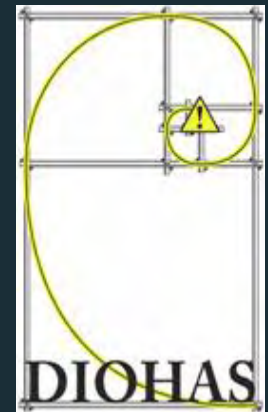


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**RIBA –CDM**  
October 2009

## Stakeholder Groups consulted

'Helping clients get better value from the construction industry and their procurement'

Consultation with various stakeholder groups including:-



THE ASSOCIATION FOR PROJECT SAFETY

Shaping and sharing best practice in construction health and safety risk management

Scott Brownrigg DIOHAS

Safe Design and Communication Oct 2009



### Judith Hackitt CBE (Chair of HSE Board)

“After many years of improvement in health and safety performance our rate of progress has slowed and **we need to regain momentum**”

“**Health and Safety** is being used increasingly as a **synonym** for **unnecessary bureaucracy** and **an excuse for not doing things**. It is time for us to regain the value of the brand for genuine health and safety –**and not trivia**”

“To be truly effective health and safety has to be **an everyday process and an integral part of workplace culture**”

“Everyone within the Health and safety system has a role but **each stakeholder** has to **understand their role** and become better at **executing their responsibilities**”

“To encourage **strong leadership** in championing **the importance of, and a common sense approach to, health and safety in the workplace**”

## CDM challenges



.....Niels Torp.....integration of cladding and CDM design essential

## Barriers to Improvements to Construction Health and Safety

Lack of **knowledge by CDM-C's** and others about what “Designers” really **need to know** about Health & Safety

**Expectations** of CDM-C's and others of Designers' Health & Safety knowledge requirements is often **excessive**

Designers **can only do so much** with regard to Health & Safety  
- **but how much?**

**How can we improve this state of affairs?**

## Proposed Solutions

There must be a **change of attitude** within the industry to accept the shortcomings of the current procedures and look to improvements suggested in CDM 2007.

We cannot keep **doing the same things in the same way and expect new outcomes.**

## Recommendations :-

Recognition and team agreement on what are the “**Significant issues**” as early in a project as possible. Then concentrate on **how to communicate these**, as well as any other significant issues that arise.

**So how can this be achieved?**

# The Burg al Arab Hotel, Dubai



..... partly cradle and partly rope accessed

## Aims of the Designer/HSE Stakeholder Consultation

1. To highlight the **“Significant Issues”** that affect CDM decisions **by designers** on a day to day basis whilst avoiding the **“trivial”** or **issues that should be obvious or within the remit of a competent contractor or specialist subcontractor.**
2. To provide examples of **“Proportionate responses”** to CDM issues by designers without **“unnecessary bureaucracy”**
3. To highlight **“what is”** - **The right information, to the right people, at the right time ?**
4. To provide examples of **“Notes on Drawings”** in a manner that is **intelligible and proportionate** to the scale and complexity of the H&S issues of the project whilst **improving safety.**

**But what should designers really Do and Not Do!**



# What do designers really have to do?

## HSE's – Do's and Don'ts for Designers

There are a lot of misconceptions about CDM:-

CDM does NOT require :-

- designers to **stifle their creativity**, limit their design freedom **or place safety above aesthetics**;
- the **elimination of attractive features** such as atria;
- designers to choose “**the safest form of construction**”
- designers **to have a detailed knowledge of the construction process**, or to specify standard construction processes or precautionary measures to the contractor;
- designers to take into account **unforeseeable hazards**;
- designers to exercise **any health and safety management functions** over contractors or sub-contract designers (who often have designer duties themselves)

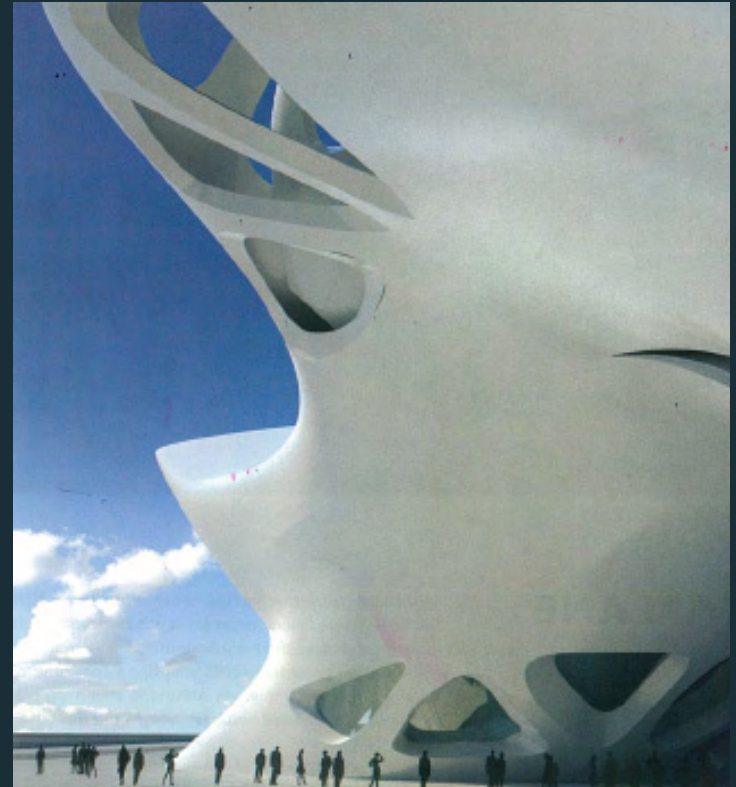
CDM **does** place certain specific duties directly on designers:

- to **eliminate hazards where feasible**
- to **reduce risks from those hazards that cannot be eliminated**
- to provide information **on residual risks if they are significant**

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 only be built at disproportionate expense!)

Even such futuristic designs as Zaha Hadid's can embrace CDM.....!!!!



## What are significant & what are trivial risks? CDM 2007 ACOP

### SIGNIFICANT RISKS

**Project Specific**

**Not obvious** to those who use the design

**Not necessarily** involving **the greatest risks** but those including health and safety risks that are:-

**Not likely to be obvious** to a competent contractor or other designers

**Unusual**

Likely to be **difficult to manage**

**Information** should be **brief, clear, precise** and in a form suitable for other users.

This can be achieved by :-

**Notes on Drawings**

**Written information** provided with the design

**Suggested construction sequences**

**TRIVIAL RISKS** – are ordinary **Health and Safety design issues** or other normal **construction risks obvious** to a competent contractor

**So how can this be done?**

# Designer Guidance –Design Risk Assessment Documentation

## 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. More complex projects may need special CDM drawings. Hand annotation for design stage issues can suffice

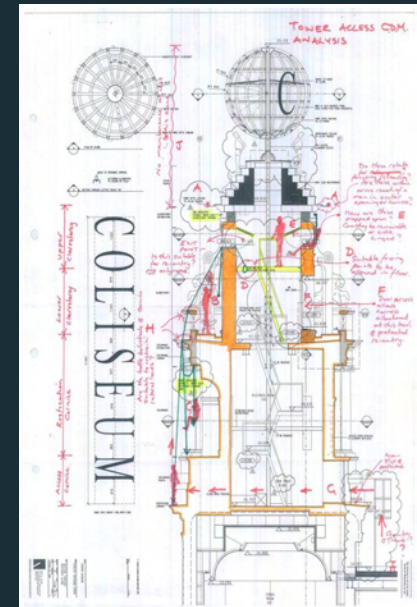
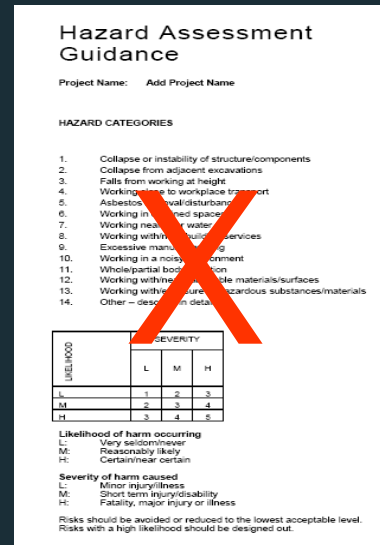
## The benefits

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

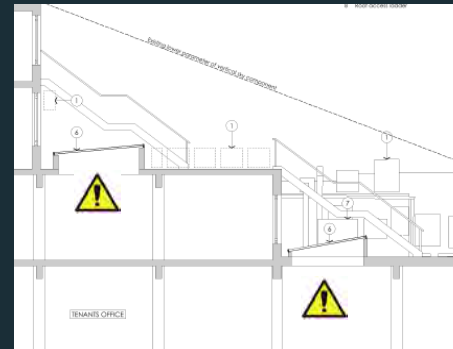
## Key Points

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” or “obvious” risk information which a competent contractor is expected to understand



Hazard and risk analysis sketched and hand annotated



Simple symbols used on survey and construction drawings



Keys in margin to amplify if required

# Team Guidance – 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**. 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

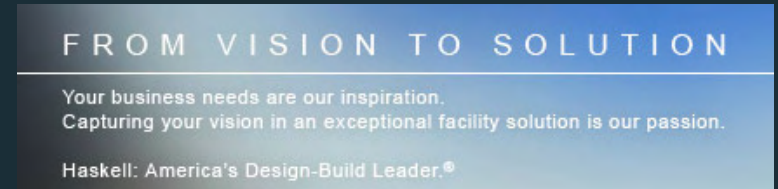
Haskell Design Build (US) are responsible for design and construction and their motto is “**one company , one responsibility**”. They have corporate liability coverage for all their architects and construction professionals. They use collaborative design-build delivery including a **safety alert system 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.

## Key Points

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



[www.thehaskellco.com](http://www.thehaskellco.com)

Scott Brownrigg DIOHAS

Safe Design and Communication Oct 2009

# Designer Guidance –Standard Safety Symbols for Design Drawings

## The Problem / Challenge

Providing **graphic significant risk data at the point of use on drawings** for designers and contractors with an explanatory key if necessary depending upon complexity.

## The risks

Designers and supervising/pricing contractors **missing the significant risk issues whilst developing designs or cost plans** and procurement

## The solution

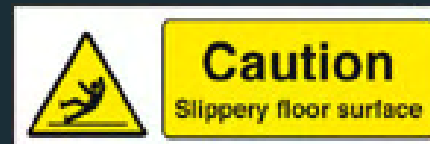
Use of an **optimal number of standard industry wide symbols** with explanatory key if required

## The benefits

**Risks are pinpointed on the actual drawn plans** rather than lost in the margins or other documents. This prevents the likelihood of risks being missed at key design stages by the entire design and client team and during workshop sessions

## Key Points

**Discretion of designer and CDM-C** needed to decide the significance, amount and complexity of risk information presented



# Designer Guidance – Symbols and SHE Boxes for Design Drawings

## The Problem / Challenge

How to put **hazard and risk data on drawings** that are relevant to other designers and other relevant construction stakeholders

## The risks

Designers could be other team members even of the same discipline and need to **see the hazards graphically on drawings**, perhaps cross referenced to SHE boxes, so the significant issues are clearly obvious, otherwise they can be missed during the design development process.

## The solution

SHE box/key **cross referenced with symbols** on the drawing eg.



## The benefits

Design team and contractor's supervising and pricing team are aware of the significant issues

## Key Points

**Avoidance of reference to non-significant**, trade or competent contractor **risk information** is essential to prevent over complication of drawings. **Caveats** are included to confirm that contractors still have their own responsibilities.

**Typical SHE box as used by Olympic Delivery Authority:-**

**Scott Brownrigg DIOHAS**

Safe Design and Communication Oct 2009

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION	
<b>SITE-WIDE AND GENERAL RISKS</b> For details, to be read in conjunction with these notes, see Drg No: .....	
<b>In addition to the risks normally associated with the types of work detailed on this drawing, note the following significant risks and information:</b>	
<b>CONSTRUCTION RISKS</b> <i>i. Asbestos in existing ceiling void</i>	
<i>ii. Temporary stability of trusses during erection, see design assumptions in document ABC/001</i>	
<b>CLEANING AND MAINTENANCE RISKS</b> For information relating to this see the H&S File and drawing nos.	
<b>DISMANTLING / DEMOLITION RISKS (Future)</b> <i>i. Cantilevered beams and suspended staircases, see Structural drawing nos.</i> <i>ii. Concealed cable runs under main beam A1/A2, see drg XYZ/1234</i>	
<b>The design team have highlighted unusual and significant risks only that may not be obvious to a competent contractor. They are to assist with risk reduction only and are not necessarily comprehensive. It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement.</b>	

# 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 unless a Design and Build project. **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.

## The solution

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

## The benefits

All operatives irrespective of nationality and education should be able to decipher the relevant information at point of use.

## Key Points

Contractors team may include a designer to update the drawings or just use their own safety team resources.

**Not needed for architectural design drawings.**

Some possible symbols shown, but others exist.





# Contractor Guidance – Workface- Supply Chain Component Signage

## The Problem / Challenge

The delivery of relevant site safety information to site operatives at the workface - Trojan Horse Messaging

## The risks

The absence of such information can lead to deaths and injuries that are relatively easy to avoid

## The solution

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.

## The benefits

Safety information about lifting, handling and fixing provided by the “experts” ie. the people who design and produce the actual components.

## Key Points

Trojan Horse messages are eye-catching cartoons which communicate health and safety information to construction site operatives at point of use, i.e. on the actual material or equipment being used.

No need for architectural design drawings.

Site Activities



Manual handling



Off-loading



Site handling



## The Problem / Challenge

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

## The Risks

Misunderstanding by the intended operatives

## The solution

NCC formed a working group to develop 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 received 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 health 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](http://www.ncc.se)



# Detailed Design- Significant Risks “only” Identified 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**.

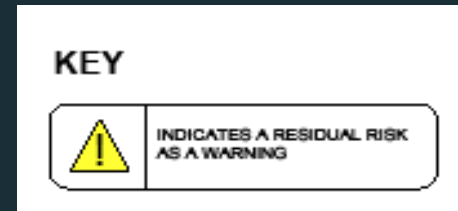
## The benefits

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

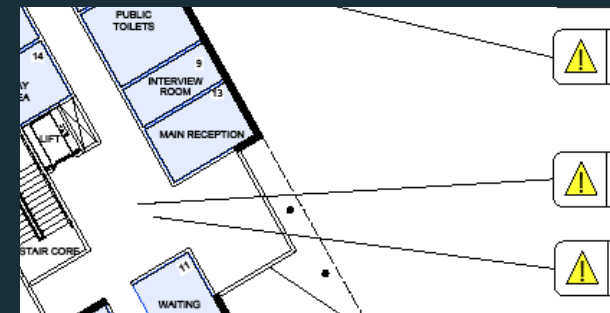
## Key Points

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.



Key and symbols identify significant risks



Significant risks “only” identified on drawings



Other symbols used for significant risks only

# Site Hazard Analysis to facilitate Initial Design & Construction Phase 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

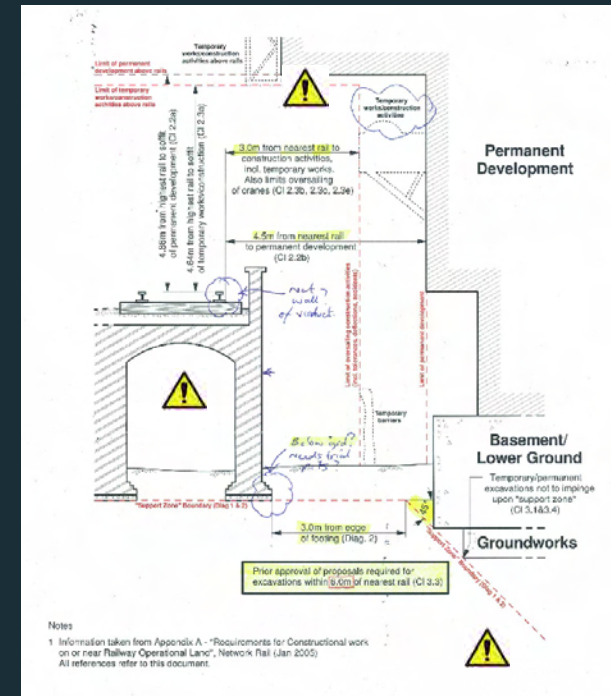
Safe theoretical maximum building envelope was agreed early together with safe site set up principles avoiding later costs and changes eg. Roads, access etc

## 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

# 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.

## 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

Designer **clearly identified hazardous underground services** on the drawings and showed other services such as water, fibre optics and drainage

## 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

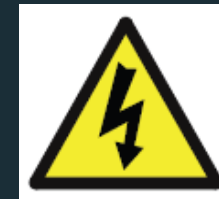
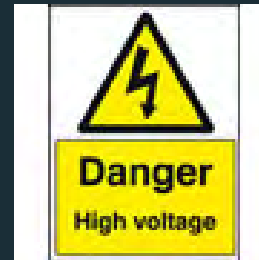
Take account of existing and new services when considering the design footprint on the site.

**Ask Clients early for adequate survey information .**

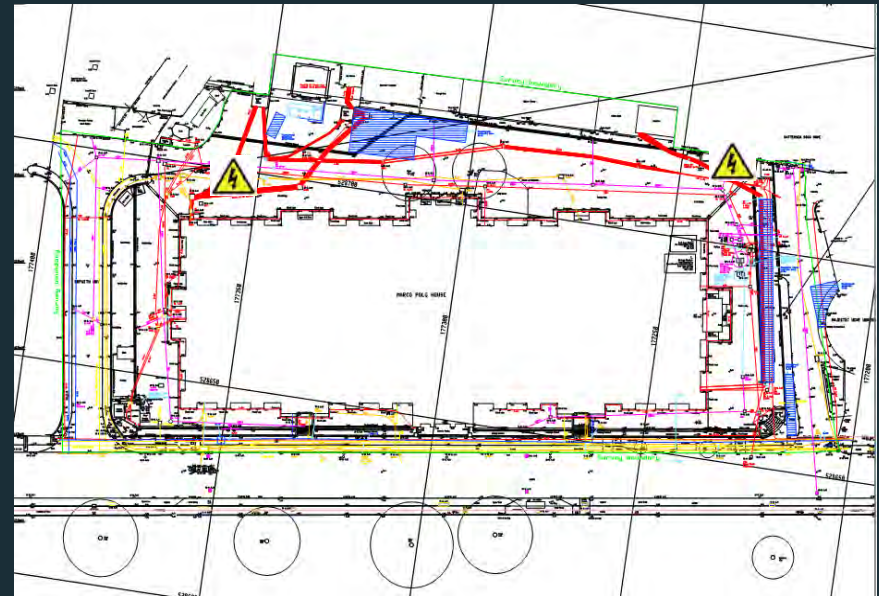
Service diversions can be planned by the contractor to avoid programme delays.

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

# Site Contamination - Asbestos Survey Information on design drawings

## The Problem / Challenge

To avoid exposure to free asbestos fibres of designers (on site visits) surveyors, site operatives, visitors, neighbours, and users by designer intervention.

## The risks

Risks of **asbestosis or mesothelioma** due to inhalation of fibres released during construction activities. This is often due to inadequately detailed surveys and **lack of understanding of how to interpret the Asbestos Report**.

## The solution

Client to instruct appropriate survey analysis of building and site and provision of accurate asbestos survey drawings and report to design team. Key issues are locations of asbestos containing materials (ACM's) and areas inaccessible to survey which must be assumed to contain asbestos, **to be highlighted on drawings**. Designer to advise client to remove asbestos but if too expensive or impracticable the designer must avoid it by designing around the areas concerned or by encapsulating the ACM's and recording its residual presence on site in the H&S Plan and on **record drawings**.

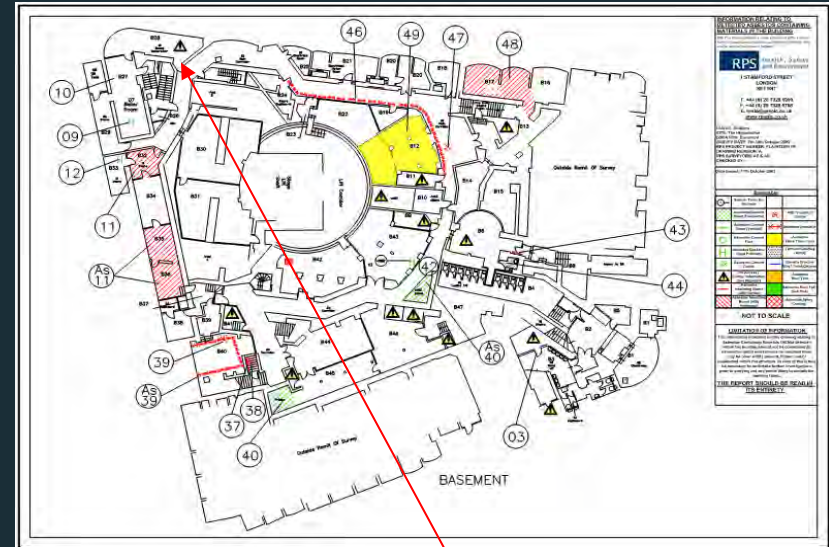
## The benefits

Reduction in likelihood of asbestos exposure before, during and after, and in future construction works.

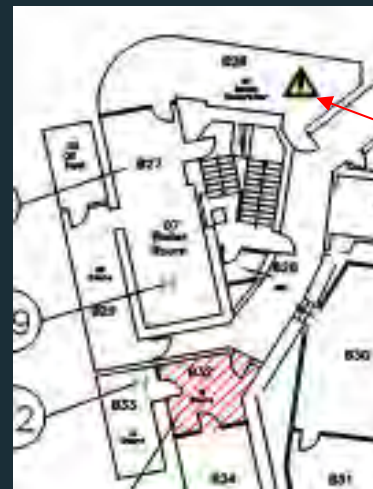
## Key Points

Liaison and communication between client, design team and contractor by interpretation of long reports.

**Paying for the appropriate type of survey early in project.**



Survey drawings to be used for asbestos survey



Areas of asbestos and not surveyed identified

# 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

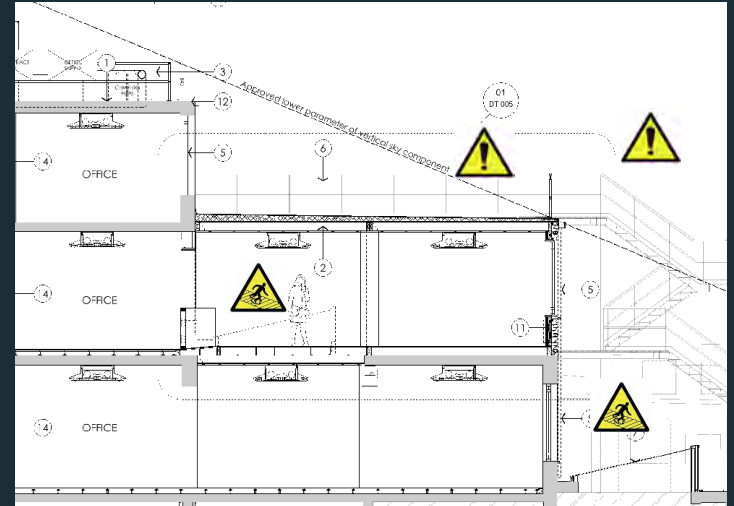
Simple drawing and survey annotation techniques showing existing features, new proposals and possible temporary works solution with commonly recognised symbols.

## The benefits

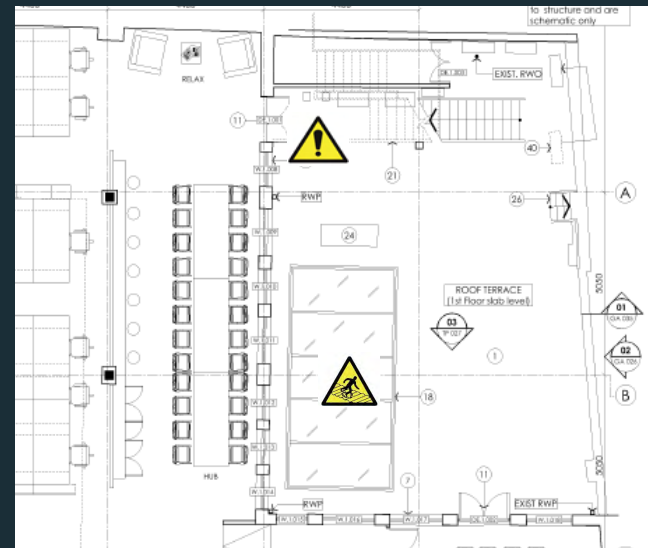
Simple identification on project drawings or surveys that can be used at pricing stages. These can also identify key issues for construction workers on site irrespective of language and educational difficulties.

## Key Points

Identification only required with symbols and simple annotation. No need for detailed explanations which can be added to risk register or hazard elimination list if required.



Fragile roof-lights, edge protection, and new stairs



Plan and sectional drawings highlighted

# 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

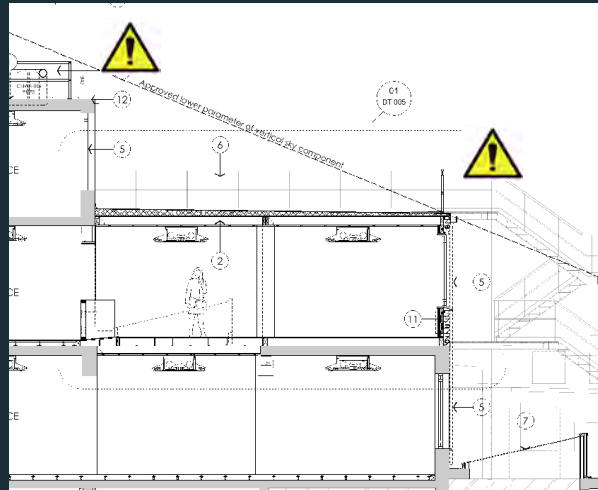
Avoidance of unnecessary bureaucracy and utilisation of contractor's advice at the appropriate stage of the project



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



# Guidance- Detailed Design- 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.

## The risks

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

## The solution

**Construction Phase** - Important to **identify existing and new fragile rooflights** and other fragile roofing materials on drawings as a method of informing the contractor to control the risk of falls through these materials during construction. 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 rooflights. **Avoid in-plane roof-lights or sheeting.**

## The benefits

Natural daylighting is a human right and engenders healthy and sustainable environments

## Key Points

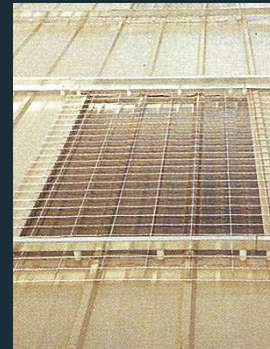
**Walk-on rooflights** tend to be very expensive so control mitigation measures are necessary. Safe **Cleaning methods** also need to be considered .



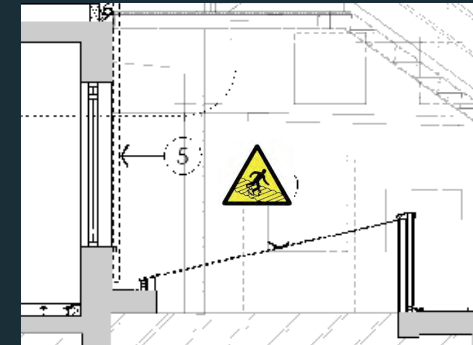
Fragile roof symbol



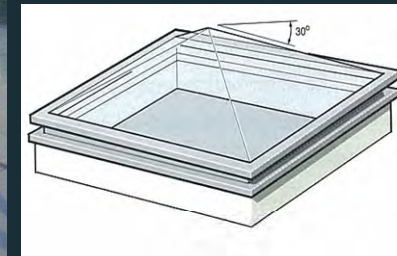
Protection Methods



Mesh fall protection

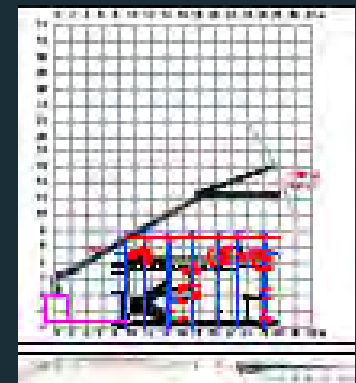
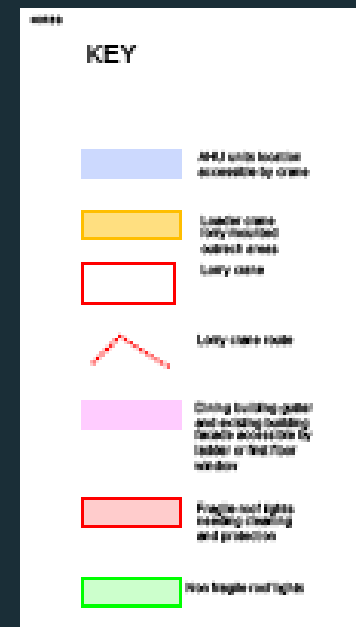
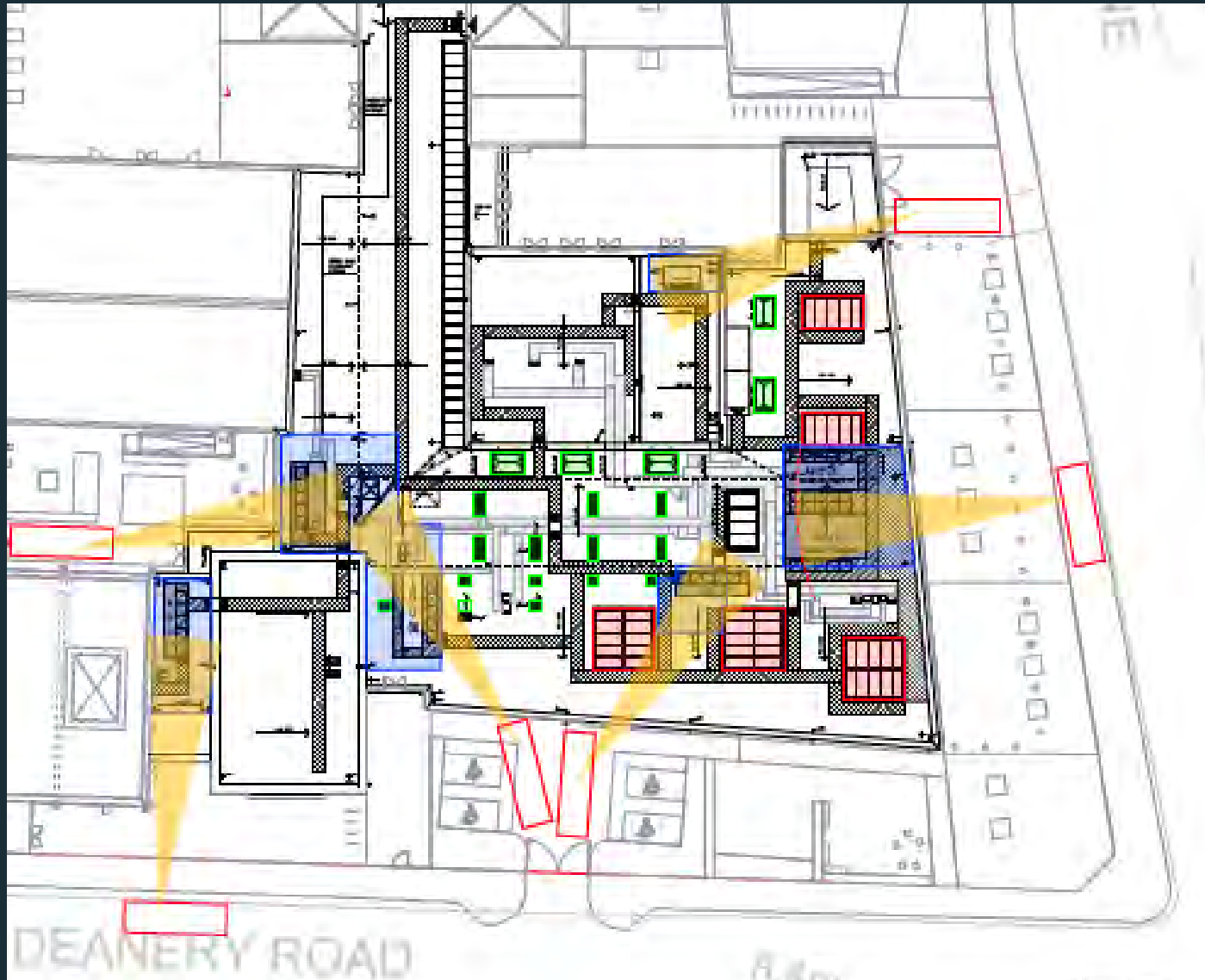


Fragile roof-lights identified



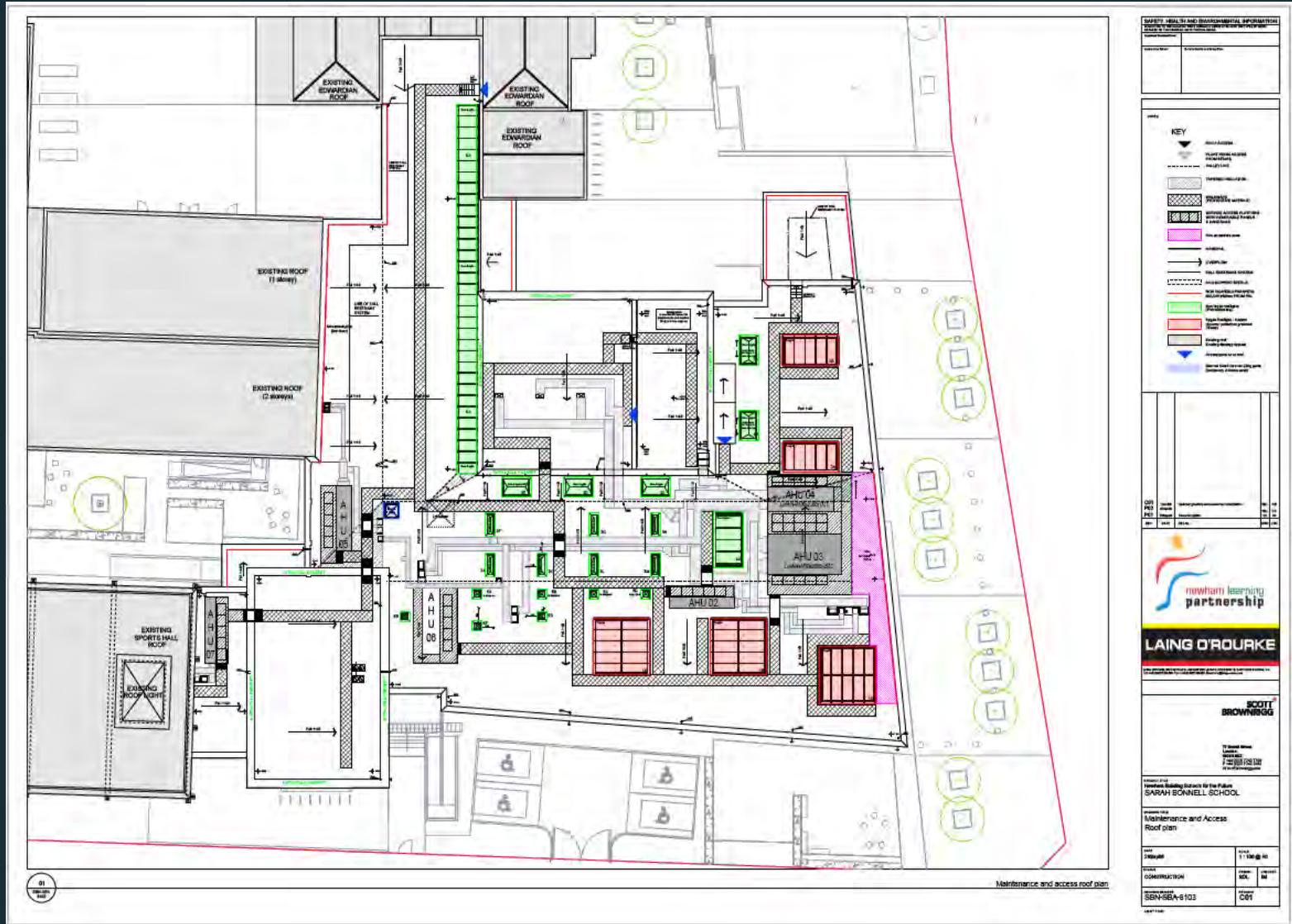
Fragile and Non-fragile roof-lights can be used

# Scheme Design - Plant and Personnel Roof Plant Access Drawings

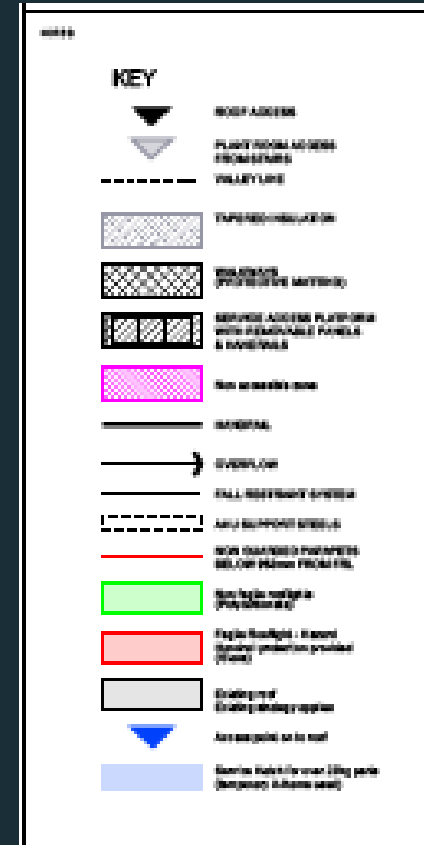
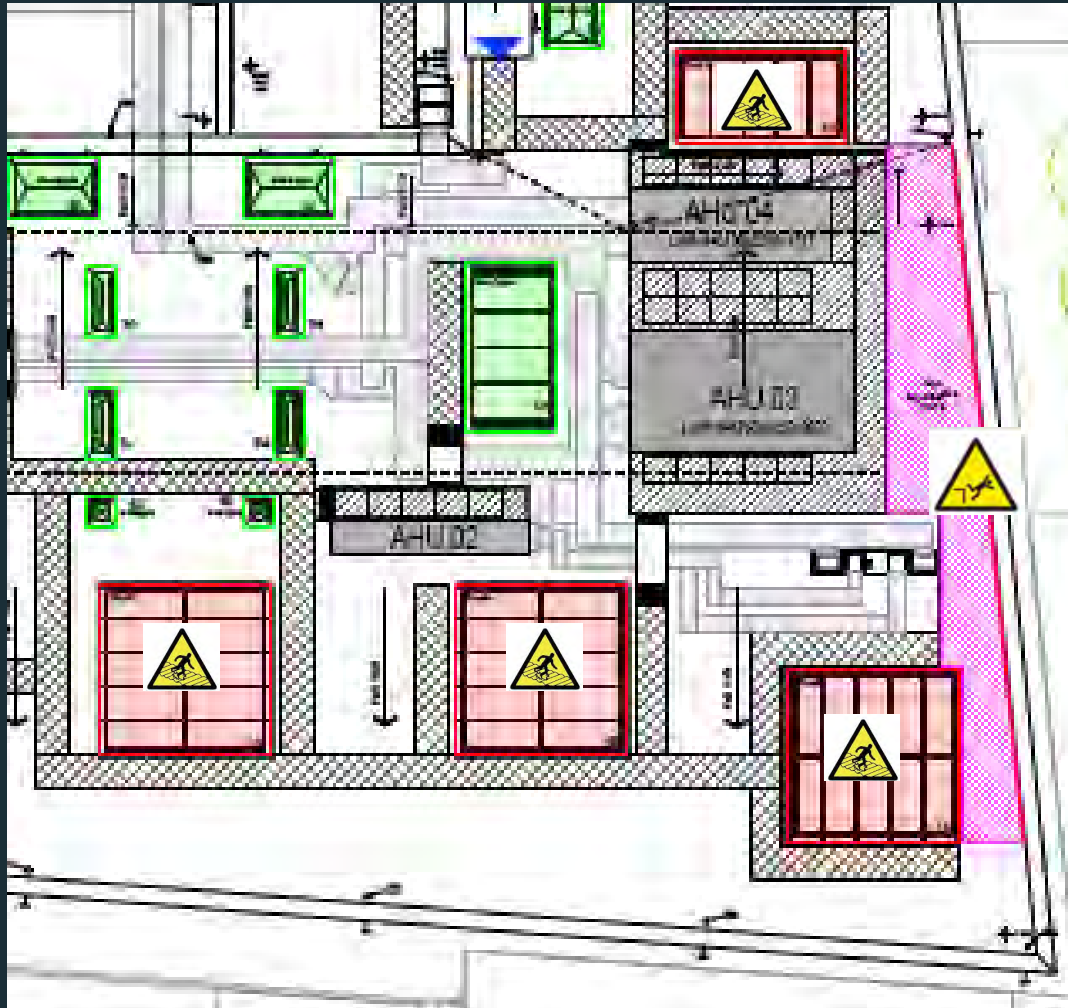


Crane Access dims.

# Detail Design - Plant and Personnel Roof Access Schematic



# Detail Design - Plant and Personnel Roof Access Zonal Details

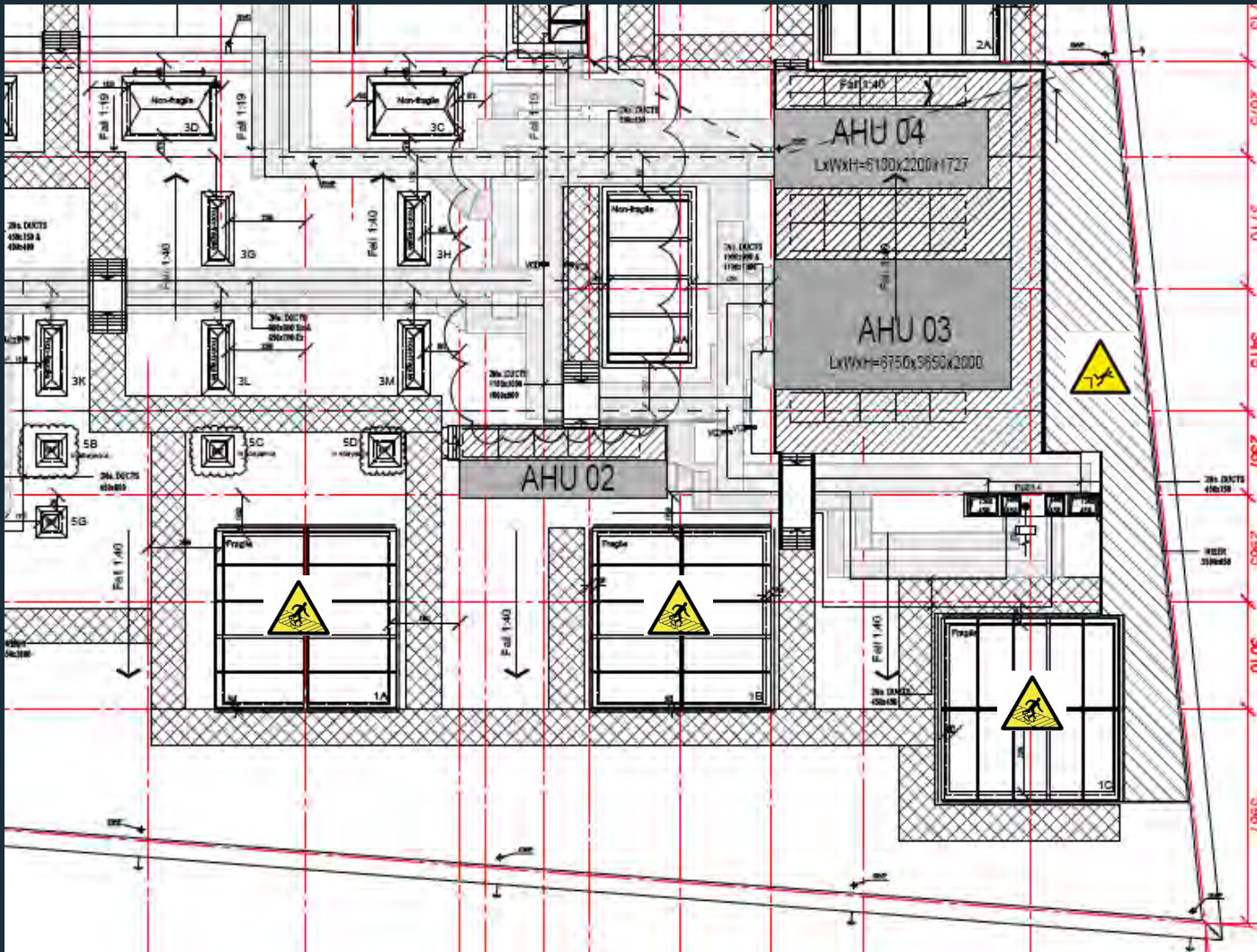


Fragile roof light  
residual risk













**Danger**  
Risk of falling

# Construction Stage - Plant and Personnel Roof Access Details



## KEY

-  ROOF ACCESS
-  PLANT ROOM ACCESS FROM STAIRS
-  VALLEY LINE
-  TAPERED INSULATION
-  WALKWAYS (PROTECTIVE MATTING)
-  SERVICE ACCESS PLATFORM WITH REMOVABLE PANELS & HANDRAILS
-  HANDRAIL
-  OVERFLOW
-  FALL RESTRAINT SYSTEM
-  AHU SUPPORT STEELS



**Fragile roof light residual risk**



**Danger**  
Risk of falling

# Summary

- Designers **significant CDM risk responsibilities** need to be clarified and **trivia ignored**.
- The project **significant risks need to be agreed early** and allocated to **each discipline**.
- The designers need to **highlight the significant hazards and risks only** on their drawings.
- **Simple non-text symbols** to be used **where possible** for visual, educational and linguistic clarity.
- **Contractors** to augment the Designers drawings with **specific site safety information symbols**
- Trade associations and **specialist suppliers** and subcontractors **to highlight their own risks**.

As Judith Hackett says:-

“From now on ,if we all **work together** with a clear vision and purpose we can recommence improvement and **bring about a change for the better**”



**Safe Design and Communication**  
**Best Practice Case Studies**  
October 2009

# Detailed Design Guidance – Riser Ducts

## 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 issues 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.

## The benefits

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

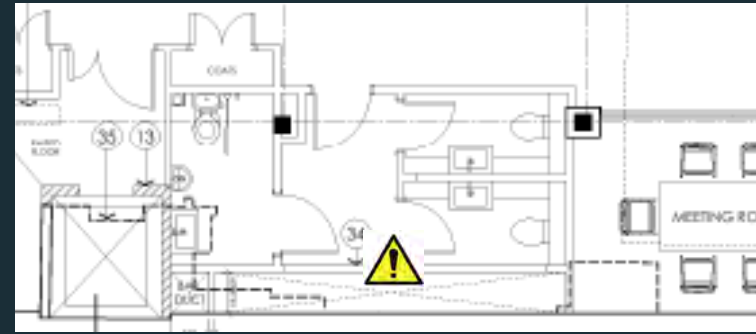
## Key Points

**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.



Large duct at party wall, fall risk highlighted



1. Sleeved services



2. Large metal mesh



3. Small metal mesh prevents falls in open areas



# Detailed Design Stage – Heavy Element Handling eg. 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

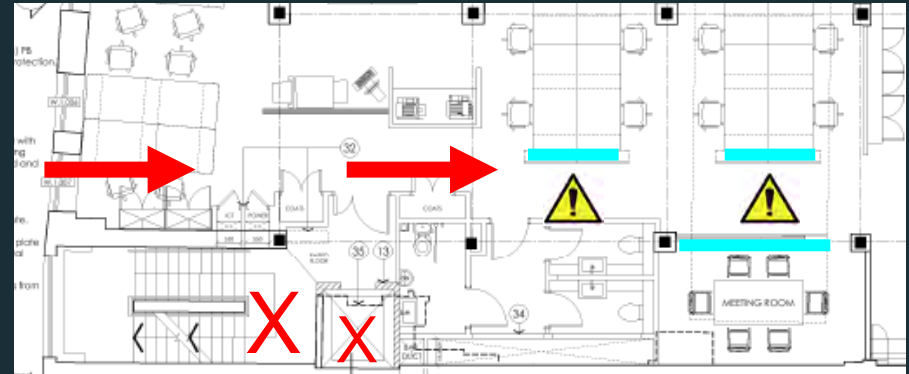
**Consider substitution** for lighter or smaller elements.

**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**.

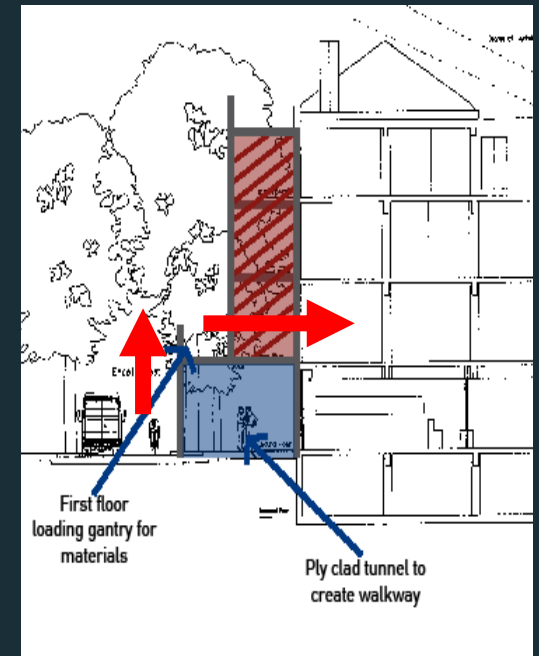
Think about **future replacement access**.



Acceptable access route shown and final locations



Mechanical aides



Vertical access route

# Detailed Design – Heavy Masonry Units

## 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 major change in attitudes** throughout the industry.

## The risks

**Lifelong injuries** to operatives and loss of skilled workforce.

## 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 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.



Weight of units significant



Traditional attitudes



Mechanised approach

# HSE Designer Guidance – Plasterboard – 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

## The solution

Boards to have heavy lifting symbols attached. 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.

## The benefits

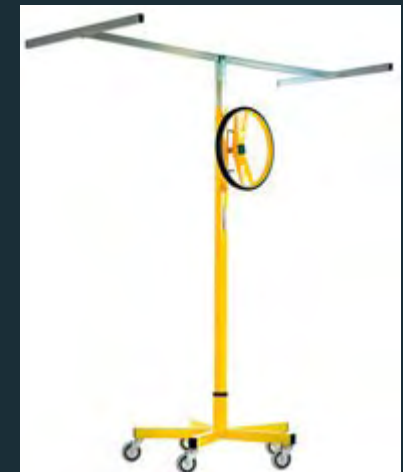
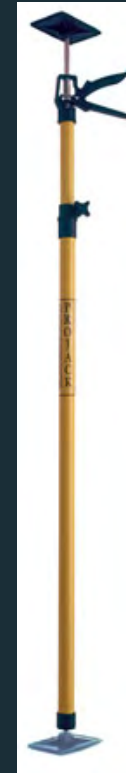
Better plasterboard installations with more motivated operatives, and increased productivity.

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.



Scott Brownrigg DIOHAS

Safe Design and Communication Oct 2009

# HSE Case Study – Prefabrication and Off-Site Manufacture

## The Problem / Challenge

Identification of construction issues involving working at height in difficult climatic or exposed 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 crange capabilities of the site are essential to validate the decisions and locations of large modules

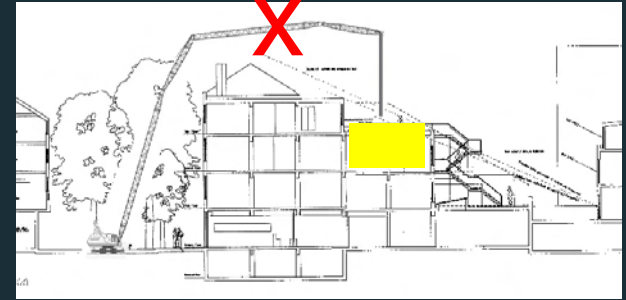
## The benefits

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

# HSE Case Study – Small Property Developers- Project Safety Issues

## The Problem / Challenge

Small and medium sized contractors to be encouraged to use safe temporary works systems of scaffolding, shoring and propping and construction methods which do not injure operatives.

## The risks

Falls from height, structural collapse during construction and personal injuries to operatives due to poor constructional techniques.

## The solution

Designers and developer clients to encourage the use of recognised safe constructional practices and procedures whilst also maintaining economic and competitive costings, by use of appropriate or traditional construction techniques for the job.

Simplicity of designs, drawings and specifications to be reflected in the simplicity of the constructional processes, highlighting unusual designs, hazards and risks only. Selection of contractors competent for specific projects and tasks is essential.

## The benefits

Projects should be constructed quicker and more precisely with appropriate methods and materials. This will improve cost benefits by shorter programmes, less defects and more satisfied customers.

## Key Points

Avoid complex unusual designs and constructional techniques without specialist advice.



Scaffolding to be used appropriately



Proprietary scaffolding preferred



Unsafe working methods discouraged

# 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.

## The risks

Potentially severe injuries to all users especially in wet weather conditions

## The solution

Select suitably slip resistant materials and finishes to give 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

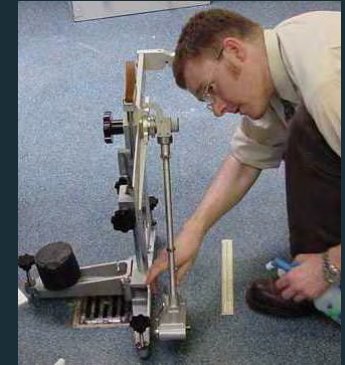
## Key Points

Drawings can be annotated early 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](mailto:sat@hsl.gov.uk)



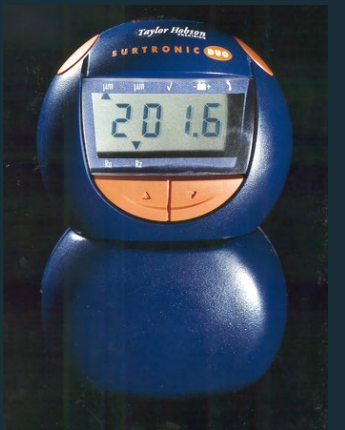
Entrance, mat-well, flooring



The pendulum test – with water spray



Management response



Surface roughness meter

# Working at Height - Single largest cause of construction accidents- WAH Regulations 2005 (Amended)

Requires designers to.....

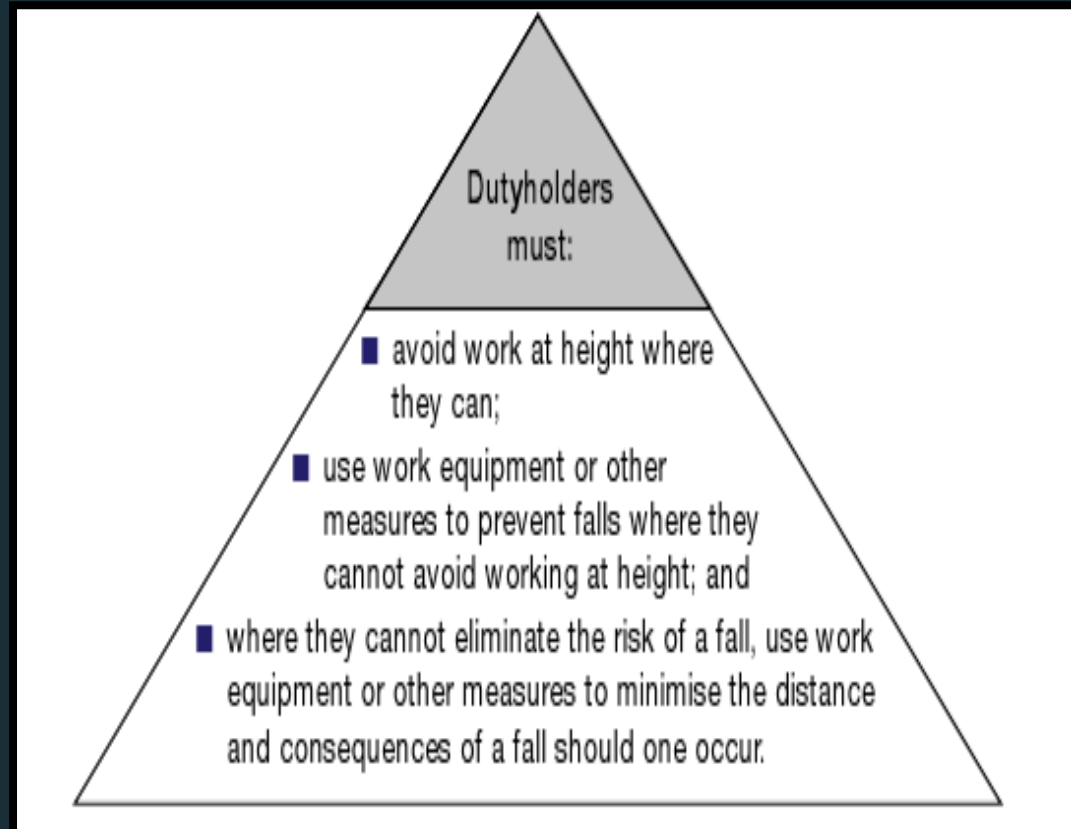
- avoid WAH where they can
- (impossible in most buildings)

• prevent falls where they cannot avoid WAH

(we can only assist contractors and users)

where they cannot eliminate falls..... minimise the consequences

- How can designers do this?



# Initial Design Stage – 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.

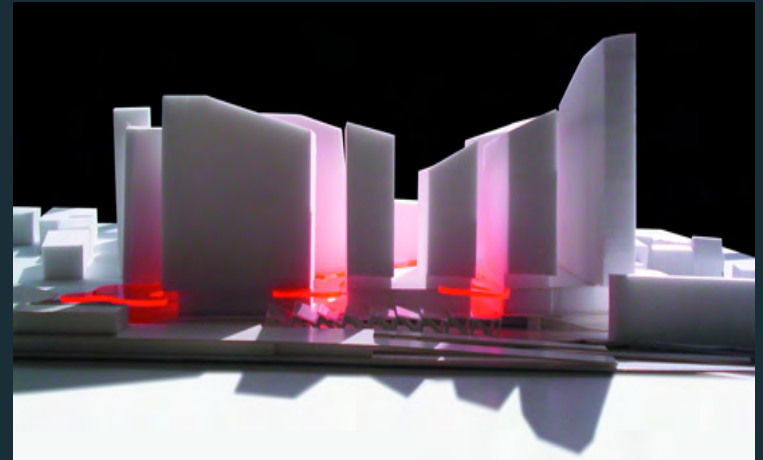
Increased costs and project delays may be avoided.

## Key Points

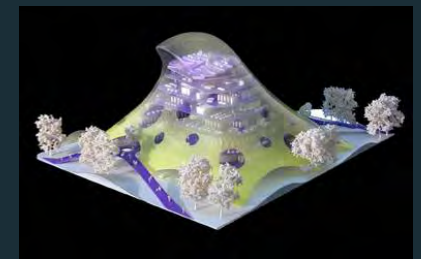
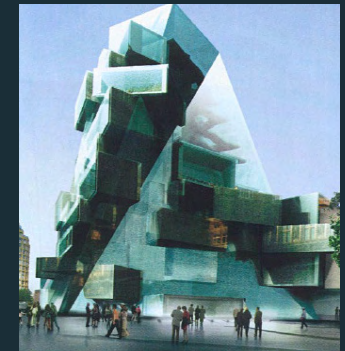
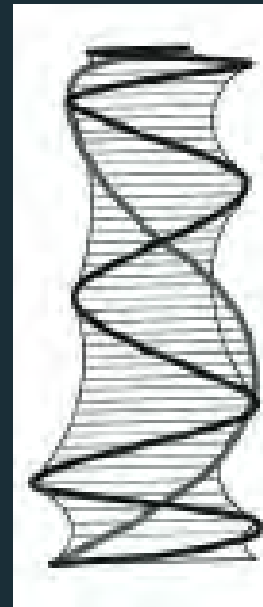
**Liaise with the client and CDM-C** in reaching these early decisions.

There are clear advantages to **involving a contractor, CDM-C or a CDM experienced designer** at the concept stage.

- Early consideration of fundamental safety issues and buildability may avoid wasted effort at later stages



Challenging forms and structures





# Initial Design –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.**

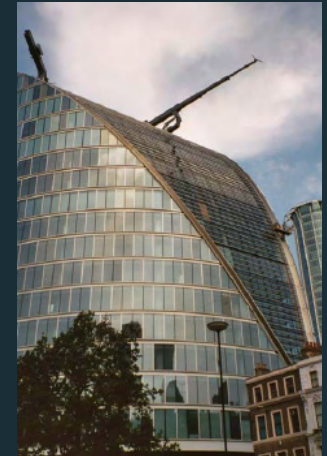
Provide a **safe working platform** in line with the Work at Height Regulations hierarchy.

## Key Points

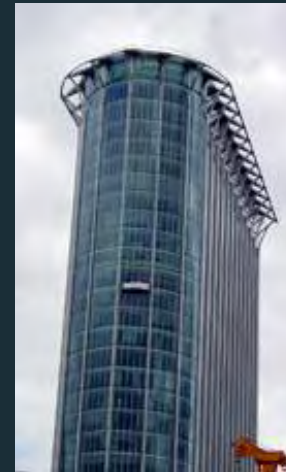
**Review** relevant viable options for mechanical systems **at an early stage.** Mechanically assisted work placement systems require early discussion with **specialists.** Non-manned **robotic systems** eliminate work at height but **can limit design** solutions. Mechanical systems are best suited to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



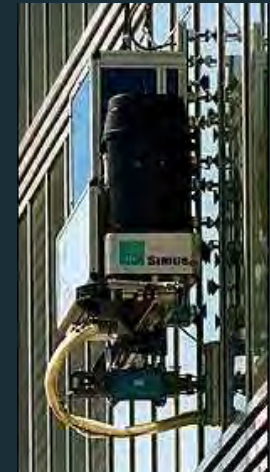
MEWP



BMU



Cradle



Robotic

# Initial Design Stage - 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

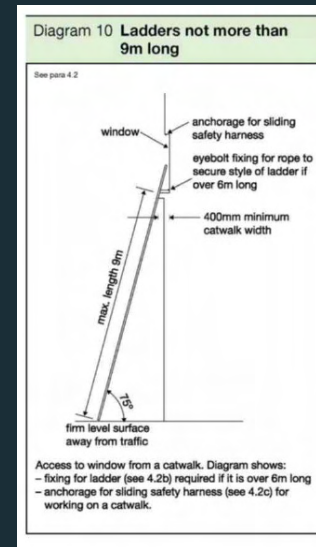
Allows **economies of scale** to be proportionately applied to all building types. Enables **quicker and more immediate** response to cleaning demands. Roped access allows work positioning to **difficult undercuts and geometrically intricate areas.**

## 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.

**Scott Brownrigg DIOHAS**

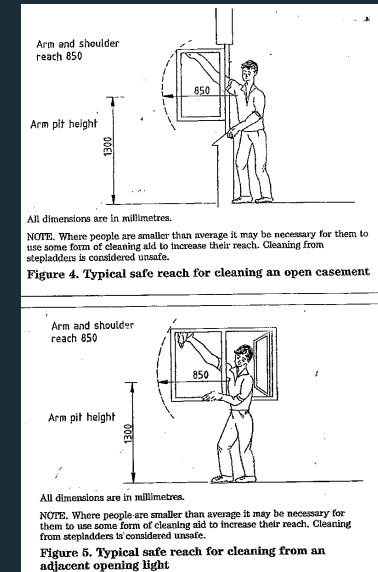
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Ladder limitations



Special roped access areas



Opening window criteria



Water-fed poles

# Initial Design – Visually acceptable Roof Edge Protection

## 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-soleil feature.

## 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

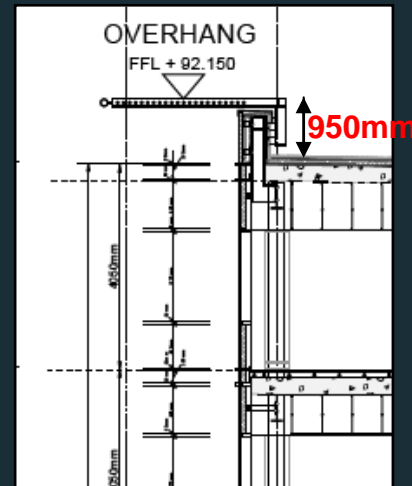
## Key Points

Permanent edge protection provides an optimum safety solution and is at the top of the work at height hierarchy.

Co-operation of client and project team required to avoid being “value engineered” out.



Visually hidden edge guarding integrated into cladding



950mm high guarding



View of roof upstand

# Initial Design- Roof Access - Permanent Fall Prevention Methods

## The Problem / Challenge

Roof access fall prevention methods proportionate to the frequency of access requirements for maintenance activities whilst considering the aesthetic and cost considerations.

## The risks

Falls from height by plant maintenance operatives or roof workers. Access is unlikely to be entirely eliminated on any 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 plant maintenance on a frequent basis.

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 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 plant areas grow.



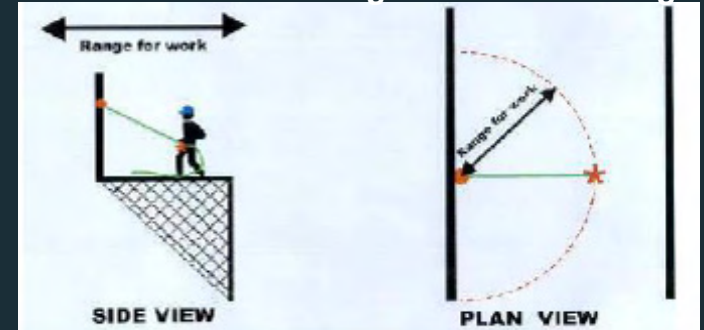
Mansafe cable and lanyard system



Personal fall arrest



Edge Protection railings



Fall Restraint protection, prevents falls

# Scheme and Detailed Design – 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

Regular man access was rejected on safety and economic grounds.

A fibre optic design was selected with projectors at lower accessible levels of the tower..

The tower was fully scaffolded during refurbishment, and can be scaffolded for periodic maintenance and cleaning.

## The benefits

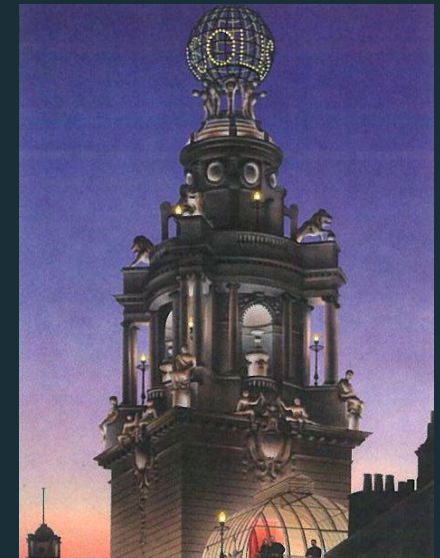
Risks associated with access to the globe were eliminated. The fibre optic solution allows client an economic method to maintain full lighting to the globe sky sign without risks to maintenance personnel

## Key Points

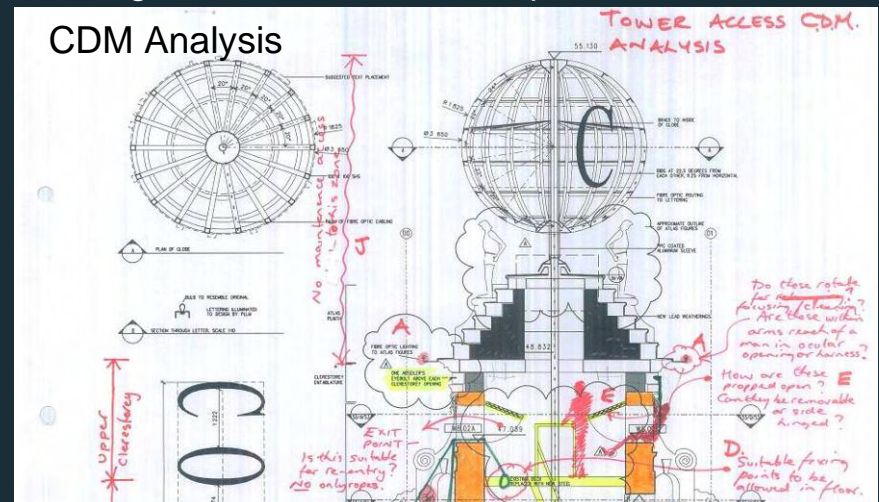
Consultation between the client / FM team and the design and contractor team allowed early decisions to be made. (The early involvement of the client allowed for the increased costs of fibre optics to be accommodated.) Survey drawings were annotated to analyse the risks and communicate the solutions.



Existing "dark" tower



Proposed "lit" tower



# Initial Design- Glass Roof Cleaning and Maintenance - Coliseum

## The Problem / Challenge

Access to the new glass barrel vaulted roof for cleaning and maintenance purposes.

The roof is above refurbished foyers and is designed to recreate the original design.

## The risks

Working at height and over fragile glass above high internal and external drops.

## The solution

A Building Maintenance Unit (BMU) with an 11 metre jib and one man cradle. Planning constraints influenced rejection of other options, eliminating the use of a travelling curved gantry that would be visible at all times from street level. Increased structural works were required to support and conceal the BMU behind the tower at roof level.

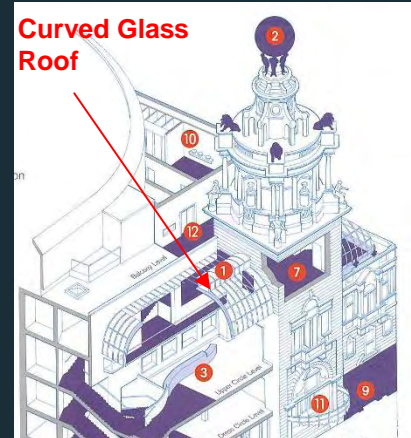
## The benefits

Both visual and safety priorities were met with some increased complexity and cost.

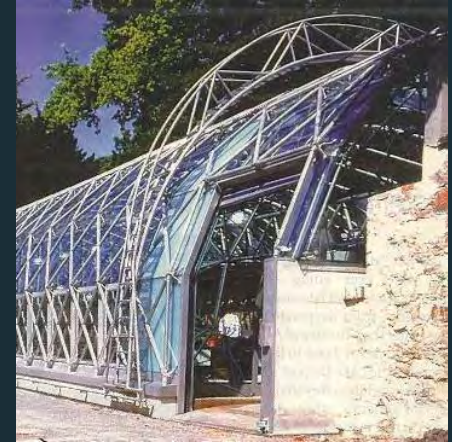
Client has the benefit of increased accessibility provided by a bespoke system

## Key Points

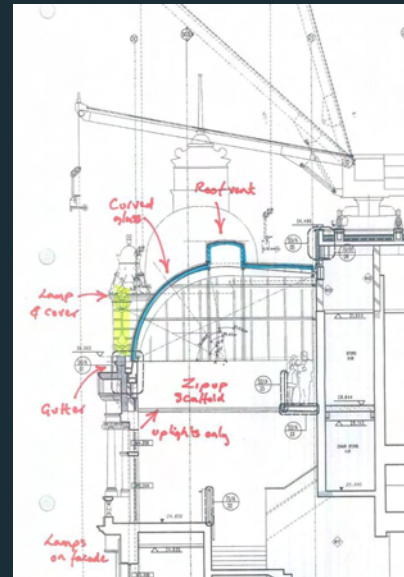
The client, the facilities managers and specialist suppliers of cleaning systems were consulted early on. The final solution for this project took account of safety, historic constraints and aesthetic considerations.



Cut away view of roof



Proposed gantry solution



Final BMU Design



BMU Solution

# Detailed Design – 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 maintenance access.

## The solution

Powered access equipment, and scaffolding were discounted after careful assessment as unsuitable.

A **roped 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 minimise the frequency of access.

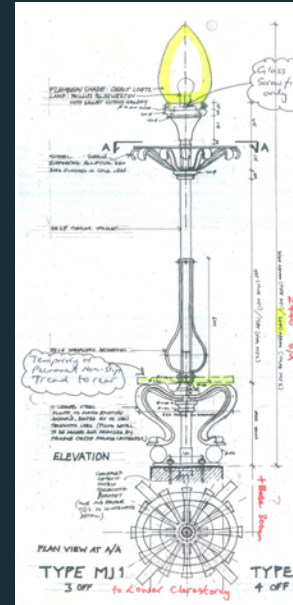
## The benefits

Provides safe and economic lamp replacement at short notice using **trained theatre maintenance staff**.

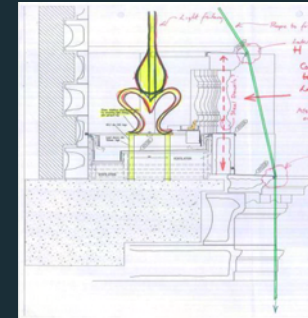
## Key Points

Lighting design **drawings were annotated** to communicate the risks and solutions to entire team.

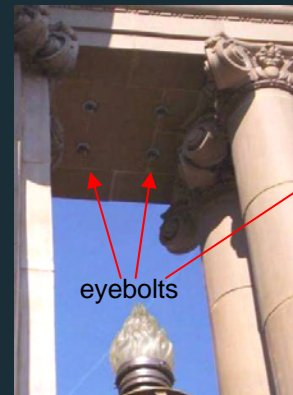
The annotated drawings were used by the construction team as the basis of the construction details



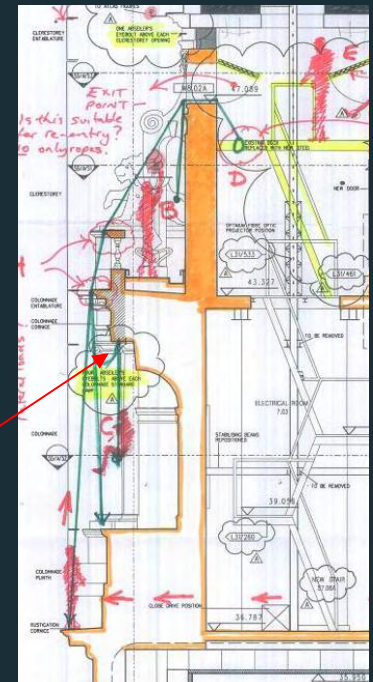
Historic Light



Parapet detail



Eyebolts installed



CDM Analysis

# Initial Design – Fragile Domed Roof-light- 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. 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 slidelock harness attachment.

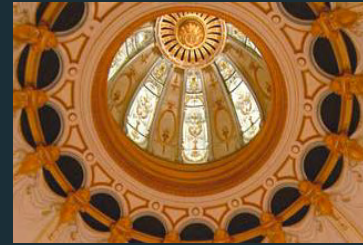
Easily accessed light fittings fitted at low walkway level reflect off the underside of the outer dome to illuminate the rooflight.

## The benefits

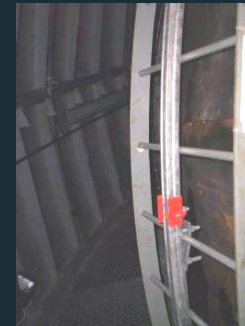
The client has been able to reinstate a spectacular roof-light feature whilst overcoming the weatherproofing and significant maintenance safety challenges.

## Key Points

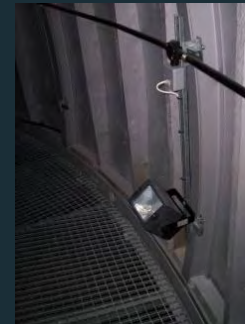
Specialist design subcontractors consulted early .  
Communication with the Client and FM team essential in agreeing strategy and budget at early stage by annotation of drawings.  
A combination of fall prevention methods were carefully selected, each justified in respect of the hierarchy of control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



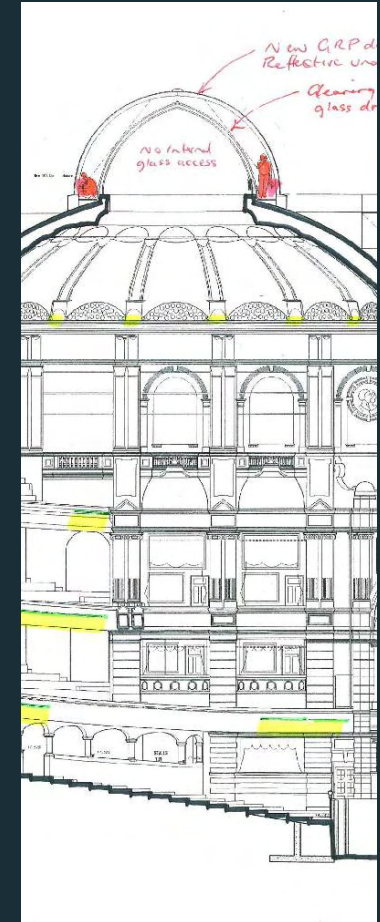
Rooflight from below



Curved rotating ladder + slide-lock



Walkway and up-light



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



# Initial Design- Roped Access- To unusual structures

## The Problem / Challenge

**Design of landmark or unusual feature** structures requiring difficult cleaning and maintenance access to windows and light features and for painting or inspection activities.

## 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** to inform the integration of rope attachment fittings and features

Scott Brownrigg DIOHAS

Safe Design and Communication Oct 2009

Question 22 What are rope access and positioning techniques?

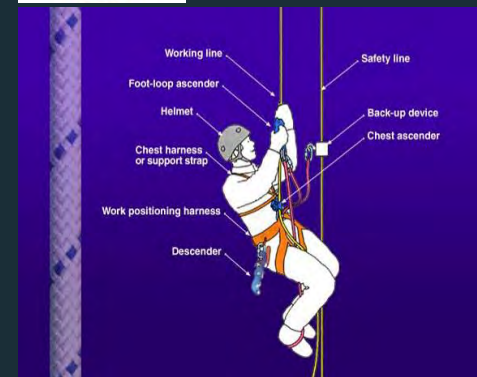
Rope access is a personal fall-protection system using two ropes each secured to different anchors. One rope is connected to a harness and the other acts as a safety back-up. Rope access is often used to access cliff faces or the sides of tall building when cradles are not suitable.



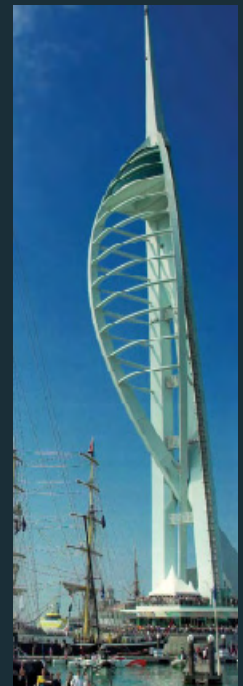
The HSE's description of Roped Access



Terminal 5 Heathrow



Roped access IRATA guidelines



Spinnaker Tower

# Best Practice Case Study – 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

International 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.

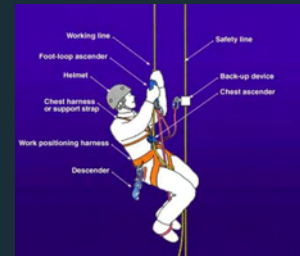
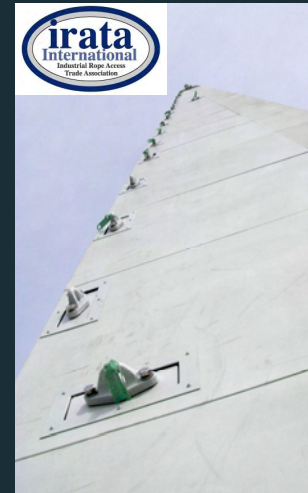
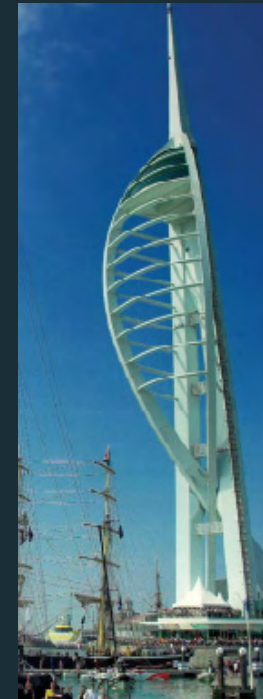
Long life lamps and paints used to minimise access.

## The benefits

**The structure does not have to be modified** for traditional access techniques higher up the hierarchy of working at height regulations.

## Key Points

**Early recognition of safety issues and consultation with specialists** to prevent 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.



# HSE Case Study – Initial 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

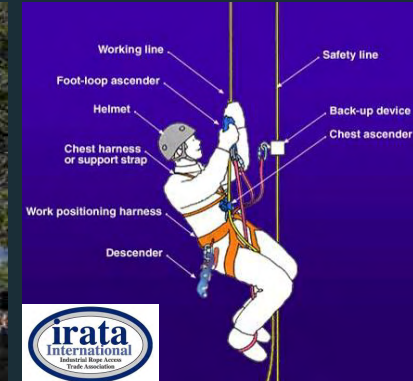
Landlord can ensure all windows cleaned at regular intervals. Operatives clean most windows from safe balconies.

## Key Points

IRATA registered company consulted on rope attachment design and details.

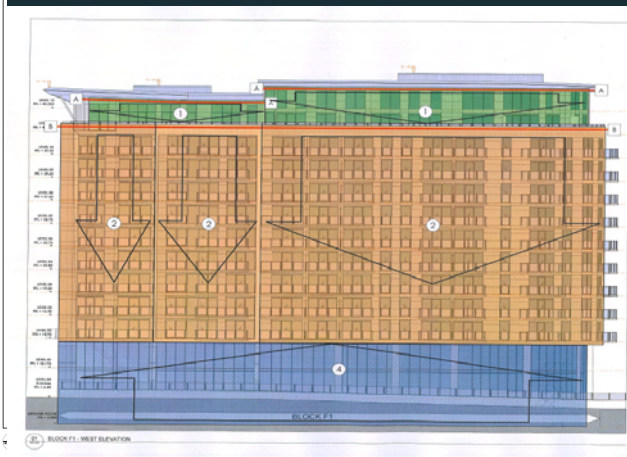
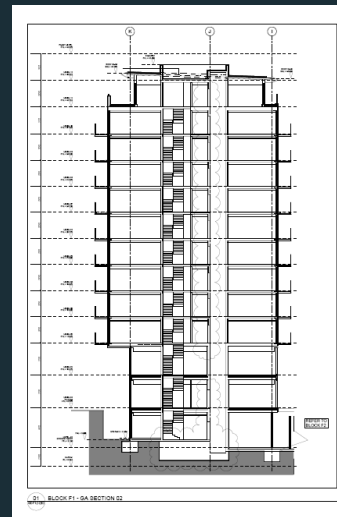
IRATA trained rope access operatives employed to ensure safe systems of working.

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

Scott Brownrigg DIOHAS

Safe Design and Communication Oct 2009

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

## 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 access to the lights for performances and general hall lighting within the roof space

## The benefits

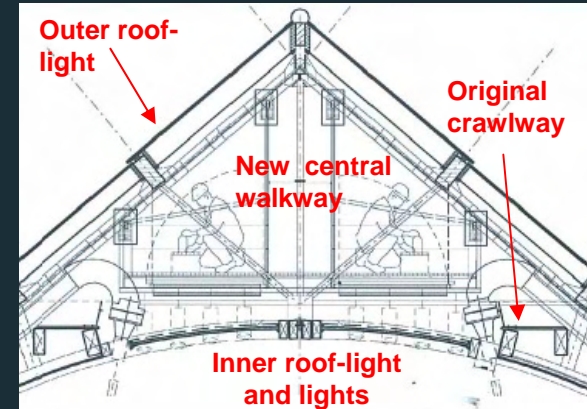
Significant improvements in accessibility and safety of maintenance operatives

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, rooflight and access analysis



Inner rooflight above auditorium



Original roof-space



Revised roof-space

# Initial Design – Maintenance Access to Unusual Roofs - 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.

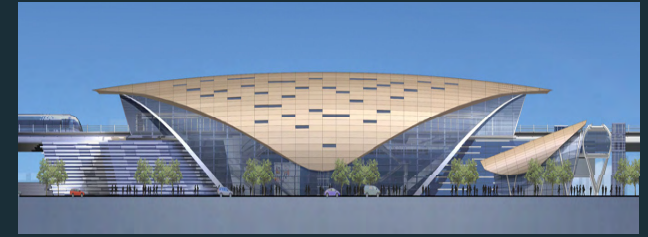
Design team and client agreed solution was a purpose designed robotic system

## The benefits

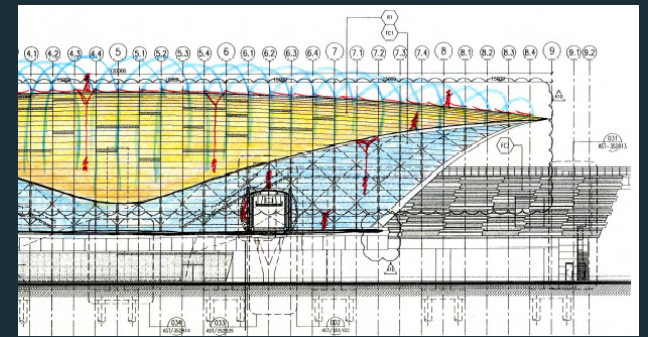
Man access to roofs eliminated for general maintenance purposes

## Key Points

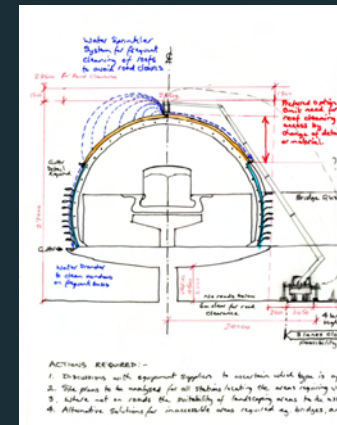
Details of sun-shading devices critical to allow passage of robot. Roof apex robot attachment system, water supply and mansafe fall restraint harness system to be developed in detailed design with specialist subcontractors .



Gold metallic curved roof 120m X 30m



Roped access +sprinkler options analysis



Cherrypicker option



Robotic system

# HSE Designer Guidance – Unusual Construction Sequences

## The Problem / Challenge

Intelligibility of unusual construction sequences

## The risks

Collapse during construction due to asymmetric loading and unbalanced cantilevers

## The solution

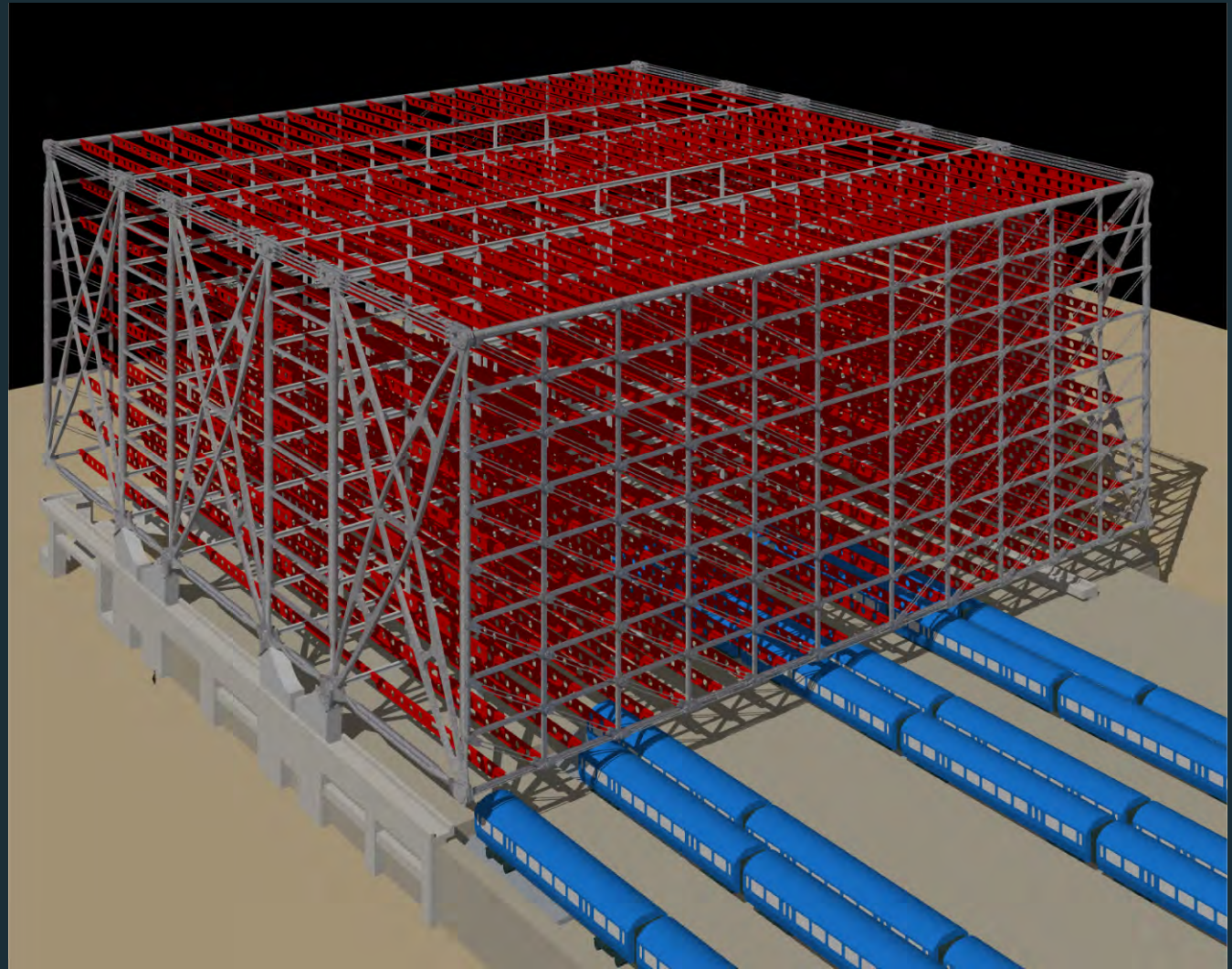
Graphic presentation of the proposed sequence for contractors to understand the structural and constructional design intentions.

## The benefits

Information sharing with the construction team at early stages of the project

## Key Points

Simple 3-D drawings overlaid in an animated powerpoint, showing the site constraints and proposed significant sequences



# HSE Designer Guidance – Demolition of unusual structures only

## The Problem / Challenge

What **demolition information** is required in the **Health and safety file** for future demolition purposes?

**Unusual and hidden** residual risks such as suspended and cantilevered features, post-tensioned and pre-stressed elements, etc.

## The risks

Unusual or hidden structural or services related elements can be accidentally damaged or incorrectly cut during future refurbishment or demolition works causing **catastrophic collapse** of the entire or large parts of the structure.

## The solution

**Indicate on drawings where these issues are hidden** so future designers and contractors can plan appropriately for temporary support or safe demolition.

## The benefits

Reduced risk of collapse and injuries

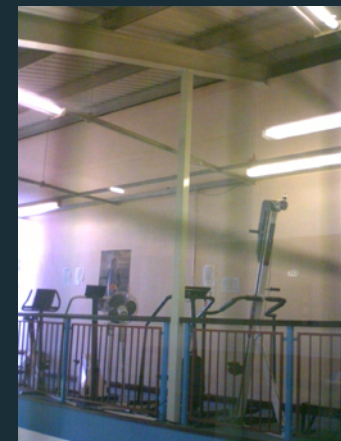
## Key Points

**Identify significant issues only.**

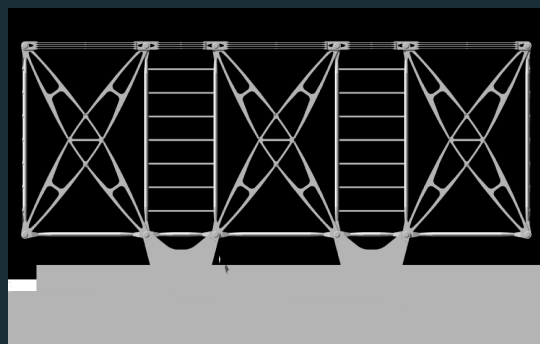
No need to indicate obvious and normal structural and constructional issues which are easily identified by future competent designers and contractors.

Too much irrelevant information will hide the real issues.

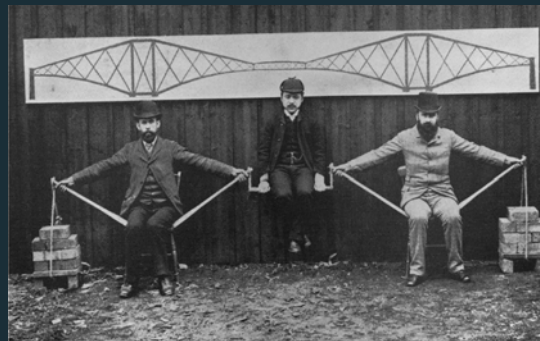
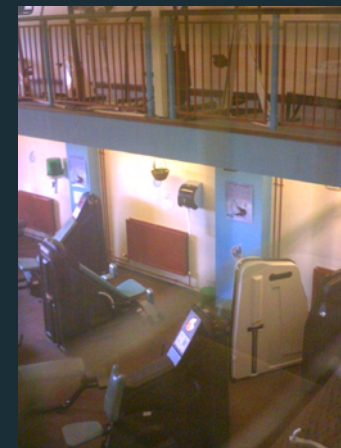
Indicate on graphic information where possible.



Suspended structures



21m Cantilevers



**THANK YOU**

**QUESTION TIME**