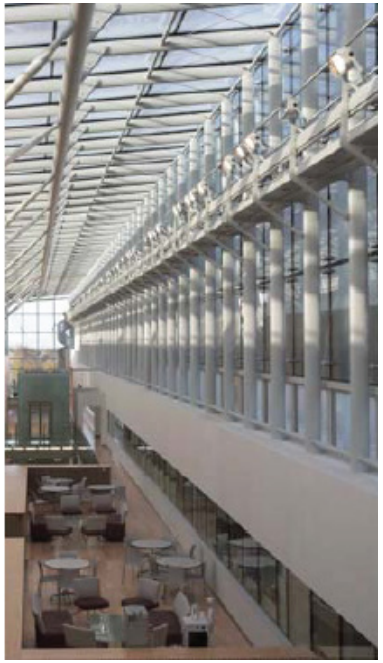
# Atrium lighting & maintenance areas

General lighting of a large, glass roofed Atrium, using a maintenance gantry. Suspending Lighting, cables, or secondary reflector mirrors from the tubular steel support or roof structure was not an option open to the Electrical Design Team.
Ease of installation of floodlighting and feeder systems essential.
Safe access for future maintenance.

Benefits and key issues:

• Bus-bar systems used to avoid conventional labour intensive wiring at height. It costs permit.
• Gantry designed to accommodate floodlighting for walkways located directly below gantry.
• Floodlights prepared at floor level with flying lead and plug in facility to enable quick installation into Bus-Bar at Gantry level.
• Colour of gantry & floodlights co-ordinated to blend into background.
• Floodlights pivot inboard of Gantry to provide safe access for relamping.
• Floodlights can slide along fixed rail for aiming during commissioning.
• Gantry designed to accept quick fix installation of Bus-Bar instead of trunking and conventional wiring.
• Clear unobstructed gantry walkway for future maintenance and relamping of the floodlights.
• No specialist working platforms or scaffolding required for future maintenance.



# Suspended ceiling access

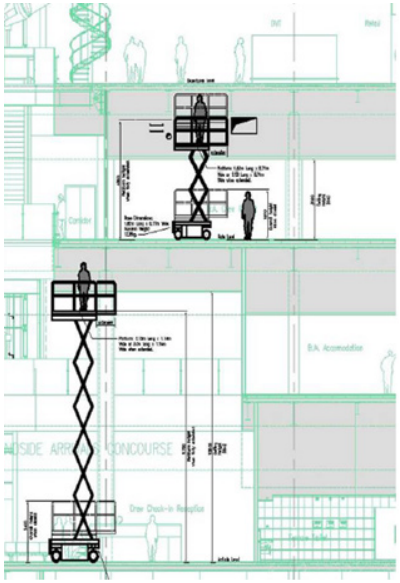
The Problem/Challenge
A major transport infrastructure client recognises that high and deep ceilings voids could be problematic to inspect and maintain. They found that it was too often impractical to close off buildings to facilitate scaffold access. Ceiling access panels were traditionally too small to allow for safe access and deep beams and large ducts and other services running in the ceiling void prevented access platforms reaching up to the space.

The Risks
Falls from height associated with unsuitable access
equipment. The unavailability of suitable access for tools, equipment and replacement parts.

The Solution
• The selection of 600 x 600 panel size was challenged and large ceiling panels were substituted. These enable access by systems such as mobile elevated work platforms (MEWPs)
• Panels were hinged or had sliding mechanisms so that they could be safely opened.
• The openings in the ceiling and the services running in the voids were designed to provide adequate space for a working platform to be raised between them, giving access to the full height of the void.
• No services were placed in any remaining inaccessible areas.

The Benefits
• There was a significantly reduced level of risk associated with work at heights during maintenance
• The improved access arrangements meant that the impact on the operational building from maintenance activities was reduced.

Key Points
• The design team planned ahead to improve access for maintenance
• There was coordination across design disciplines to produce the final design
• There was willingness and commitment to challenge the norm



# Closing out ceiling - timely installation

The During most construction projects there comes a time to fit the ceiling grid to enable light fittings and diffuser grilles to be fitted before commencing tiling. This activity is often badly planned and the interaction and communication between the construction element (the fixing of the grid) and the M & E element (working above the ceiling grid) does not happen adequately.

The solution involves simple planning and discussions around the timing of the grid fitting. In addition a simple closing-out meeting should be arranged (involving all relevant parties) prior to the ceiling being closed off.
The ceiling grid below has been fitted too early, prior to much of M & E work above (second fix electrical and mechanical connections, fire detections, audio visual equipment, insulation etc..)

Items to consider before fitting grid:
- Completion of smaller power and electrics
- Testing of small power and electrics
- Bracketry for any final fix equipment (audio/visual/ceiling grids/cassette units)
- Pressure testing of mechanical pipework
- Pressure testing of mechanical ductwork
- Insulation of mechanical ductwork and pipework
- Completion of all fire alarms cabling and fitting of ceiling void detection

Better still- do youreally need a ceiling grid at all?

Benefits
Health and safety ~ holding back the installation of the ceiling grid until the ideal time can greatly increase health and safety giving safer simpler access for all engineering contractors. If communicated correctly, there should be little or no need to access through the grid to carry our work without correct handrail protection or the need to use stepladders. Therefore the risks of falls at this critical time on the project is greatly reduced.

Speed ~ work before the fitting of the ceiling grid is far more efficient than after. Holding the fitting of the grid until the ideal time can actua ly reduce the overall programme. This has been successfully tried and tested on a number of projects.

Reduced damage ~ the closing out meeting will encourage contractors to complete the above grid. Therefore it is less likely for the need for contractors to require access above the ceiling once it has been fitted.

Tried and tested ~ this simple but effective planning and co-ordination has been successfully tried and tested on a number of projects.

# Pre-installed support for M&E services

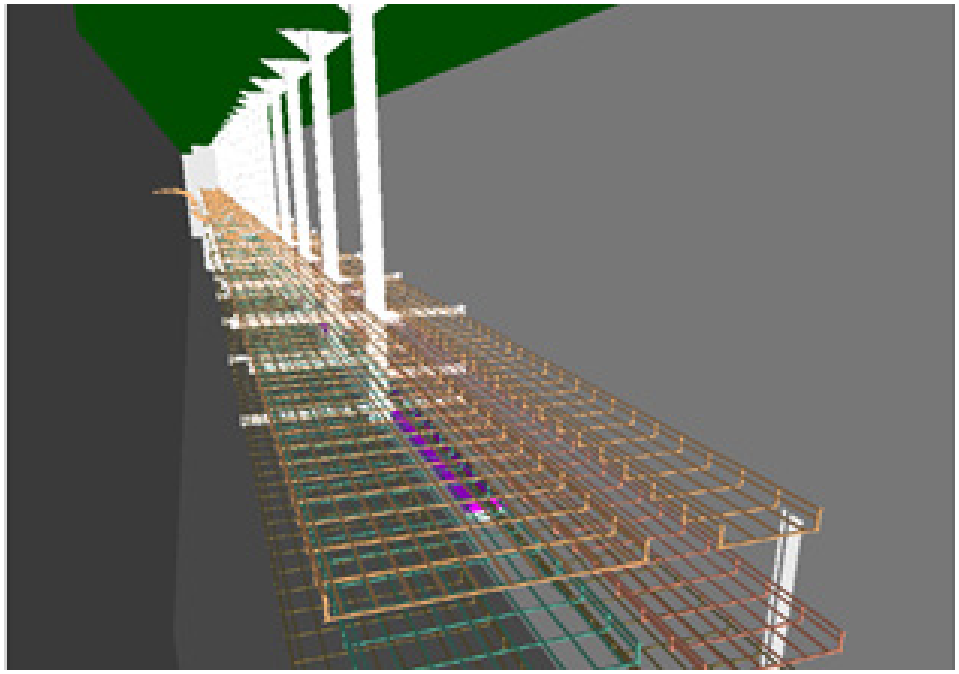
**The Problem/Challenge**
The designers of the Mechanical and Electrical (M&E) installation for a complex project wanted to reduce the risks and programme time associated with the M&E installation.

**The Risks**
The installation of M&E is often left to contractors to manage. This can require significant work at height, which is made more difficult by obstructions. There may also be a need to drill a significant number of holes for the fixing, giving rise to a risk of hand arm vibration.

**The Solution**
A well designed, pre-installed support system was specified that significantly reduced the risks associated with installation, it helped to improve productivity for both installation of the support system, and installation of the services, leading to a significantly shorter programme…

**The Benefits**
The design of the supports allowed good access for the initial installation of services and cabling. It also meant that access could be easily achieved for subsequent maintenance and replacement. There was a reduction in the need to drill into the soffit, leading to improved quality, reduced exposure to vibrating tools, dust and reductions in the noise generated.

**Key Points**
• Early layout coordination with other designers, looking at the positions of the ceiling grids and working out the ductwork routes was required.
• Early establishment of the sizes and positions of the cable trays and service routes was required.
• Consultation was needed with the suspended ceiling designer to ensure that appropriate access panels were provided that would allow sufficient space for access.



# Parapet design - folding rail systems

Architectural building designs often require uncluttered facades for aesthetic reasons. The parapet design often requires careful detailing to provide clean, sleek lines free from rails window cleaning apparatus etc. This is in conflict with the desired approach to ensure a fixed barrier is in place to prevent falls from heights.

In some cases the roof area can be designed to be free of services in order that roof access is for essential maintenance only, and access can be strictly controlled. Usually safety harnesses or lanyards could be incorporated to allow for occasional access.

However flat roof areas are useful areas for plant and services, and folding balustrades could be considered to provide protection. If a roof edge is a particular feature of the building design an installation such as Barrial folding rail systems by ICB could be considered, the barriers would be raised prior to walks on the roof commencing and simply lowered on completion.

Quite often the plant is set well into the roof area so it cannot be seen from the ground, here fixed barriers or enclosures could be incorporated to allow safe maintenance zones. Infrequent access nearer the parapet could be by an anchor system and lanyard or harness, ICB offer a (FLG) Lifeguard Portable System, which could be considered. This system does not require penetration of the roof membrane or mechanical fixing and offers complete flexibility for site operatives working at roof level.

# Roof Plant Access - Detailed Design

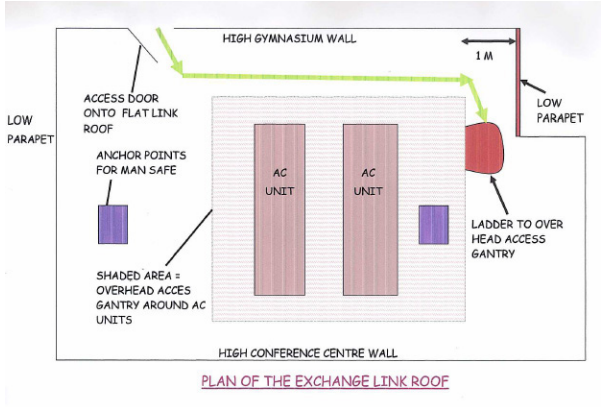
**The Problem/Challenge**
Access to raised platform. HSE prosecution of designer, planning supervisor and contractor due to fatal fall off ladder and over the low parapet.

**The Risks/Accident**
Fatal fall 10m over a low parapet from a vertical ladder whilst carrying tools to maintain plant.

**The Solution**
Provide inclined stairs, or relocate the ladder and provided raised protection to parapet edge.

**The Benefits**
Safe access for regular plant maintenance.

**Key Points**
Preference to provide inclined staircase and handrails for safe maintenance access. Appropriate edge guarding for frequent access not anchor points.
Review all access routes to roots, plant and service areas with architectural services and steelwork specialist drawings all coordinated onto one drawing.

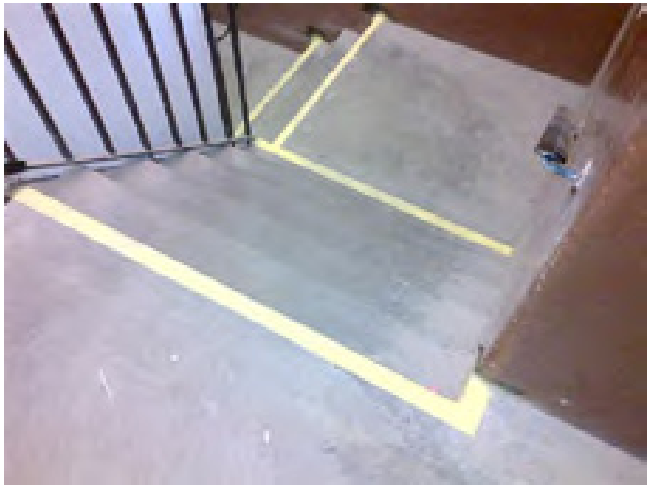


PLAN OF THE EXCHANGE LINK ROOF

# Stairs and ramps during construction

**During construction:**

• All stair surfaces must provide adequate grip for users.
• There should be sufficient lighting to see step edges clearly with emergency back-up.
• Highlighted edge of top and bottom step with a high visibility finish.
• Stairs/ Ramps should be kept clear of materials and debris and any spillages cleaned up.
• Stairs and steps must be maintained and checked regularly.
• Double guardrails on the inner well or open side of access stairs.
• Provide handrails on each side if flight of stairs is wider than 2m.
• Half landings should be screeded as soon as stairs are installed, alternatively, infill gap with ply to remove trip hazard.
• Sockets for temporary balustrading can be cast in RC or added to steel stairs and infilled or removed after final handrail installed.



# Stairs and ramps during construction

• Self-adjusting stairs should be utilised where possible in preference to ladders. (a)
• Stairs must be provided as primary means of access for scaffolding. (b)
• Use ladders only as a last resort or on small projects or works. Access holes to be guarded. (c)
• Ramps must be suitably constructed (with Temporary Works design if required) and suitable for moving materials. The steepness of the slope must be considered and factored in. (d)
• Ramps must be clearly visible with sprayed edges or signage as required. (e)
• Ensure adequate edge protection provided if there is a fall risk. (a,d,b)
• Should be adequate grip underfoot – brush finish to concrete or anti-slip finish on vehicle ramps.

# Low Level Access and Work at Height Stepladders

Designers do not need to advise on access to all working at height unless of a potentially difficult or unusual nature. However, if unsuitable access provisions are used on site an accident can happen which could cause a shutdown of the site and long court case litigation.

Designers should look for:

**Stepladders**

- Stepladders can only be used if they are the only practical means of access.
- Stepladders can only be used for short duration works only e.g (up to 30mins).
- Users must be trained and instructed to use the equipment safely.
- The stepladder must be long enough to safely reach the work.
- The stepladder must be level.
- The user must face in the direction of work at all times.
- The user should maintain 3 points of contact at all times.
- Stepladders must not be used as a leaning ladder.
- Users must not use the top three steps of a stepladder unless a suitable extending handrail is available.

# Podium steps

Users must be trained/familiarised.
• Brakes must be applied at all times when in use.
• Gate must be shut when in use.
• Guard rails must be at the correct height for the platform and extension kits used as required.
• Additional braces /climbing steps must be used as required.
• All locking clips must be in place at all times.

Consideration must be given at all times by users to maintaining access and egress for others in work areas

# Mobile Aluminium Towers

Where short term high level access is required a static or mobile scaffold tower may be most appropriate. Look out for:-

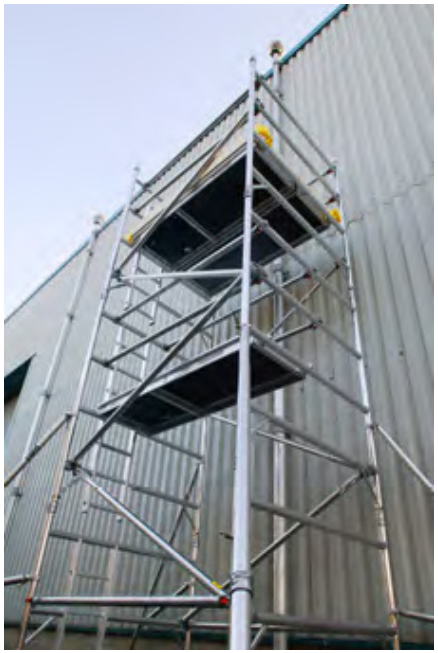
- Only PASMA trained competent persons may be permitted to erect, use or dismantle towers
- Towers must be erected and used on firm ground
- Static towers must have metal base plates.
- Castors should be locked into the base and brakes fitted and locked when the tower is in use.
- Ensure the height to base ratio is in line with the manufacturer's instructions.

Where a tower is likely to be exposed to wind loading, or where the maximum recommended height to base ratio needs to be exceeded, the scaffold should be tied to the structure it is serving, or be designed to ensure stability by means of ground anchors, guys or kentledge.

- Guardrails and toeboards must be fitted on all four sides of the platform.
- Guardrails must be 950mm above the platform with the distance.

between the top of the toeboard and the middle guardrail not exceeding 470 mm.

- Diagonal bracing should be correct as per manufacturer's instructions.

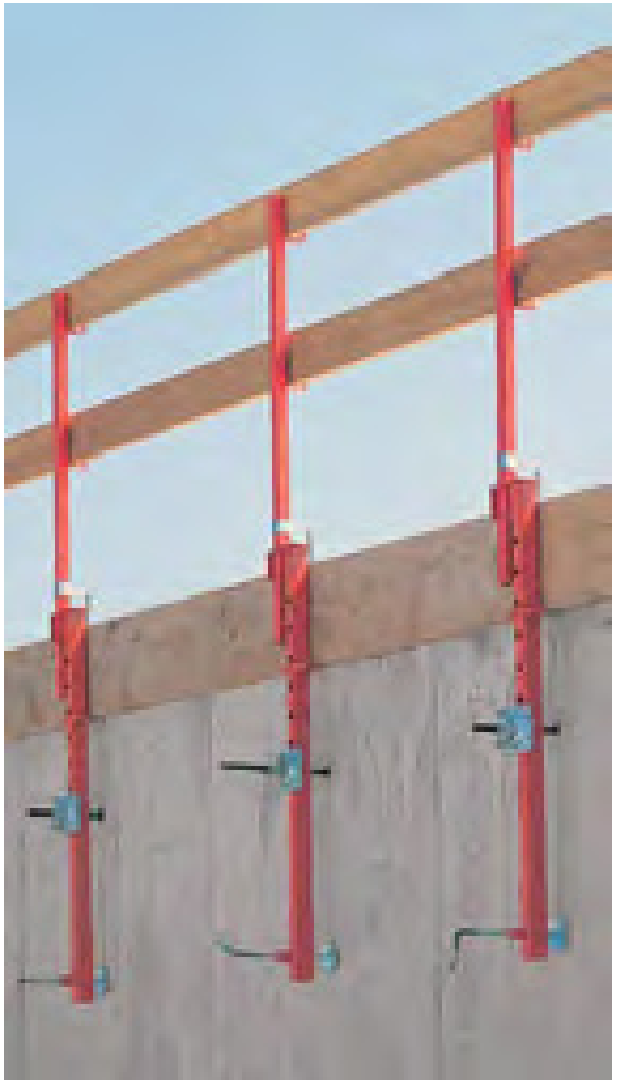


# Edge protection

Designers can make the installation of temporary edge protection much safer by clearly identifying locations on drawings, providing sockets or fixing lugs and agreeing proposed systems with sub-contractors or the PC.

Edge protection must be considered through the design process on items such as steel members/false work/formwork  etc. and must be in place at the point of installation to prevent the need for further work at height.

- Design details/ approvals of systems must be available on site.
- The security, strength and stability of supporting structure must be verified as adequate.
- The base connections for any edge protection must be suitable and fitted correctly to the structure.
- Counterweights must be correct to design/manufacturer's instructions.
- The guardrail must be at least 1.0m high and also have an intermediate rail fitted.
- Toe board must be at least 150mm above the working surface, with no gap through which a 20mm sphere could pass.
- Ensure the class of edge protection is appropriate for slope of working surface (see overleaf).



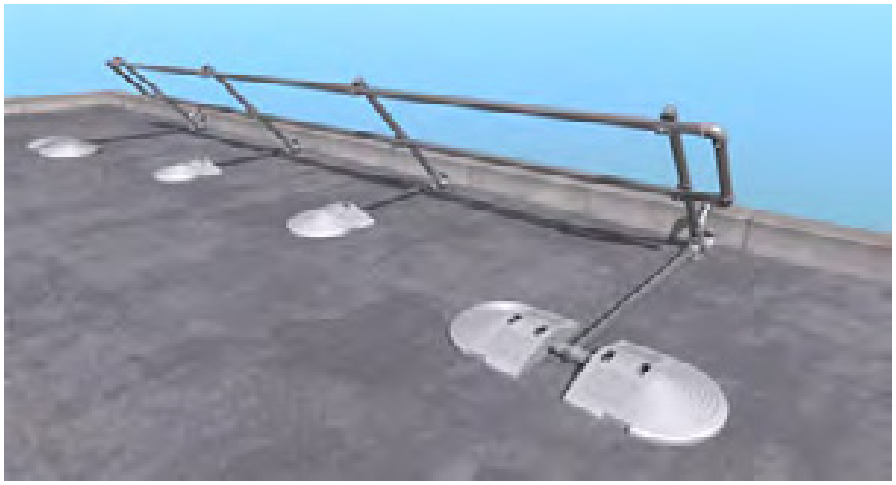
# Edge protection edge

General
Check there are no gaps in protection greater than allowable for class. (470mm for up to 10° slope, 250mm for up to 30° etc).

Class A
Provides protection to flat surfaces and slopes up to 10 degrees. It provides resistance to static loads and is based on the requirements to support a person leaning against it, walking beside and possibly stumbling against the edge protection.

Class B
Provides protection to flat surfaces and slopes, generally up to 30 degrees and to even steeper slope lengths. It provides resistance to both static. Edge protection fitted after installation of steel and low dynamic loads and is based on the requirements to support a person leaning against, walking besides, possibly stumbling against and sliding down a sloping surface towards the edge protection.

Class C
Provides protection to steeply sloping surfaces, generally up to 45 degrees and up to 60 degrees for 5m slopes.
It provides resistance to high dynamic loads only and is based on the requirements to contain a person sliding down a steeply sloping surface.



# Riser ducts - Fall protection/ Construction and Maintenance

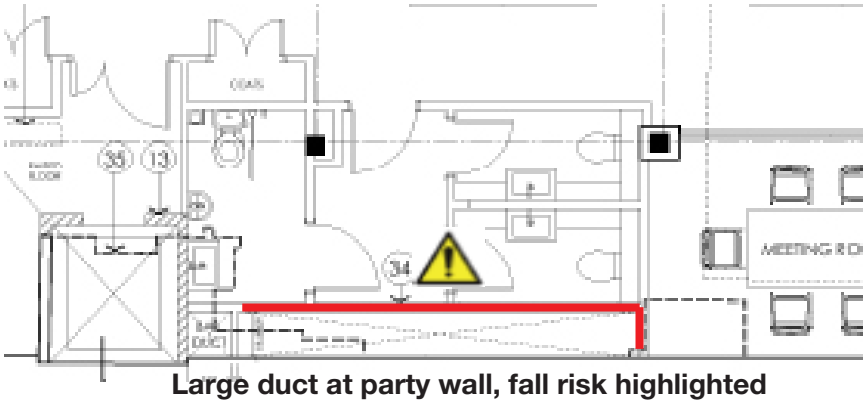
**The Problem/Challenge**
Maintaining the safety of floor openings before installation of service risers.
The programme usually requires the installation of services after the riser holes formed.

**The Risks**
This can lead to openings in the floor that the contractor has to manage, creating a potential fall risk or trip hazard.

**The Solution**
Alert the contractor to the riser duct holes at tender on drawings. By keeping risers adjacent to walls they can be easier to protect. Co-ordination between M & E designers and structural designers can enable the size of riser openings to be reduced. Sleeves or ducts can be cast in ready for services. Alternatively, it may be possible to cast mesh into the floor. The contractor to agree the preferred solution with the health and safety subcontractor.

**The Benefits**
Significantly reduce the reliance on scaffolding or coverings that can be easily moved. Reduce the likelihood of accidents on site.

**Key Points**
Talk to other designers, involve M & E designers as early as possible to minimize risks and size of riser openings.
Consider casting in sleeves or mesh to eliminate fall risks.
Consider pre-assembly of services, reducing work at height.
This is a “competent contractor” issue to manage but the design team can assist to prevent accidents by alerting the contractors as early as possible in tendering process.



**Large duct at party wall, fall risk highlighted**

**1. Sleeved services**

**2. Large metal mesh**

**3.Small metal mesh prevents falls in open areas**

# Edge Protection to Risers and Shafts

All shaft openings must be protected with proprietary gate system such as Fullgate.
Installed progressively as cores constructed to prevent any need for fall restraint.

Double guard rails and toeboards to shaft openings are not acceptable.
Riser protection must be considered through planning of work to incorporate built in solutions.
Consider reinforcement mesh cast into riser opening and cut out for services progressively.

- Solutions such as GRP grating considered to fill voids.
- Minimum double guard rails and toe boards to all riser openings.

# Hole protection

Holes in sites can cause serious accidents. Designers can clearly identify all duct, holes, manholes and other service risers on drawings to help contractors make cost allowances and order equipment. This does not take the responsibility away from contractors to protect holes.

All holes or voids inspection/valve chambers or manholes must be protected if there is a risk of persons or materials falling through.

The size and type of holes determine the type of protection but hole covers must be clearly identifiable and marked with 'Fall Protection Do Not Remove'. A template for spraying this warning should be available. Hole protection such as plywood should be recessed into a hole where possible.

Covers must be chamfered on the edges and placed so they do not create a trip hazard.

Covers must be designed to withstand exposure and any left open and unattended point or impact loads.

• Holes subject to additional loads, plant or vehicles require additional assessment and may need the involvement of a Temporary Works Designer.


# Hole Protection

On larger projects, with extensive holes or penetrations, consideration must be given to an agreed protection solution which should be monitored for adequacy.

• Hole coverings must allow for secure fixing but also safe removal and refitting. Where the work methods require this, Risk Assessments and Method Statements for operations must cover both the removal and replacement process.

•Sub-Contract Supervisors must be appointed to take responsibility for any on-site management and inspection of holes and voids.

Where it is impractical to cover larger holes or voids, full edge protection must be provided and consideration given to additional debris netting to stop smaller falling material. Hole protection must be inspected daily by the Supervisor nominated for that area and any deficiencies must be rectified immediately.

• Hole protection must be maintained to a high standard and securely fixed to avoid displacement or tampering.

• Holes should never be left open and unattended.

# Service risers - safe construction

The traditional way of installing services through risers is notoriously difficult to manage safely. The solution below had the following sequence:

• Temporary steel plates were fixed over the service risers as the profiled metal decking was installed for the floors.
• Services required to pass through the risers were designed (in some cases oversized) holes were provided where the design was not finaised.
• Service riser requirements were passed to the steelwork contractor who had the riser plates laser cut off site.
• The new service plates were delivered to site with temporary caps in place and were swopped with the temporary plates.
• Temporary caps were removed to allow each services in turn to be installed as required from a safe platform.

**Advantages**

• This method allowed services to be installed from a safe working platform in many service riser positions.
• Avoided the cost and time involved in providing scaffold solutions within the riser void.
• A neat final solution without the need (cost and time) to make good the service riser platform after the services were installed.

**Issues to Consider**

• Required co-ordination of various designers to provide their service requirements at the same time.
• Extra service penetrations can be cut after the riser plate is in place but requires design input to ensure the strength of the plate is not compromised.

# Breathe Freely by design (BOHS) - www.breathefreely.org.uk (P1)

The BOHS Design Guides
are intended to help those at the very beginning of the construction process to produce practical designs that reduce the use of activities or materials that have the potential to produce ill health in construction workers.
These guides cover common materials and activities associated with construction, maintenance, refurbishment and demolition.
If you have any feedback on this guide please contact the Breath Freely campaign.

Cutting stone and cementitious materials
Typical occurrence
Stone and cementitious materials are often cut on site for basic building construction or to produce a particular finished effect.
This might include paving or materials used to face buildings.
Chasing is often employed to cut channels in walls or floors to fit pipework or cables.

| Approximate crystalline silica content of different materials | |
|---|---|
| Sandstone | 70–90% |
| Concrete, mortar | 25–70% |
| Tile | 30–45% |
| Granite | 20–45%, typically 30% |
| Slate | 20–40% |
| Brick | Up to 30% |
| Limestone | 2% |
| Marble | 2% |

Potential Heath Effects
Stone and cementitious materials contain varying amounts of crystalline silica. Breathing in dust produced by cutting or abrading these materials can result in the development of serious lung diseases, including
fibrosis, silicosis, chronic Obstructive pulmonary disease (COPD) and lung cancer. These diseases may cause permanent disability and early death. It is estimated that over 500 construction workers die every year in the UK from exposure to silica dust.

# Breathe freely by design BOHS (P2)

**How to avoid or reduce**

•Less is more? Can a low silica or even a no silica material be used? The table above shows the wide difference in silica content of common materials ; or may-be something completely different such as plastic kerbs.

•Death by a 1000 cuts? Consider whether your design is reducing or increas-ing the number of cuts of paving or facing materials. Complicated mono-block designs can require many cuts to each piece; every one exposing the worker to harmful silica. Choose pre-cut blocks and kerb pieces.

•Pour not cut. Can walkways be produced by poured materials rather than paving?

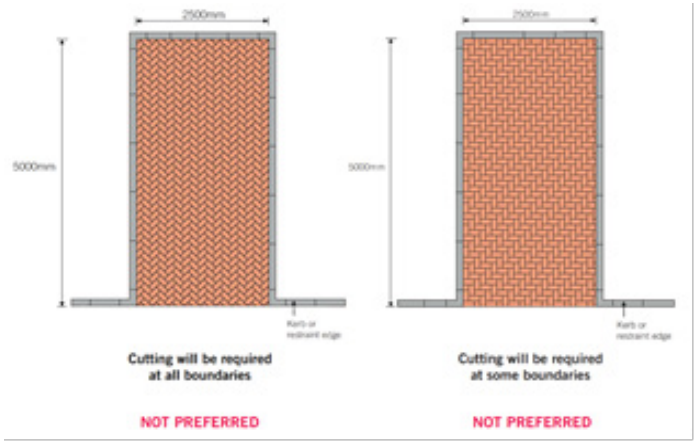
•Offsite option? If cutting is required can the design facilitate offsite cutting where fixed dust suppressing or dust extraction equipment can be used?

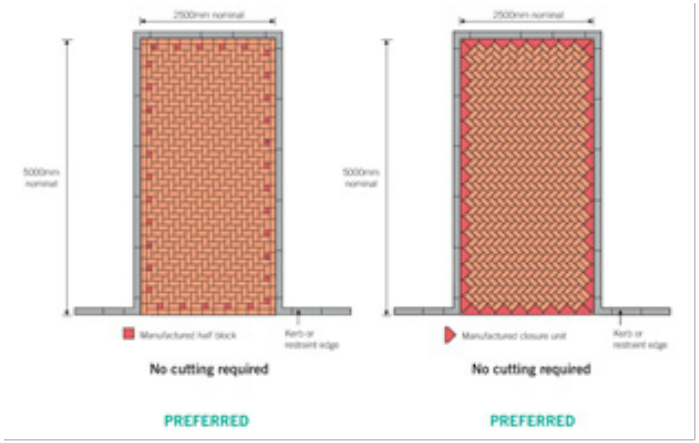
•Predict and precast. Can any fixings or channelsrequired be determined at the design stage and blocks precast with the required channels shaping or fixings?

**SFARP**

The design team need to consider their options of cutting or no cutting, or a combination of both to achieve the desired design effect in the context of the design intent.

If a high percentage of cutting cannot be designed out for reasons of practi-cability other control measures need to be specified eg. Off site cutting, tented enclosure, dust suppression and dust extraction.

# Dust control - Construction dust partnership

Regularly breathing in construction dust can wreck people's life, eg. Site workers, visitors & neighbours.

It can cause workers to die early, permanently damage their lungs, and significantly reduce the quality of their life as they get older.

The Construction Dust Partnership brings together organisations from across the industry to help protect workers and others against the devastating effects of breathing in construction dust.
Protecting site workers from the effects of construction dust needn't be difficult or costly.

Making easy, practical changes to the way jobs are done can greatly reduce the amount of dust created, help stop it from spreading in the air and prevent it being breathed in.

Visit our website to take advantage of the free resources available that will help you identify the risk of construction dusts, provide practical solutions and give information to your workers.

Help them understand why construction dust is a risk to their health and not just an inevitable part of the job.

# Keep dust under control - safety and productivity

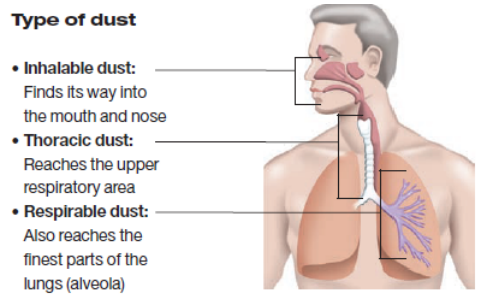
**The Problem/Challenge**
Dust is generated by many of the processes carried out in the construction industry such as cutting, grinding, chasing or breaking. Airborne dust results in serious health and safety and environmental risks, and can also reduce the lifetime of power tools and consumables which effects productivity and creates higher costs.

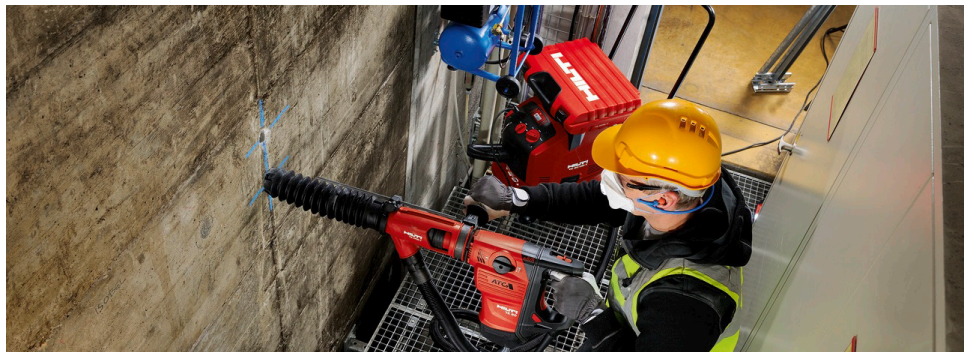
**The Risks**
Airborne dust has considerable effect on a person's health and may lead to serious medical disorders. Dust also results in
Environmental risks to people, wild plants, agriculture and crops that have frequent exposure to the source of dust.

**The Solution**
Tools with Dust Removal Systems (DRS) allow the removal of dust at its source and to be collected by the vacuum removal system. These dusts must be disposed of at special plants which recycle them into other products, not just discharged into waste recycling or landfill sites.

**The Benefits**
Reduce health and safety and environmental risks, whilst improving productivity by protecting the motors and tools for optimal energy efficiency and a useful life.

**Key Points**
The components of dust removal systems (DRS), including power tools, drill bits,discs, blades or other accessories, should be a fully integrated systems to maximisethe amount of dust removed at its source and collected by the vacuum removal system.



# Asbestos (www.safetyindesign.org.uk)

**The Problem**

If disturbed, asbestos can be a very harmful material. Designers are in an ideal position to help manage the hazards associated with it – making the construction site a safer place to be.

Asbestos is a dangerous material with the potential to cause very serious health problems for those who come into contact with it.

Although the use of asbestos is now completely prohibited in the UK, it was used extensively in the construction industry throughout the 20th century. As a result, there is a risk that construction workers will be exposed to high levels of asbestos during renovation or refurbishment projects, if the right precautions are not taken.

To guard against the risks associated with asbestos, there is now a set of regulations that strictly controls how people work with asbestos-containing materials (ACMs).These are the Control of Asbestos Regulations 2012, which bring together all previous sets of Regulations.

**Hazards associated with asbestos**

If ACMs are disturbed, asbestos fibres are released into the air. If these fibres are inhaled they may become trapped in the lungs and remain there for many years. This, in turn, may lead to asbestosis, mesothelioma, or certain types of lung cancer – all diseases for which there is no cure.

**Identifying an asbestos risk**

Before asbestos was completely banned in 1999, it was commonly used in construction projects. Designers should bear in mind that, if a structure was completed before the mid-1980s, it is likely to pose an asbestos risk. This will be relevant to any project that involves the demolition, renovation or refurbishment of such buildings or structures.

It is the client's duty to provide contractors with information that will help them manage asbestos. Designers should advise clients of this duty, and of the need to establish the location of any ACMs prior to the commencement of any work on the fabric of the building.This is where the asbestos report comes in.

**Asbestos survey reports**

An asbestos survey report should confirm the exact location of any asbestos or ACMs, their physical state and the approximate quantities to be removed or retained. If any area could not be accessed for surveying, this should also be stated in the report.

**Helping to manage the asbestos risk**

Although it is the contractor's responsibility to ensure the safe handling of asbestos on site, designers have an important role to play in the management of this material.If an asbestos report confirms the presence of asbestos, you should alert the contractor to this. As a minimum, you should provide the contractor with the following information:

•Any asbestos reports

•A physical description of the work area – for example the number of:

– Windows and doors

– Other ventilation points

– Penetrations in the fabric of the work area (for pipes, ducts, lift shafts)

• Approximate quantities of ACMs to be retained or removed

•The physical state of the ACMs – for instance, are they completely intact or badly degraded?

• A schedule for turning off ventilation systems, if they have to be left active while work is being carried out

• The location of the nearest licensed dump, if known.

If ACMs are identified on a site, they may either be retained or removed. If the asbestos report indicates that ACMs are in a degenerated state, designers should seek expert advice before making a decision to retain them. In either case, you should ensure that all exposure to asbestos is kept to a minimum.

# Asbestos (www.safetyindesign.org.uk)

**Where ACMS are to be retained**
The best way to deal with asbestos is to leave it undisturbed.

**Covering asbestos**
If existing protective coatings are degraded or damaged, you should specify a new protective barrier. For example, asbestos-containing floor tiles could be left in situ and covered with overlay, or additional protection could be added to existing insulation. In such cases, the asbestos should be covered at the very earliest opportunity.
You should also keep a full record of the location of ACMs in both the asbestos register and the health and safety file.

**Working near asbestos**
If a design requires operations to be carried out close to an ACM, and this is likely to increase the risk of disturbing it, you should consider an alternative specification.

**Working on asbestos**
Designers should also avoid specifying the application of any aggressive process – such as cutting, hammering, sanding or drilling – to an ACM. This is because such processes may cause the ACM to break, disintegrate, crumble or turn to dust, and allow asbestos fibres to become airborne.

**Where ACMs are to be removed**
Asbestos removal should only be carried out by a licensed asbestos-removal expert.
Any restrictions that apply to the site, such as restrictions on transportation routes, should be communicated to the contractor.

To prevent the spread of asbestos, the contractor should also be informed of any ventilation systems that cannot be shut off during the removal process.
After the build, employers have an obligation to assess all non-domestic buildings for asbestos.
The position and condition of any ACMs must be recorded, and a plan put in place to manage them safely. This information must be made available to anyone who may need it, such as the occupants of the building, contractors, and anyone else who may need to work on the structure.

**Where asbestos may be found**
(Note: this list is not exhaustive, and is intended only as a general guide)
Asbestos, or ACMs, have been found in the following:

- Slates and roof sheeting
- Some cement pipes
- Cement wallboard
- Asphalt floor tiles
- Vinyl floor tiles and sheets, and wall coverings
- Construction mastics
- Acoustic plasters and some decorative plasters
- some textured paints and coatings
- Some ceiling tiles
- Some fireproofing materials
- Thermal taping compounds
- Some packing-out materials – especially where services and other pipework penetrate the building fabric
- High temperature gaskets
- Fire curtains
- Elevator equipment panels and brake shoes
- HVAC dust insulation
- Thermal insulation, as follows:
  – Insulation to boilers and pipes
  – Spray-applied insulation
  – Blown-in insulation
  – Insulation to electric wiring
  – Breaching insulation
  – Insulation to some industrial chimneys
- Flexible connections in service runs – especially hot runs
- Cooling-tower channels
- Chalkboards
- Roofing shingles and felts
- Base flashing
- Thermal paper products
- Fire doors
- Caulking putties
- Some industrial adhesives
- control of Asbestos Regulation 2012. These regulations consolidated the 2006 regulations by including related EU requirements for …
- … Largely the same

# Asbestos removal by HSE licensed contractor

Asbestos is present in many buildings built before 1990 and will continue to need to be removed or controlled on construction projects.

Only asbestos removal contractors and laboratories with the necessary HSE licence, experience and training are to be used on projects.

• Notifications must be in place for all asbestos removal.
• A suitable specific plan/method statement must be in place, outlining the method of work and any health and safety issues raised by the initial assessment;
• Facilities provided by the asbestos removal contractor must be suitable and must not obstruct any general access/egress. This applies particularly to the enclosure, the hygiene facility and air ducting.
• Before work starts, the enclosure within which the asbestos removal contractor is to work, must not permit any escape of asbestos fibre into the atmosphere. PC must witness the smoke test being carried out. The enclosure must include a viewing panel.

A maintenance / inspection schedule must be in place for the enclosure and any air extraction equipment.

• Asbestos must not escape into the atmosphere during the asbestos stripping operation.
• An adequate personnel decontamination procedure must be in place so that asbestos is not released from personnel transiting to and from the workplace.
• The area being stripped must be clean, both visually and with the supporting air sampling results provided to SCL.
• Removal of the enclosure must not give rise to the release of asbestos fibre; (Air monitoring must be carried out)
• The storage of the asbestos on site must not give rise to asbestos fibre release and all asbestos must be effectively removed being double bagged and in locked skips.
• The works must be overseen by a nonworking Supervisor/Manager with sufficient experience to ensure that all requirements are complied with and to ensure that any other matters of good practice are implemented.


# Prevent exposure to silica dust

Where designers cannot design out cutting, drilling or chasing the PC should be made aware of the extent and put proactive site measures in place.

Risk assessments must adequately assess the exposure of a person to silica dust.  In cases when it is reasonable to expect dust levels to be significant, atmospheric sampling will be required.

As a general rule levels greater than 0.1mg/m3 can be regarded as significant and will require monitoring.

Risk Assessments must be set out in detail the manner in which the control measures are to be monitored, supervised and maintained.
First of all, try to eliminate silica dust from the work altogether, i.e. use a block splitter instead of a cut off saw to cut blocks. If silica cannot be eliminated, exposure must be minimised.

- Respirable silica dust release must be controlled using dust suppression techniques, local exhaust ventilation, or totally enclose the work area.
- Stone cutting abrasive wheels must be fitted with a water suppression system.
- Respiratory protective equipment must also be worn in addition to any suppression technique. For the dustiest processes, positive pressure or airline breathing apparatus must be utilised.
- Correct RPE (minimum level is FFP2) must be worn. Refer to Eye, Ear, Respiratory Protection
- All users must be trained, face fit tested, and checked by activity supervisors.
- Segregation / Zoning / Signage must be displayed as per Hazard exclusion.

# Masonry cutting - Avoiding by design

**The Problem/Challenge**
Cutting and blocks, paviours or tiles on site due to setting out or design detailing decisions eg. Notching concrete blocks into the web of a steel column for a smooth cavity face.

**The Risks**
Creation of silica dust which affects operatives, other workers and the public. Silicosis is an increasingly common disease.

**The Solution**
Early identification of the issues to the team to avoid the need to cut, grind or smooth where possible. Analysis of the alternative processes possible to achieve the same result.

**The Benefits**
Cutting and grinding operations are slow and not cost effective. Minimize cutting of paviours, tiles, slabs etc. by setting out accurately on drawings. Where unavoidable use of safe cutting and grinding equipment and wet methods or vacuum dust hoods essential.

**Key Points**
Review the detail design, equipment and access issues with contractor as early as possible. Cost benefits may be possible as well as safety benefits. If the details is essential off site and controlled cutting is recommended.

**Avoid unnecessary or excessive cutting**

**Avoid "Notched" block details**

# Lead Paint - www.safetyindesign.org.uK (P.1)

Lead can seriously damage human health, whether it is ingested or inhaled. Exposure can result in a range of symptoms, such as nausea, headaches, kidney damage or problems with the nervous system and brain. If an unborn child is exposed to lead, it can result in a still birth.
This issue is serious enough to warrant its own set of regulations, known as the Control of Lead at Work Regulations 2002 (CLAW 2002). While designers do not specify lead in projects now, its use was sufficiently widespread in the past to make it a significant hazard when working on existing structures.
That means designers should be aware of the dangers associated with lead-based paint. They should consider the aspects of a project where the risk of exposure to lead is high, and be certain to minimise the hazard.

**Gathering and sharing information**
Strict controls have governed the marketing and use of lead-based paint since 1992, so it is unlikely to feature in a construction project. If you are designing for works on any structure built before this time, however, you should keep in mind the high likelihood that lead-based paint surfaces will be present.

**Lead surveys**
Information is of uppermost importance during such projects. Designers and contractors need to be aware of the location and extent of lead-based paint on any demolition, renovation or refurbishment. That way, they can ensure the project proceeds in a fashion that minimises the hazards associated with lead poisoning.
As it happens, clients have a statutory duty to advise designers and contractors about the whereabouts of lead-based paint prior to the commencement of a project. You should therefore advise clients to conduct a lead survey prior to the start of any work on the fabric of the building.
A lead survey should indicate the exact location of lead-based paint surfaces, as well as the lead content of those surfaces and details of any areas that could not be accessed for surveying.The findings of this survey should be communicated to contractors, and inform your approach to the design.

**Sharing information**
Once a lead survey has been carried out, designers are able to provide contractors with the information needed to minimise the risk of exposure. At the very least, you should:
• Describe the work area, including full details of the amount of lead-based paint present. You should also state the number of doors/windows, the number of other ventilation points, and the number of other penetrations (e.g. ducts or pipes) in the fabric of the work area
• Estimate the areas of lead-based paint to be removed and/or retained
• Analyse the physical condition of the lead-based paint. You should clearly state whether it is badly degraded and likely to become airborne, or completely intact
• Develop a schedule for turning off ventilation systems if they have to be left active while the work takes place
• Locate the nearest licensed dump

**Leaving lead-based paint undisturbed**
This is the most effective way to eliminate the risks associated with lead-based paint, as it reduces the chances of harmful lead particles being inhaled or ingested. If a lead survey indicates that lead-based paint surfaces are in a degenerated state, you should refer to an expert before making a decision about their retention. Covering lead-based paint surfaces. If it is possible to retain a lead-based paint surface, the most effective ways of protecting it are:
• Using an overcoat of modern paint to seal it, or
• Applying a panel or wallpaper covering
If your design adopts either of these approaches, you should ensure that the lead-based paint surface is covered as early as possible in the works schedule. You should also keep a full record of its location in the health and safety file.
If a lead-based paint surface is already covered, you should ensure that it continues to have sufficient protection. If the coating is degraded or damaged, a new one should be specified. It should be installed at the earliest opportunity, and a record kept in the health and safety plan and file.

# Lead Paint - www.safetyindesign.org.uK (P.1)

**Working near lead-based paint**

If a design requires contractors to carry out activities near to lead-based paint surfaces, this may increase the risk of the surfaces being damaged. If this happens, lead particles may become airborne or product harmful fumes. So, where this elevated risk exists, you should consider alternatives.

# Lead Paint - www.safetyindesign.org.uK (P.2)

**Working on lead-based paint surfaces**

Where a design requires contractors to work on a lead-based paint surface, there should be no risk of the surface, or its protective barrier, sustaining damage. This rules out aggressive operations to the surface, such as:

- Cutting
- Sanding
- Hammering
- Drilling
- Burning

**Removing lead-based paint**

If lead-based paint is to be removed because it is too damaged to be retained, the contractor should be given full information about its location, condition and scope. Only specialist contractors should be used for the removal of lead-based paint from a work area.

Designers should advise contractors in advance of any restrictions that apply to the site, such as restrictions on transportation routes. You should also provide information about other features of the site that will have an impact upon the work. For example, contractors need to be made aware of any ventilation systems that cannot be shut off while the removal work takes place.

**Keeping records**

The position and condition of all lead-based paint present on a site must be recorded for future reference, and plans must be put into place to manage it safely. This information should be made available to anyone who needs it, including occupants, contractors, maintenance staff, and anyone else who needs to work on the structure in the future.

Lead-based paint poses an ongoing hazard to anyone working on buildings that pre-date the restrictions imposed on its use. By following the advice in this Guide, designers can play a part in reducing the risks associated with lead poisoning, and protecting both the workforce and the general public from unnecessary exposure to potential harm.

**Where you'll find lead-based paints**

Paint containing lead pigments was widely used in domestic and industrial projects until the 1960s. On buildings constructed prior to the mid-1980s, lead-based paint can commonly be found on:

- Windows, doors and interior woodwork in domestic structures
- Exterior woodwork
- Iron and galvanised metalwork, including radiators, railings and structural steelwork
- Other surfaces that are covered by oil-based paint

Taking a lead on lead at work

CLAW 2002 places a duty on employers not to carry out work that exposes employees to lead, or a substance or material containing lead, without fulfilling certain requirements. The duty extends, so far as is reasonable practicable, to any other person who might be affected by such work.

This list includes:

- Another worker (including those employed by another employer) not engaged in work with lead, such as maintenance staff and cleaners
- Visitors to the work site
- Users of the structure who may be exposed to residual dust or, if not properly segregated from the work, to fumes and dust generated during work with lead-based paint
- Families of those who are exposed to lead at work, and who may be affected by the unintentional carrying-home of lead on clothing and footwear.

# Lead Paint - www.safetyindesign.org.uK (P.2)

New technology
Technological advances have made the identification and removal of lead-based paint easier.
Portable XRF (X-Ray Fluorescent) lead paint analysis enables comprehensive surveying. This method has been assessed by the Health and Safety Executive as highly accurate.
Use of infrared (IR) technology is an effective means of removing lead-based paint, and avoids the production of hazardous fumes and dust.

Useful resources
www.LiPSA.org Lead in Paint Safety Association
The Control of Lead at Work Regulations 2002

# Inhalable and respirable dust and fumes

All dust an fumes have the potential to damage the human body by normal breathing and inhalation. Minimisation of such products should be
attempted by the design team but where impossible the following measures should be adopted by the PC's.

• All work activities which generate dust or fumes must have adequate suppression measures in place

• Inhalable dust is defined as airborne material which is capable of entering the nose and mouth during breathing

• Respirable dust means very fine airborne material which is capable of penetrating to the deepest part of the lung.

• All wood dust (including dust from composites like chipboards, MDF and fibre boards etc.) is hazardous to health: it can affect the nose, the respiratory system (and lungs) and the skin.

• Dust respirators will give no protection at all against gases and vapours (e.g. from paint spraying).

• Dust respirators filter the air breathed by the wearer to make it safe to breathe. They are not suitable for use where the amount of oxygen in the air may be low, such as in confined space working which will require breathing apparatus, which provides air from an independent source such as a cylinder.

When work activities are carried out, where dust or fume is likely to be generated, specific control measures and protective clothing/equipment must be used. These precautions should be selected with advice from specialist contractors, manufacturers, and COSHH assessments.
Points to consider include;

- Type of material
- Work to be carried out
- Area to be worked in
- Period of exposure
- Position of worker i.e. bending down

In some cases, there will be a need for atmospheric sampling of respirable dust and fume. Results of this monitoring will assist in determining the degree of control measures required.

Following the assessment, detailed precautions must be established, and must include:
- The control measures

# Inhalable and respirable dust and fumes

The monitoring arrangements
• The supervision
• The maintenance arrangements

When considering the control measures the following hierarchy of controls must be considered:
• Designing out at the planning stage, the need for scabbling, drilling or high speed cutting of materials
• The use of respiratory protective equipment (RPE) as a last resort only
• Use of debris netting, hoarding, sheeting etc.
• All types of RPE restrict the wearer to some extent by making it more difficult to breathe and reducing visibility. This is why it is important to control exposure by other means such as extraction.
• Engineering controls such as LEV will protect everyone in the workplace - a respirator will only protect the person who wears it.
• Controlling dust or fume by using local exhaust ventilation (LEV) at the point of work.

The use of respiratory protective equipment (RPE) as a last resort only
• Use of debris netting, hoarding, sheeting etc.
• All types of RPE restrict the wearer to some extent by making it more difficult to breathe and reducing visibility. This is why it is important to control exposure by other means such as extraction.
• Engineering controls such as LEV will protect everyone in the workplace - a respirator will only protect the person who wears it.


# Excessive Noise and Hearing Damage - Design to Avoid

**The Problem/Challenge**
Noisy site operations which cannot be avoided by design omission or given a protective enclosure.

**The Risks**
Permanent future hearing damage to operatives and others in proximity.

**The Solution**
Avoidance of excessively noisy activities especially in confined reverberant spaces, in combination with the provision of the correct type of ear defenders where the work is necessary, and alternative procedure impossible. These works are usually associated with but not exclusively breaking out concrete or screeds or cutting steelwork, etc. Automated remote controlled breakers may increasingly become available or sound insulated cabs.

**The Benefits**
Minimal future hearing problems to all. Morale in the workforce is improved with better working conditions and audio-environment. Creates a more efficient and therefore better economic environment for all.

**Key Points**
Review the procedures and equipment selection, noise production and ear protection issues with contractor as early as possible.


# Noise/ Dust/ Emissions

Designers should be aware of these issues but can only have a limited influence on their control by minimising noisy, dusty and fume emitting processes:
PC: - to carry out regular road sweeping, manual sweeping, scraping and jet washing to remove excess build-up of materials on site and public roads.
• Damp down.
• Clean the wheels of vehicles leaving the site so that mud is not spread onto the highways.
• Obtain consent from the regulator for the use of mobile plant for crushing materials such as bricks, tiles and concrete and locate away from sensitive receptors.
On cutters and saws, use equipment and techniques such as dust extractors to minimise dust.
• Consider a wet cutting saw or use vacuum extraction or block splitters.
• Take account of the wind conditions when arranging activities that are likely to emit aerosols, fumes and odours.
• Ensure vehicles and plant used on site are well maintained and regularly serviced.
• Make sure that engines are switched off when they are not in use. Change the working method to use equipment or modes of operation that produce less noise.
• Where possible, place sources of noise away from sensitive receptors.
• Consider placing screens close to sensitive receptors but not parallel to nearby walls (1 m above the highest sight line).
• Adopt working hours to restrict noisy activities to less sensitive periods of the day.
• Arrange delivery times to suit the area – daytime for residential areas, perhaps night time for commercial inner city areas.
• Route construction vehicles to take account of the need to reduce noise and vibration.
• Keep haul roads well maintained.
• Undertake noise monitoring.
• Change the working method to use equipment or modes of operation that produce less vibration, for example: breaking out concrete, where practicable, should be undertaken using equipment that breaks by bending rather than by percussion.
• Undertake vibration activities as far away as possible from sensitive receptors.
• Adopt working hours to restrict high vibration generating activities to less sensitive periods of the day.
• Suitable anti-vibration mountings should be fitted where practicable to rotating and/or impacting equipment.
• Consider using rubber linings on tippers in sensitive sites.

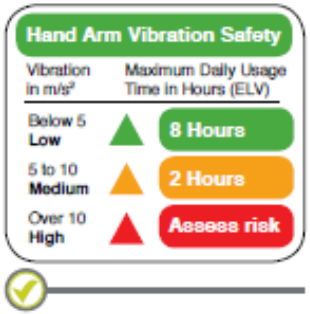
# Hand arm vibration syndrome (HAVS)

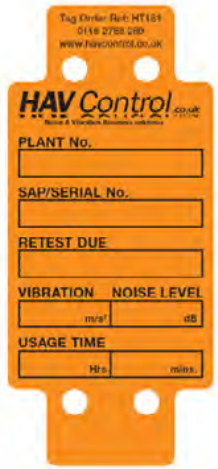
Concrete, breaking, screed removals and other sile activities cannot always be designed out by the design team, so the PC needs to put in place the following control methods:-
Hand arm vibration is vibration transmitted into the hands and arms from the use hand of held powered work equipment.

Too much exposure to vibration can cause HAVS and carpal tunnel syndrome. The symptoms include;
- Tingling and numbness in the fingers (which can cause sleep disturbance).
- Not being able to feel things with the tips of the fingers.
- Loss of strength in the hands (less able to pick up or hold heavy objects).
- In the cold and wet, the tips of the fingers going white then red and being painful on recovery (vibration white finger).
- Long term exposure can result in permanent disability.
- Managers and supervisors must check tool users regularly for any symptoms.
- Long term exposure can result in permanent disability.
- Managers and supervisors must check tool users regularly for any symptoms.

If any work is being carried out that involves excessive use of vibrating tools or plant that could contribute to the symptoms of Hand
Arm Vibration, employers must;

- Identify employees at risk from HAVS.
- Make a valid estimate of their exposures, compared with the Action Value and Limit Value.
- Identify the need for immediate action if the Limit Value is exceeded.
- Consider the available and appropriate options for controlling risk.
- Produce an action plan for control and arrangements to monitor progress against the action plan.
- Make arrangements for periodic review of the assessment.
- Reduce exposure to a minimum by using alternative tools or processes to avoid exposure.
- Provide information and training on the risks and their control.
- Provide appropriate health surveillance when exposure reaches the exposure action value:
- Exposure action value (EAV) of 2.5 m/s2 A(8) or 100 exposure points.
- Exposure limit value (ELV) of 5 m/s2 A (8). Or 400 exposure points.



# Hand arm vibration syndrome (HAVS)

Excessive hand trimming of piles must be avoided. Pile croppers or debonding sleeve techniques should be utilised.

• The use of technologies such as remotely operated machinery must be utilised to reduce the potential exposure of personnel to vibration.
• The use of paint-on retarders and power jetting to avoid scabbling operations must be considered as way of reducing exposure.
• Drill bits and tool points must be kept sharp to reduce vibration.
Sub-Contractors must ensure;
• The use of suitable low vibration tools.
• Operators check tools before using them to make sure they are properly maintained to avoid increased vibration caused by faults or general wear.
• Cutting tools are kept sharp so that they remain efficient.
• Operators avoid gripping or forcing a tool or work piece more than is necessary.
• Tools are stored so that they do not have very cold handles when next used.
• The work pattern/environment is assessed and monitored - it is beneficial to have regular breaks and to keep warm and dry throughout the activity to allow the blood to circulate.
• Correct operative selection- smoking, poor fitness, age, strength and hereditary conditions may increase individual susceptibility to HAVS.

# Fire and Emergency

A construction site fire will seriously affect the programme, quality and completion of any project. Designing out hot works activities can be very beneficial however if not look out for:-

CAUTION
HOT WORKS AREA!! PERMIT REQUIRED

All precautions reflected in the PTW (permit to work) must be in place and checked by a subcontractor supervisor or manager before work starts.

- Correct PPE is worn.

- Suitable extinguishers are at hand.

- A careful watch maintained for fire during the work activity.

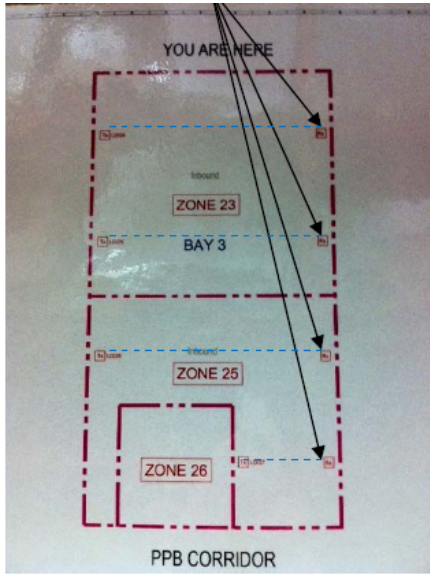
- Monitoring the hot work area thoroughly for some time after the work has finished (typically this will be at least an hour).

- Gas must be stored in lockable cages, in minimal amounts outside of the building.

# Fire and smoke beam detection installation

Design engineers are now recommending the use of self-aligning beam detection to detect smoke in large areas such as warehousing. Traditional beam detection is mounted at high level and requires accessing at regular intervals to manually check for alignment and for signs of dirt contamination.

By utilising motors within the beam head the self-aligned fire beam can make servicing and commissioning a safer procedure. Its method of using stepper motors allows it to make minute adjustments of just 1/40 of 1 degree to the beam head. This is automatically controlled software which finds and continually monitors for optimum performance. The beams condition is then displayed at a ground level remote display.




Detection Layout of 2 bays
in large warehouse

- Negates the previous requirement for regular high level access.
- The beam only requires accessing when the lens becomes contaminated.
- Depending on the environment this makes the use of high level access a rare occurrence.

Ground level remote display

Ground level remote display

# Emergency Exit Routes and Lighting- during construction

Escape routes must be established from all areas of the site, regardless of the stage of construction. Designers should consider this in refurbishment and new build projects, and when inspecting site.

- A minimum of 2 fire exit signs should be visible at all times, except in small dead ends. The green fire exit signs to indicate routes of travel.
- Emergency lighting is required in all escape routes to aid escape (including stairwells).
- Emergency lighting should be checked, visually and tested weekly by PC.
- Fire exit routes must be kept clear from obstructions and must lead to a place of safety
- Fire exit doors, even temporary ones, must not be wedged open.
- All fire exit doors from accommodation or within the building under construction must open outwards, with push bars, these must not be locked when the building is occupied.
- The site layout drawing must identify 'Fire Points' / Escape Routes and Muster Points as a minimum and be marked with the last
revision date and location of the Fire Point in relation to the escape route.
- The appropriate means of raising an alarm must be provided for all areas of the site and the stage of the project. e.g...

**Smaller open site (Minimal Construction)**
Air horns or stand-alone fire alarms.
**Partially enclosed building or site**
Wireless or hard wired linked alarm system to a central call point
**Fully enclosed site (including refurbishment)**
Hard wired/linked system linked to a central panel in project office or security cabin.



# Ensuring correct firestop for pipe penetration

**The Problem/Challenge**
Firestop products around services of pipes are often installed to prevent the fire to spread through different fire-rated compartments but their efficiency highly depends not only on their performance, which can be assessed through the relevant approvals, but also on the quality of the installation during the contraction process. It is preferable to install during concrete slat pouring rather than afterwards, which can require additional drilling and associated risks.

**The Risks**
A proper firestop system needs to prevent the fire from spreading through the building in order to save assets and ultimately the lives of the occupants. It also reduces dust, noise or vibration and associated contamination if controlled retrospectively by Dionard or other drilling techniques.

**The Solution**
Removing any liability from a poor instalation and ensuring a good performance for the exact pipe selected to be used.Using Pre-formed firestop solutions which have been tested using the real conditions found on a construction site.

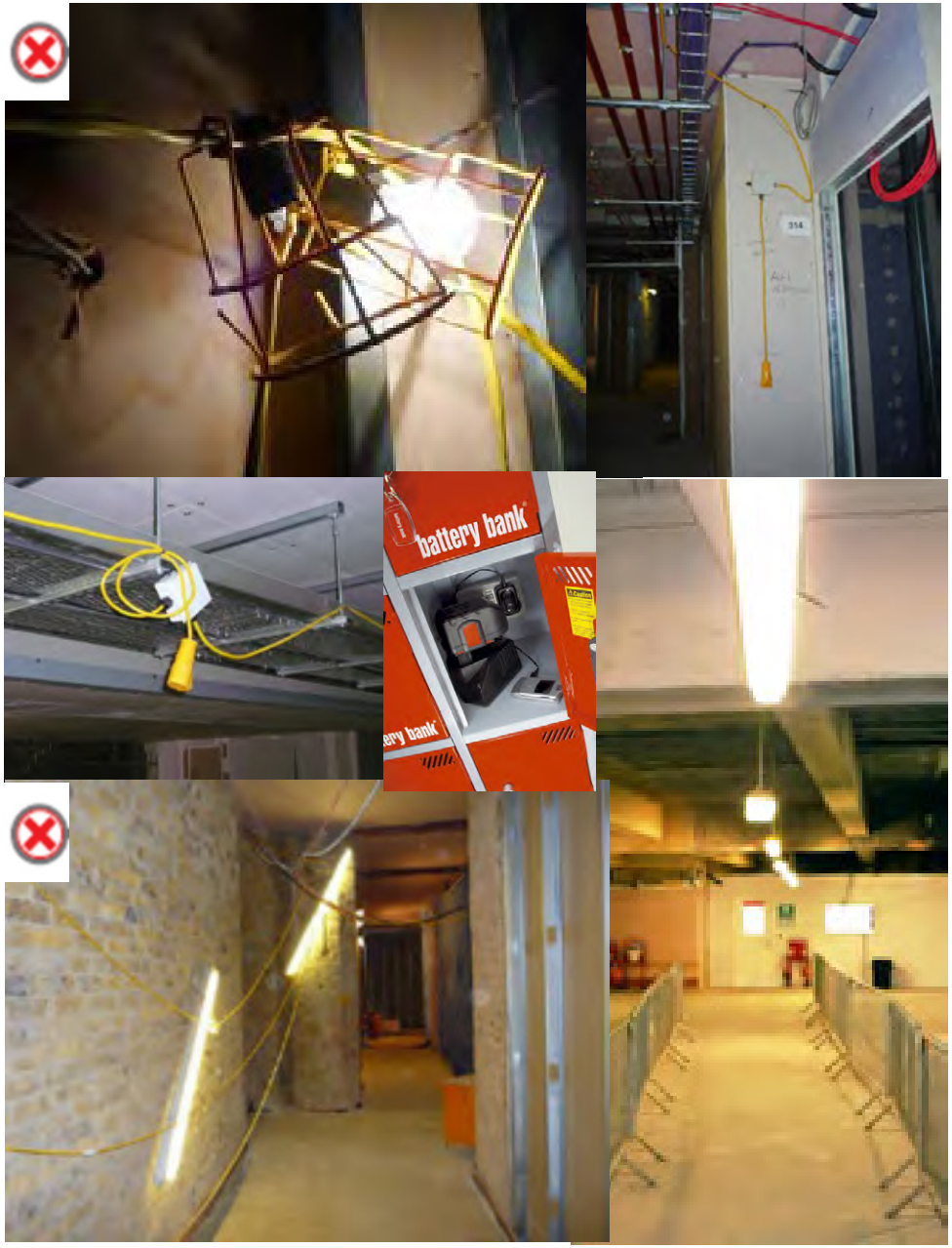
**The Benefits**
Increasing the fire safety of buildings and their occupants, while also saving timenand cost in the installation process.

**Key Points**
The coordination between designers, contractors and trades within the project can reduce the overall installation time for pipe penetrations, increasing the overall efficiency and ultimately the safety of the building, users and constructors.


# Temporary site ligting

The quality and programme implications of Temporary Lighting is important to designers as well as the safety implications. When on site consider: -

• Lights must be fixed so that the supply cable is not required to bear any weight. Festoon lighting is not permitted.
• All lamps must be in waterproof lampholders and protected by guards or shades with all cabling suspended above.
• Task lighting at the work point is usually provided by Sub-contractors but PC should facilitate this.
• Luminaires must be placed so that no-one is required to work in their own shadow and that the local light for one person is not a source of glare for another.
• Lighting can only be moved by qualified electricians with permission from PC.
• Temporary Electric Scheme should allow sufficient transformer positions for work areas and transformers are not placed near to emergency exit points etc.
• Promote the use of cordless tools with subcontractors and PC to provide battery banks in easy to access areas.
• Overhead power connections should be provided along corridors etc. Where possible 1 power point per room along a corridor.



# Hazardous substance protection

Designers have to sometimes specific hazardous materials for special purposes. These must be identified to the PC in specifications, drawings and CDM documentation.

Hazardous substances encountered in the Construction Industry include;
• Chemicals and products containing chemicals.
• Fumes.
• Dusts.
• Vapours.
• Mists.
• Gases and asphyxiating gases.
• Biological agents (germs). If the packaging has any of the hazard symbols then it is classed as a hazardous substance.
• Germs that can be encountered that could cause diseases such as leptospirosis or legionnaires disease.

To ensure adequate levels of control and protection from hazardous substances, Sub-contractors must;

• Plan and operate processes and activities to minimise emission, release and spread of substances hazardous to health.
• Carry out suitable COSHH assessments and provide these to SCL.
• Take into account all relevant routes of exposure – inhalation, skin absorption and ingestion – when developing control measures.
• Control exposure by measures that are proportionate to the health risk.
• Choose the most effective and reliable control options which minimise the escape and spread of substances hazardous to health.
• Provide suitable personal protective equipment where adequate control of exposure cannot be achieved by other means.
• Check and review control measures regularly for their continuing effectiveness.
• Inform and train all employees on the hazards and risks from the substances they work with and the use of control measures in place to minimise the risks.
• Ensure that the introduction of control measures does not increase the overall risk to Health and Safety of any person even those not directly involved with the task.
• PC must maintain a COSHH register.

# HSE Designer Guidance - Slips and Trips Avoidance Strategy

The Problem/Challenge
Clients and designers like prestigious “shiny” entrance hall floors but many accidents happen as a result of slippery floors whether due to wetness or to these highly polished finishes, or a combination of issues.

The Risks
Potentially severe injuries to all users especially in wet weather conditions.

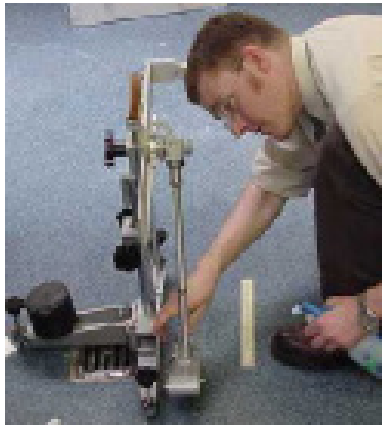
The Solution
Select suitably slip resistant materials and finishes to give a compromise of visual finish with slip performance requirements. Management solutions such as mopping and warning signage can further minimise the risk. Provide suitable mat-wells.

The Benefits
Impressive entrance halls and other areas can still be designed but are safer to use.

Key Points
Drawings can be annotated early in the design stage until a suitable finish is found.

Slip resistance values of materials to be checked or tested prior to specification. See HSE Slip assessment tool at sat@hsl.gov.uk


Entrance, mat-well,flooring


The pendulum test – with water spray


Managment response

Surface roughness meter

# Gate Safety - Fully Automatic

**Fully Automatic Operation**

This is a gate that is activated by a device (intercom, radio control, etc) and the gate will open and close within a pre determined time.

Design teams, contractors and clients should ensure (sfarp).

That the gate features the necessary safety devices to protect the user and other pedestrians from all potential trap points.

That the gate is operating with the correct force as stated by the regulations (this should be the minimum required to enable the gate to operate).

That the person responsible for the gate has been trained in the safe operation of the gate and its maintenance requirements.

That the control cabinet is housed in a weatherproof enclosure that is lockable.

That pedestrians have an alternative method of entry and exit (wherever possible pedestrians should not use a vehicular gate) giving alternative access in the event of the gate failing.

That there are clearly visible signs advising that the gate is an automated device.

That trained operatives regularly maintain the gate and that full servicing records are kept.

Note: Signs & Symbols are for design guidance


# Working with concrete

Concrete mixing and pouring is a PC responsibility, but PDS and D's need to understand the health risks associated with we concrete when brought into contact with people.
Contact with concrete can cause both dermatitis and burns. Skin affected by dermatitis feels itchy and sore, and looks red, scaly and cracked.
Cement is capable of causing dermatitis by two mechanisms - irritancy and allergy.

• Wet cement can cause burns if wet cement becomes trapped against the skin, for example by kneeling in it or if cement falls into a boot or glove, a serious burn or ulcer can rapidly develop.
• All operatives must wear a full type suit or suitable coveralls to protect skin when working with concrete.
• Operatives must wear wellingtons under the suit. Trouser bottoms to be either taped to the wellingtons or ensure the bottoms of the trousers are tightly fitted (elasticated) to prevent concrete contamination.
• No wet clothing is to be worn and there should be no exposed skin.
• Operatives must not kneel in concrete.
• Clean drinking water must be available at the workface and clearly marked as such in order to wash off any splashes etc.
• All personnel placing concrete must wear the correct type of gloves to prevent absorption of wet concrete.
• All personnel must wear correct eye protection to prevent splashes entering the eye.
• All personnel must be aware of thehealth effects of concrete burns.

# Hazard Exclusion Zones

If hazardous activities cannot be designed out the PC should put in place exclusion zones to keep all persons on or near the site out of the relevant area. Hazard exclusion zones must be in place to separate the workforce from particular risks associated with certain activities, including;

- Demolition works including use of explosives.
- Removal of asbestos or use of harmful substances.
- Excavation.
- Plant movement.
- Piling.
- Mechanical lifting.
- Core drilling/cutting/sawing/bursting.
- Post tensioning or stressing.
- Raised access floor installation.

Use of specialist equipment, i.e. pipe threading machines.

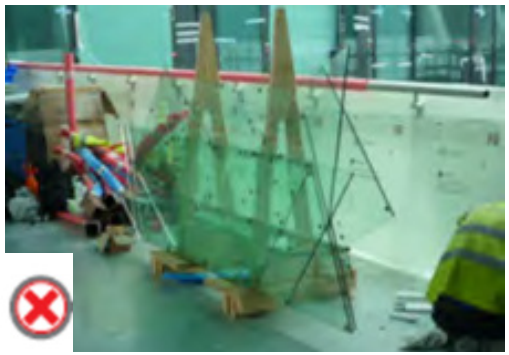
- Scaffolding (including dismantling).
- RC Frame Construction
- Rigging and de-rigging of plant/hoists etc.
- High pressure jetting
- Works creating noise/dust.
- MEWPS.
- Any activity where there is potential for material to fall from a height as that material cannot be effectively prevented from falling by a safe system of work will require an exclusion zone to be created eg rope access operations.


# Material storage and stacking on site

Poor storage and stacking of materials on site indicate poor construction techniques and poor safety, both of which can result in accidents and a poor quality of construction.

Project designers should look for:-

- Designated contractor storage areas must be agreed by project team for plant, materials, waste, flammable substances etc.
- Do not allow storage areas to ‘spread’ on to footpaths and other walkways.
- No storage of materials where they obstruct access routes or where they could interfere with emergency escape routes.
- All storage areas must be tidy, whether in the main compound or on the site itself.
- Measures must be in place to prevent accidental and/or weather damage to materials. No palletised material such as plasterboard or bricks etc. to be stacked more than 2 packs high. Flammable materials must be stored away from other materials and protected from accidental ignition.
- The use of cardboard packing on sites should be minimised due to fire risk, where possible
- No storage of materials on top of containers.
- Fragile material (such as glass on stillages) must be fully banded/protected at all times until the point of installation.
- Deliveries must be planned to keep the amount of materials on site to a minimum. Stillages must be maintained in good condition for stacking purposes.
- Sheet material must not be stacked vertically where it could topple or be knocked over.



# Site infrastructure -Temporary power and water

Insufficient power and water on site can inhibit good construction and should be readily available. Client and design team can help to facilitate this, but contractor to control appropriately.

Electrical Power
All temporary electrics schemes must be designed and installed by a competent electrical contractor with layout drawings available.
• The position and routing of temporary electrical cables must be planned to ensure they are not routed along the floor or across vehicle routes.
• All cables must be visibly marked as live with signage or marker tape.
• Ensure that an electricity meter is installed to monitor project energy usage.
There must be an adequate supply of transformers in each work area to reduce trailing leads and power drop off.

Mains water supplies to sites must be tested and chlorinated as part of the establishment of welfare facilities.
• A water meter is required to monitor project usage
• There must be a supply of drinking water
• Bib taps must be established in fixed positions e.g. through risers and positioned where they are easily accessible and cannot be damaged.
Hydrants must be clearly marked on site plans.
• It must be possible to isolate the water supply outside the building or on the ground floor so the supply can be turned off at the end of each working day.

Water must be cleared from open floors and walkways to prevent slips, trip or falls.


# Proprietary mobile scaffold towers e.g. BETA GUARD

**Main advantages (over traditional mobile tower scaffolds)**

- Simpler to erect as there are no horizontal and diagonal braces.
- Main components are significantly reduced which means less chance of loss on site
- Very quick to erect – 2 men took less than 5 minutes to erect a two tier platform.
- Safer to erect (and dismantle) as advance guardrails are in place before the platform.
- Ergonomically better to erect as stretching to put components in place from a safe position is not required with this system.

**Disadvantages**

- Initial cost outlay (glut of traditional towers in circulation)

**Designer benefits**

Knowledge of the versatility speed of erection and usability of such scaffold towers allows consideration for use in access to architectural features without ladders of MEWP's. Size and scale of towers and ground loading criteria is to be considered.

# Concrete construction design - reducing health risks

**The Problem/Challenge**

On a landmark concrete frame building, traditional construction methods called for the construction joints to be prepared to expose the coarse aggregate. This would ensure that the shear resistance and water tightness of the joint was as close as possible to that of unjointed concrete. The design team were concerned to address the health hazards associated with the various methods of joint preparation:

- **Scabbling** – the use of a hand-held power tool to roughen the joint surface. This can be hazardous to carry out due to HAVS, noise, dust and can damage sound concrete behind the joint.
- **Water jetting** – the use of a pressurised jet to remove the surface of the joint. This can be messy to undertake and there is a danger of excessively eroding green concrete, or alternatively that it can be difficult to prepare the joint adequately on older concrete.
- **Brushing/washing** – the concrete is brushed while sill green, and washed to expose the aggregate. Time is crucial.
- **Retarder/washing** – a retarder is applied to the joint surface (horizontal) or the stop end (vertical) to prevent setting of the concrete surface, which is subsequently washed off. There is a risk of getting retarder on the surfaces where it is not wanted.
- **Expanded metal** – vertical stops ends are formed with expanded metal, which provides a key for the next pour. It can be difficult to ensure that loss of fines through the expanded metal does not cause voids in the concrete behind it.

**The Risks**

Irrespective of the method used, health risks existed, including Hand Arm Vibration Syndrome. If necessary joint preparation work could be omitted, then exposure would be reduced.

**The Solution**

The consulting engineers were asked to identify whether there were construction joints for which the need to expose the coarse aggregate could be omitted. Engineering judgement was applied and it was agreed that aggregate exposure was only needed in the basement slab, four key walls, all beams and one area of superstructure slab propping the retaining walls around service risers (ie. Where it was required for sheer transfer). This was communicated to the contractor with the drawings.

**The Benefits**

- There was a considerable reduction in the number of joints requiring preparation.
- The exposure of operatives to serious health risks was reduced significantly.

**Key Points**

As this was a design and build project, there was good co-operation and communication between the design team and the contractor, concentrating on buildability. This enabled the team to maintain a focus on health as well as safety hazards.

# Design tips for improving piling safety

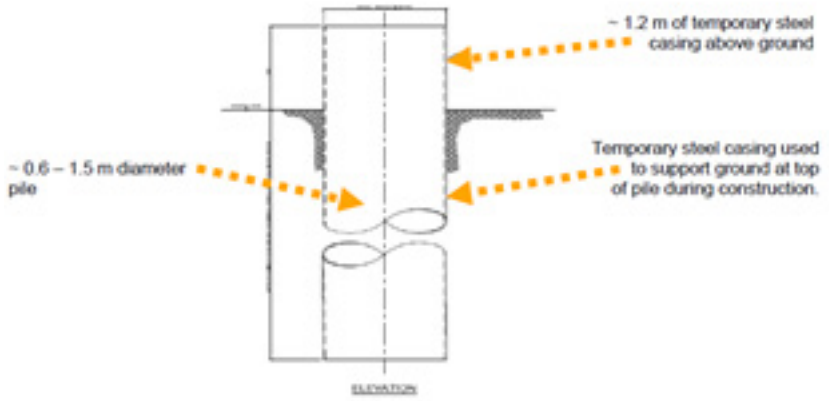
**The Problem/Challenge**
A designer working with a piling contractor recognised that piling techniques can be prone to leaving open shafts in the ground during their construction.

**The Risks**
There was potential for personnel to fall into the shaft.
Piling machinery tracking over the shaft could damage the top of the pile shaft or even become destabilised and overturn.

**The Solution**
When specifying a temporary steel casing for use in the pile construction, a longer casing was selected, leaving ~1.2m to act as a parapet around the top of the open shaft. Once the pile had been formed the steel casing could then be moved to the next pile under construction.

**The Benefits**
The risk of falls down the shaft and overturn of site vehicles was substantially reduced. (Of equal significance, the designer was also aware of the health risks associated with the breaking down of pipe caps by hand. A method of mechanical cropping was selected that minimised the need for hand finishing of the pile.)

**Key Points**
The designer employed by the piling contractor worked closely with the project team to improve the piling methodology. This methodology was then transferred to subsequent sites.




# Precast concrete units - ‘Turning Plate’

Although generally robust, the corners of precast concrete units are vulnerable to damage, particularly when lifting. In order to avoid damage on site, Morgan Sindall’s Engineering Services Team
developed a technique which enables precast units to be lifted without causing damage to the vulnerable nibs.

This was achieved by bolting a removable turning plate (pre-fabricated steel) onto the parapet unit before lifting. The turning plate is quickly and easily re-moved once the unit is vertical. Previously any damage to the nibs would have necessitated either the re-ordering of replacement units, resulting in additional costs and delays or insitu repair at height.

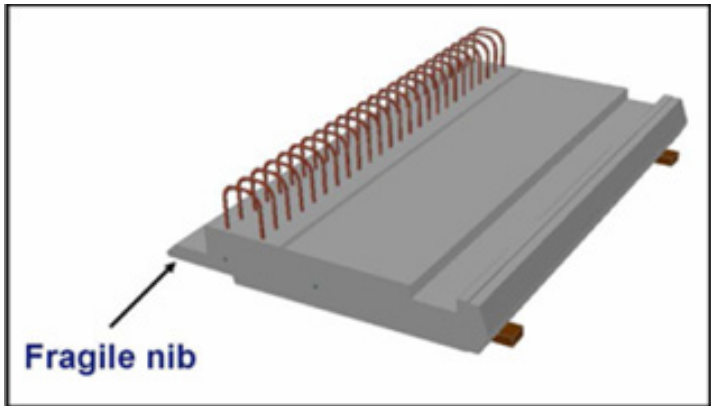
This technique can be replicated to suit a variety of different shapes and sizes of precast units.

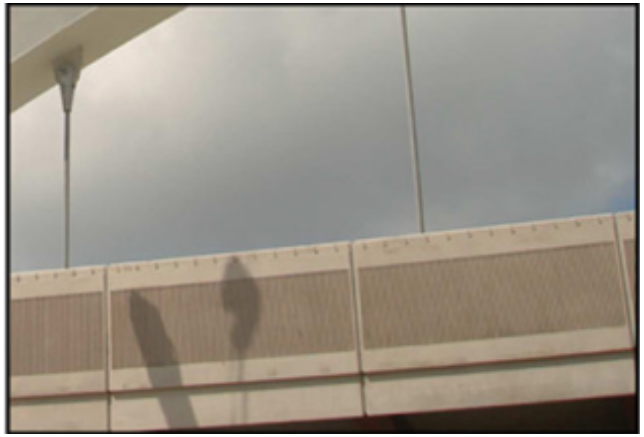
**Key Points**

1. Avoids damaging fragile nibs or precast units.
2. Reduces cost and time of replacing damaged units.
3. Removable and reusable turning plates.
4. Transferrable to a range of vulnerable elements
that require lifting.

Temporary turning plates fitted to a precast panel.

View of a typical precast panel.



Finished panels erected.

# Reinforcing bar - Designing to reduce hazards

**The Problem/Challenge**
A project design team recognised that the installation of cast in-situ concrete could lead to exposed projecting ends of steel reinforcement bars during construction. In particular, the safeguarding of starter bars in vertical elements could be difficult to manage.

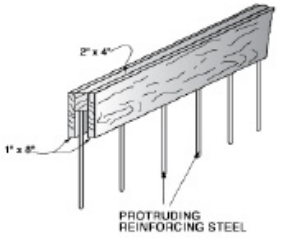
**The Risks**
They were aware of a serious accident involving impalement on another site and concerned about the risk of lacerations from the exposed cut rebar ends.

**The Solution**
There are a number of options available in order to reduce the risks:
1. The use of bent 'bob bars'
• This was an effective solution in that it did not need management control or supervision on site to implement it.
However ,
• This was not always appropriate as in certain locations it had the potential to cause rebar congestion and compromise concrete quality, especially in columns.
• To be successful it needed to be adopted by the designer undertaking the rebar detailing
2. Building inverted timber formwork boxes.
• The effectiveness of this was dependent on the contractor and required active management intervention. The boxes could be re-used for standard sections.
3. Providing plastic 'mushroom' caps
• This was a less effective measure dependent on the contractor maintaining ontrol.
• The caps were known to be prone to falling off and needed regular replacement. Their effectiveness relied upon he contractor keeping the caps up with the pace of work.

**The Benefits**
Effective control of a known but often overlooked hazard during the construction phase was achieved using a combination of control measures. Priority was given to those measures that most effectively dealt with the hazard. Where it was practicable, permanent protection was put in place during construction (bob bars), reducing the likelihood of cuts and impalements.

**Key Points**
• Effective communication was required between the design team and the contractor.
• The range of control measures was discussed with the contractor
• There were cost implications which required contractual agreement

**Rebar End Caps**




**Inverted Timber Formwork**

**Bent 'Bob bars'**

# Pre-Installed supporters for M&E services

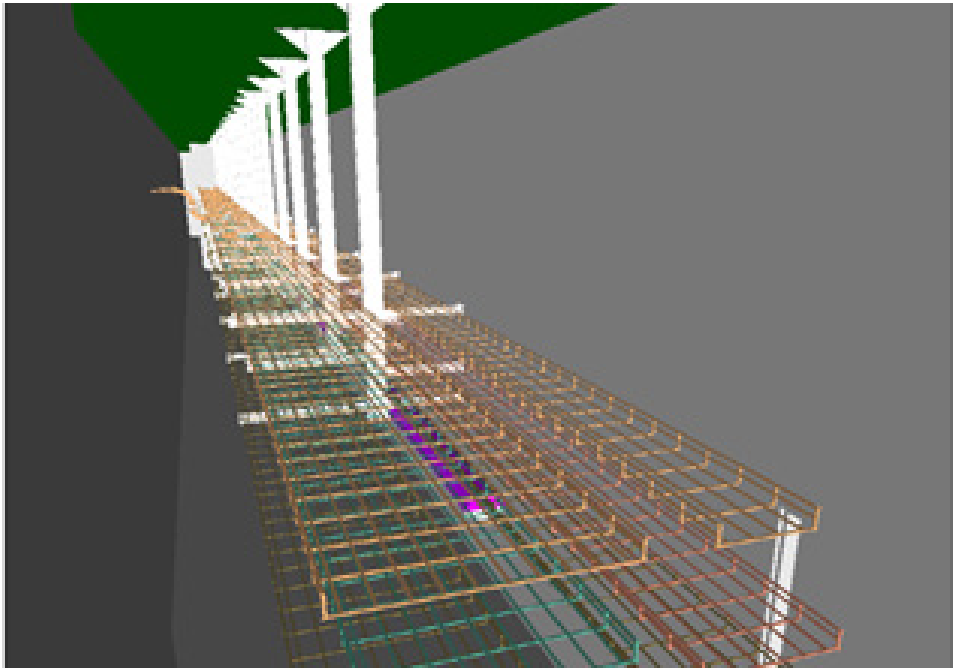
**The Problem/Challenge**
The designers of the Mechanical and Electrical (M&E) installation for a complex project wanted to reduce the risks and programme time associated with the M&E installation.

**The Risks**
The installation of M&E is often left to contractors to manage. This can require significant work at height, which is made more difficult by obstructions. There may also be a need to drill a significant number of holes for the fixing, giving rise to a risk of hand arm vibration.

**The Solution**
A well designed, pre-installed support system was specified that significantly reduced the risks associated with installation, it helped to improve productivity for both installation of the support system, and installation of the services, leading to a significantly shorter programme…

**The Benefits**
The design of the supports allowed good access for the initial installation of services and cabling. It also meant that access could be easily achieved for subsequent maintenance and replacement. There was a reduction in the need to drill into the soffit, leading to improved quality, reduced exposure to vibrating tools, dust and reductions in the noise generated.

**Key Points**
• Early layout coordination with other designers, looking at the positions of the ceiling grids and working out the ductwork routes was required.
• Early establishment of the sizes and positions of the cable trays and service routes was required.
• Consultation was needed with the suspended ceiling designer to ensure that appropriate access panels were provided that would allow sufficient space for access.



# Hinged Floodlight bracket

The original lighting bracket was of a fixed nature on the roof edge of a two storey office building.
Its position made it difficult and time consuming to access for maintenance procedures.
A hinged bracket was designed with two angled stays bolted into position when the light is in its normal operating position.
These stays can be unbolted and used to manoeuvre the light back to an easily accessible position for maintenance.

**Key Points**

- Access is quicker and easier
- The requirement of a mobile tower for access is removed
- Manual handling issues are removed, by eliminating the need to drag the original bracket back to the handrail
- Wiring to the light is run neatly inside the hollow bracket frame removing the original possibility of compromising the wiring when moving the bracket.

*Bracket being unbolted and manoeuvred back into maintenance position*

*Bracket in situ*

# Backfilling solution behind basement or retaining wall

This building had a large basement construction which had been constructed close to other existing buildings such that it was not possible to position plant on the upper level in order to backfill in the traditional way.

A novel solution was employed as shown in the photograph where backfill material was loaded by an excavator onto a truck mounted mobile conveyor system.

**Key Points**

- The hire cost of the conveyor system was far outweighed by the time savings achieved by this solution.
- This solution was also far quicker than would have been the case with just an excavator.
- Attempting to backfill using the excavator had significant risk of damage to the existing building.
- Awareness that this equipment is available.

# Glass Balustrades

Glass is used extensively as a balustrade material in modern buildings. Its safe use at height is made possible by the wide availability of advanced glass types such as toughened and laminated. However when failure of a toughened glass panel occurred in a building recently a risk review was carried out, resulting in remedial action and the agreement of a revised design philosophy to apply to future buildings.

When glass is to be installed at height the main choice is between toughened glass, designed to fail by shattering into small blunt ‘dice’, or laminated glass, which stays as a single sheet when it fails, but requires a sturdier frame to prevent the whole sheet falling out.
There has been no definitive guidance and either approach would be considered acceptable if a new building were designed today.
After seeking professional opinion, the review team decided on the following risk based approach for our building and recommended the same to be adopted as a design philosophy for all future buildings:

• At or below 5M (this is typically up to first floor level) heat-soaked toughened glass can be used. In the event of failure the small glass ‘dice’ will not cause significant injury to a person standing below, even if it clumps together as sometimes happens. (The heat-soaking testing process ensures that spontaneous failures due to nickel sulphide inclusions are minimised.)

• Above 5M only laminated glass will be used, in combination with a correctly specified mounting system. Toughened glass will not be used above 5m as the risk of injury to a person standing below would be unacceptable.
The 5M is recommended in guidance from the centre for Window and Cladding Technology (CWCT).
(The 5M measurement is taken from the floor to the TOP of the glass panel.)

# Maintenance access of kitchen extract ducts

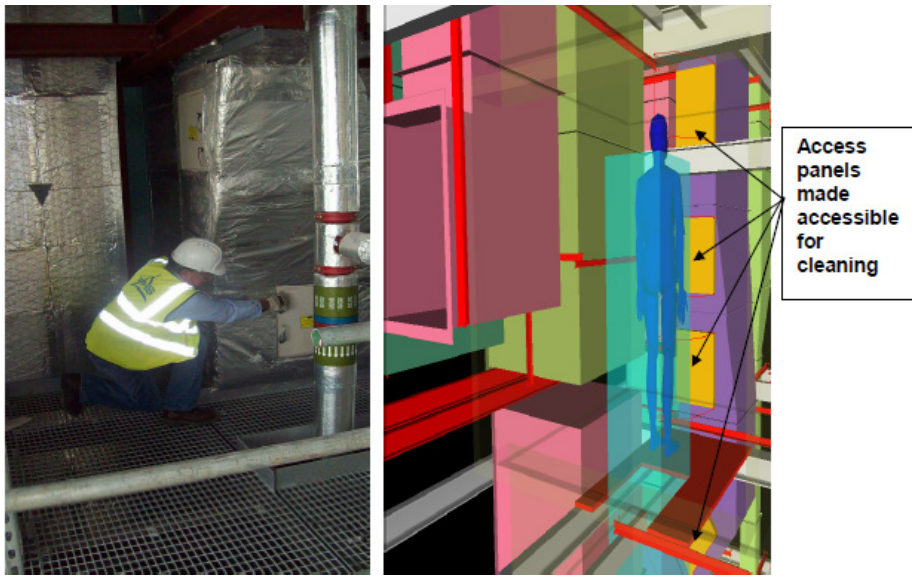
**The Problem/Challenge**
On a major project with several catering units, the designers were asked to consider the maintenance requirements for ait extraction ducts. The ducts, providing air extraction for catering units, required regular maintenance and thorough cleaning. This was actually chiefly because grease build up could provide a significant fire risk.al.

**The Risks**
There was a risk of poor safety critical maintenance if in practice it was difficult, costly, or time consuming to do. There were hazards associated with work height and confined spaces as well as the potential for fire, slips and trips and musculo-skeletal injuries (MCDs).

**The Solution**
The catering facilities were positioned, where possible, along external walls facilitating short, direct (mainly vertical) duct routes. Access gantries were provided for maintenance. Access panels were also installed at frequent intervals for internal inspection and cleaning (at a minimum of one arm span apart).
Computer modelling was used to eliminate obstructions and service clashes.

**The Benefits**
Usable access was provided for maintenance and visual inspection. Regular preventative maintenance was encouraged as it was both low cost and easy to achieve.

**Key Points**
• Early communication was essential with the end user to determine their maintenance needs.
• Early coordination between the designer and developer improved the location of the catering units relative to feasible exhaust positions.
• The frequency of maintenance required influenced the final design.



# Strategic, Detailed & Contract Design - HSE Red, Amber and Green Lists

Red Lists: Hazardous procedures, products and processes that should be avoided where possible (i.e. sfarp). Due to “other factors” this is not always possible.

• Lack of adequate pre-construction information, eg asbestos surveys, geology, obstructions, services, ground contamination etc.
• Hand scabbling and tooling methods of concrete (‘stop ends’, screed preparation, etc).
• Demolition by hand-held breakers of the top sections of concrete piles (pile cropping techniques are available).
• The specification of fragile rooflights and roofing assemblies without adequate fall protection.
• Processes giving rise to large quantities of dust (dry cutting, blasting etc.) without suppression or vacuums.
• On-site spraying of harmful substances without overspray and respiratory protection methods.
• The specification of structural steelwork which is not purposely designed to accommodate safety nets eg. holes are drilled.
• Designing roof mounted services requiring frequent access (for maintenance, etc), without provision for safe access (eg. barriers, plant enclosure etc).
• Glazing that cannot be accessed Safely, All glazing should be anticipated as requiring cleaning and replacement, so a suitable safe system of access is essential.
• Entrances, floors, ramps, stairs and escalators etc not specifically designed to avoid slips and trips during use and maintenance, including effect of rain water and spillages?
• Design of environments involving adverse lighting, noise, vibration, temperature, wetness, humidity and draughts or chemical and/or biological conditions during use and maintenance operations.
• Designs of structures that do not allow for appropriate fire containment during construction eg. Stair cores, flammable material stores, timber stores.

General comment: A proportionate decision has to be made whether to include or exclude this issues.

- Clients to be requested to provide and references made in PCI if not sometimes scabbling is essential for good screed or plaster board, safe methods must be adopted.

- Offsite methods to be used if possible.
- Offsite or tented areas to be used.
- Per net fixings.

- A combination of design for slip resistance, cleaning methods and reactive management measures in extreme conditions.
- This relates to the work place regulations but also building regulations, and applies to the construction site also.

# Strategic, Detailed & Contract Design - HSE Red, Amber and Green Lists

Amber Lists: Products, processes and procedures to be avoided or minimalised as far as possible and only specified/allowed if unavoidable. Including amber items would always lead to the provision of information to the Principal Contractor, e.g. CDM Analysis and/or safety highlighted drawings.

| | |
|---|---|
| • Internal manholes / inspection chambers in circulation areas; | - Sometimes this cannot be avoided and suitable protection will be necessary. |
| • External manholes in heavy used vehicle access zones; | - Sometimes this cannot be avoided and suitable protection will be necessary. |
| • The specification of “lip” details (i.e. trip hazards) at the tops of pre-cast concrete staircases; | - If required, for levelling of finishes a temporary timber infill or ramp to be provided. |
| • The specification of shallow steps (i.e. risers) in external paved areas without adequate visual contrast; | - “Perrons” are a common landscape steppery arrangement. Contrast is key. |
| • The specification of heavy building blocks i.e. those weighing > 20kgs; without suitable mechanisation; | - Repetitive manual handling of heavy blocks is to be avoided. |
| • Large and heavy glass panels unless appropriate mechanical handling methods proposed; | - A system of transportation from delivery vehicle to installation to be agreed in principle. |
| • The chasing out of concrete / brick / blockwork walls or floors for the installation of services; | - Including cableways in the design is preferable but not always possible. Tented enclosures to be considered where not. |
| • The specification of heavy lintels (the use of slim metal or hollow concrete lintels being alternatives); | |
| • The specification of solvent-based paints and thinners, or isocyanates, particularly for use in confined areas; | - A combination of quality points and ventilation methods may be the preferred solution. |
| • Specification of curtain wall or panel systems without provision for the tying (or raking) of scaffolds; | - Cladding system specialists need to be consulted to agree preferable methods of access and stability. |
| • Specification of blockwork walls >3.5 metres high using retarded mortar mixes; | |
| •Site traffic routes that do not allow for ‘one way’ systems and/or vehicular traffic segregated from site personnel. Early strategic design proposals to be made for later contract stage discussions with contractor; | |
| • Site layout that does not allow for adequate room for delivery and/or storage of materials, including project specific or unusually large or difficult to handle components; | |
| • Heavy construction components which cannot be handled using mechanical lifting devices (because of access restrictions / floor loadings etc); | |
| • On-site welding, in particular for new structures unless in refurbishment or maintenance projects; | |
| • Need to use large piling rigs and cranes near ‘live’ railways and overhead electric power lines or where proximity to obstructions prevents guarding of rigs. | |

# Strategic, Detailed & Contract Design - HSE Red, Amber and Green Lists

**Green Lists: Products, processes and procedures to be positively encouraged**

- Adequate access for construction vehicles to minimise reversing requirements (one-way systems and turning radii) sfarp.
- Provision of adequate access and headroom for maintenance in plant rooms, and adequate provision for replacing heavy components.
- Thoughtful location of of mechanical / electrical equipment, light fittings, security devices etc. to facilitate access and away from crowded areas sfarp.
- The specification of concrete products with pre-cast fixings, by coordination, to avoid drilling.
- Specify half board sizes for plasterboard sheets to make handling easier unless mechanical handling.
- Early installation of permanent means of access, and prefabricated staircases with hand rails sfarp or provision of temporary staircases, edge protection or fixing sockets.
- The provision of edge protection methodology at permanent works floor and roof edges or holes where there is a foreseeable risk of falls during construction and after handover.
- Practicable and appropriate safe methods of window cleaning (eg. from the many safe options available).
- Appointment of a Temporary Work Coordinator (BS 5975), by client or contractor.
- Off-site timber treatment if PPA- and CCA-based preservatives are used (Boron or copper salts can be used for cut ends on site).
- Off site fabrication and prefabricated elements to minimize on site hazards sfarp.
- Encourage the use of engineering controls and mechanisation to minimize the use of manual techniques with Personal Protective Equipment.