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Code of practice for the design of buildings incorporating safe work at height

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 December 2012. It was prepared by Technical Committee B/209, *General building codes*. A list of organizations represented on this committee can be obtained on request to its secretary.

Information about this document

Clause **3** of this British Standard is broadly aligned with the RIBA Outline Plan of Work [1], in particular the stages of the design process. At the time of publication, the RIBA Outline Plan of Work [1] was being revised and the stages were being updated, however, the stages given in this British Standard are not affected by this change.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word “should” is used to express recommendations of this standard. The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Particular attention is drawn to the following specific regulations:

- The Work at Height Regulations 2005 (as amended) [2].
- The Construction (Design and Management) Regulations 2007 [3].
- The Lifting Operations and Lifting Equipment Regulations (LOLER) 1998 [4].
- The Provision and Use of Work Equipment Regulations (PUWER) 1998 [5].

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Introduction

This British Standard encourages designers to assess, as early as possible in the design process, how work at height can be minimized, and where required the provision of practical, efficient, cost-effective solutions for the safety of those who work at height.

*NOTE For the purposes of this British Standard, the term "designer" covers either an individual engaged in design or a team, perhaps representing several disciplines. An integrated design team offers benefits in terms of collective design consideration, including knowledge, experience and problem solving. Also see **2.4** and **3.3**.*

New-build and refurbishment projects require people to work at height over the lifespan of a building in order to construct, clean, maintain and repair it. By its nature, work at height is hazardous and presents the risk of a fall. Falls from height account for a significant proportion of fatalities and serious injuries experienced during construction and maintenance. As a significant safety risk, it is important that everyone, including designers, who work within the construction industry give it the appropriate attention.

To reduce the number of accidents, designers have duties under health and safety legislation [3], so far as is reasonably practicable [1)] (see **2.13**), to avoid the need for work to be carried out at height. Part of a designer's duty is to adapt the design where this cannot be achieved so that equipment can be provided to prevent falls. If provision of fall prevention equipment is impractical, equipment or systems of work to minimize the distance and consequences of a fall can then be included within the design. By working collaboratively, the design team is in a strong position to make provisions within their designs that reduce the risk of falls occurring.

Designers assess and manage many competing factors as they prepare their designs. At the concept design stage (see **3.4**) the form of the building develops and this can be influenced by factors such as function, location, aesthetics, cost and planning. In addition, there are other factors such as building and fire regulations, sustainability, buildability (see **2.2**) and maintainability (see **2.9**) to be addressed. The best time for designers to consider work at height is during the early stages of the design: how it can be minimized and carried out in a manner that provides an appropriate level of safety. This is the focus for this British Standard.

By early consideration of the extent, nature, duration and frequency of work to be done at height, appropriate equipment and techniques for use in construction, cleaning, maintenance and repair can be identified. Also how access to and from equipment and places of work at height, and the loads equipment imposes on the structure or surrounding ground can be included early in the design process. Early consideration can help to resolve aesthetic or other conflicts between the proposed equipment or work methods and the other factors influencing the design of the building and its surroundings. This should enable accurate costing and planning for the provision of access equipment, its inclusion into the building and its lifetime use.

Where work at height is taken into account later in the design process, there is a greater likelihood of there being difficulties in making adequate provision for access and inclusion of access equipment. There is potential for poorer detailing and additional cost resulting from redesign, structural alterations and inappropriate access arrangements that increase lifetime costs.

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1) This principle underpins this British Standard.

By giving due consideration to work at height issues early in the design process, designers assist those who have to organize, manage and carry out the work at height during construction, cleaning, maintenance and repair. It is also vital that contractors and operatives are trained and competent to carry out work at height.

1 Scope

This British Standard gives recommendations for incorporating safe work at height into the design of buildings during the design process.

NOTE The recommendations in this British Standard can also be applied to other structures.

It gives recommendations for designers on working safely at height and how to take this into account throughout the design process with specific focus on the early strategic and conceptual stages. It also takes into account the requirements of those who are involved in construction, inspection, cleaning and maintenance.

This British Standard does not give designers prescriptive solutions for work at height but does provide useful guidance to help them manage the process. It is for the design team to develop specific solutions for each individual project.

2 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

2.1 anchor line
flexible or rigid line connected, at least at one end, to a structural anchor and to which personal protective equipment can be attached

NOTE 1 A flexible horizontal anchor line is often referred to as a "cable system".

*NOTE 2 Anchor lines can be designed to be used as part of a work restraint (see **2.15**) or fall arrest system (see **2.5**). Systems designed for work restraint only are not suitable for fall arrest.*

2.2 buildability
design solution that can be safely and practically constructed

2.3 building maintenance unit (BMU)
suspended access equipment intended to be permanently installed and dedicated to a specific building; BMUs consist of a platform, suspended from a suspension rig that is generally a trolley unit with a hoist operating either on rails or on a suitable surface

NOTE For further information see BS EN 1808.

2.4 designer
person who prepares or modifies a design or who arranges or instructs any person to do so

NOTE 1 Attention is drawn to the Construction (Design and Management) Regulations 2007 [3] for a more detailed definition of a designer.

NOTE 2 Designers can include the client, principal contractor, architects, consulting and contractor engineers of various disciplines, suppliers and manufacturers with design or specification responsibilities.

2.5 fall arrest system
personal fall protection system that limits the impact forces on the body of the user during the arrest of a fall

NOTE The height and consequence of a fall depend on the anchor position relative to the fall hazard and the equipment used.

2.6 hazard
any object, circumstance or activity with the potential to cause harm

*NOTE See **2.11** for a definition of risk.*

2.7 lettability
desirability of a building to a potential tenant

2.8 life cycle cost (LCC)
cost of equipment, materials or processes, including their maintenance provision to fulfil their function for the lifetime of the building

2.9 maintainability
ease with which a product, element, structure or building can be maintained in order to isolate defects or their cause, correct defects or their cause, make future maintenance easier or cope with a changed environment

2.10 mobile elevating work platform (MEWP)
mobile machine that is intended to move and raise persons in a platform to working positions

NOTE For further information see BS 8460.

2.11 risk
chance and consequence of harm occurring

2.12 rope access
technique using ropes to suspend or support a person, normally incorporating two separately secured systems, one as a means of access and the other as back-up security, used with a harness in combination with other devices, for getting to and from the place of work and for work positioning

NOTE For further information see BS 7985.

2.13 so far as is reasonably practicable (SFARP)
level of risk that is balanced against the cost, time and effort that is put into averting the risk

NOTE A point at which an action is not reasonably practicable is where the cost or effort of reducing a risk is disproportionate to the level of risk reduction that would be achieved.

2.14 work at height
work carried out at any place above, at or below ground level, including access and egress to that place, where, if precautions are not taken, a person could fall (from a higher to a lower level) a distance liable to cause injury

NOTE Work at height does not include slipping or tripping and falling on the same level.

2.15 work restraint system
personal fall prevention system that uses a body holding device connected to a reliable anchor to prevent a person reaching zones where the risk of a fall exists

2.16 work positioning
personal fall protection system that enables the user to work supported in tension or suspension in such a way that a fall is prevented

2.17 value engineering
organized approach to the identification and elimination of unnecessary cost

3 Design development process, including work at height

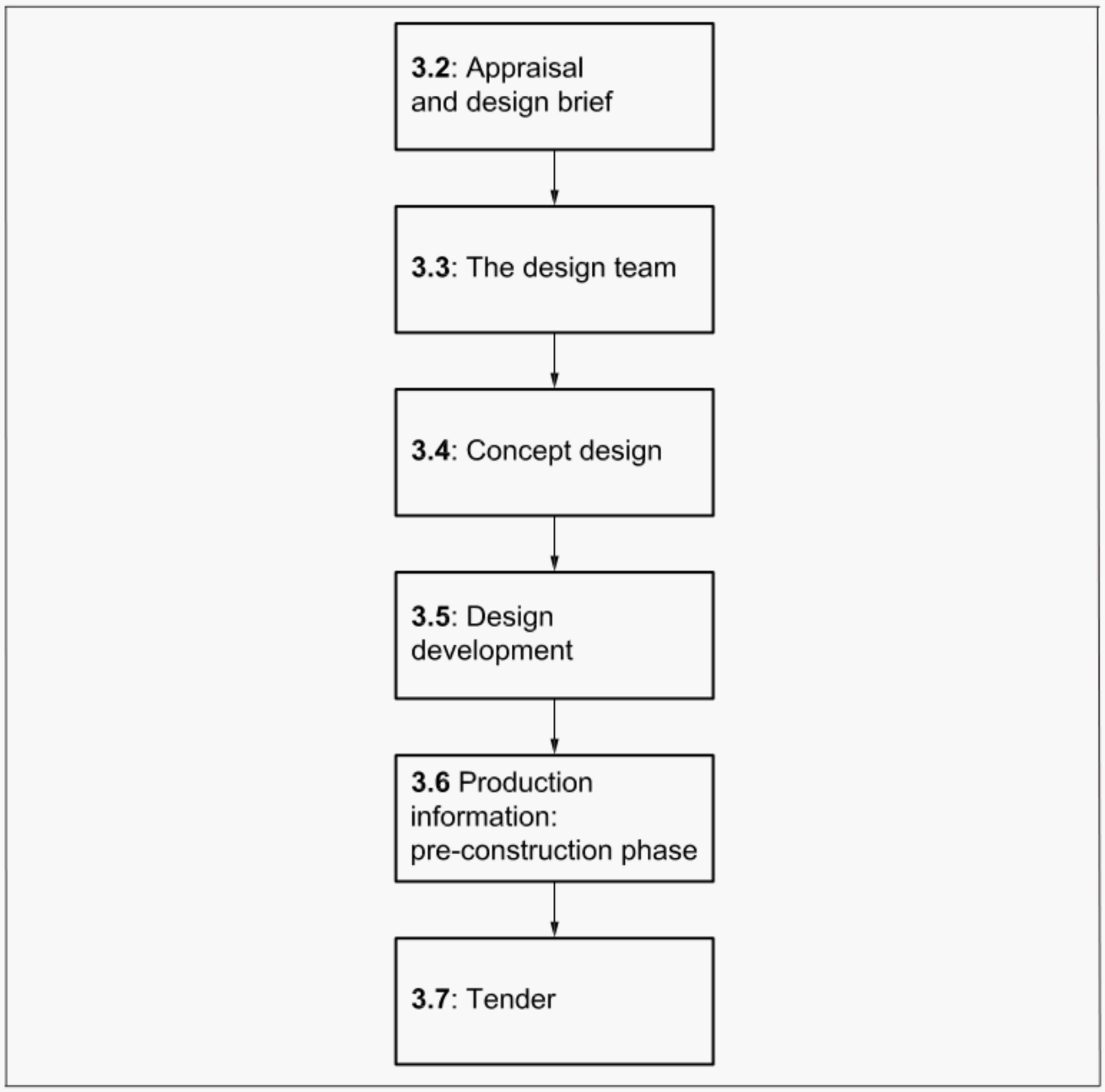
*COMMENTARY ON CLAUSE **3***

*Subclauses **3.1** to **3.7** cover the design development stages (see Figure 1) that are followed to develop the design of buildings. These stages are typically embedded into appointment contracts and dictate the design progress, client sign off and payment of fees. At each of these stages, recommendations for how safe work at height can be incorporated into the design are given; these stages also broadly follow the RIBA Outline Plan of Work [1]. Although the stages of the design process broadly relate to those of the RIBA Outline Plan of Work [1], they are flexible and often merge together within different forms of procurement, e.g. design and build contracts.*

*Many risks identified during the design process are commonplace and obvious to the design team (see **3.3**) who have to address them. During the design process these can be eliminated or reduced by conventional good practice, providing effective solutions for the permanent building, the construction phase and future maintenance. Significant risks are not necessarily those that involve the greatest risks, but those, including health risks, that are not likely to be obvious to other designers and competent contractors, are unusual or are likely to be difficult to manage effectively.*

NOTE Attention is drawn to the Construction (Design and Management) Regulations 2007 [3] and Work at Height Regulations 2005 (as amended) [2].

Figure 1 **Design process flowchart**



3.1 General

The design process and resulting construction and maintenance access strategy should minimize the need for work at height as far as is reasonably practicable. Where work at height is necessary, the design team should ensure practical and effective solutions are adopted to prioritize the prevention of falls in accordance with **3.4**, **3.5**, **3.6**, **3.7**, **3.8** and Clause **5**.

3.2 Appraisal and design brief

3.2.1 Appraisal

The client's needs and objectives for the design project should be identified, including possible constraints on development. The client should assess the options and feasibility studies to make a decision on whether to proceed with the further development of the project.

A site or existing building hazard survey should be provided to the designer and the design team should analyse this to identify significant work at height risks associated with the project.

NOTE Site hazard information could be found in an existing health and safety file or from a site survey, existing drawings, documentation or historical information.

At this stage, the designer should also take account of site and other project constraints, for example:

a) location and topographical features;

b) town planning limitations;

c) existing building details;

d) any project specific issues where work at height could be a significant consideration, e.g. observation platforms, unusual features, high-level lighting, etc.

3.2.2 Design brief

An initial statement of requirements should be developed into the design brief by, or on behalf of, the client, which confirms the key requirements (e.g. visual or aesthetic impact and/or economical design, etc.) and constraints of the project. The proposed procurement method, procedures, organizational structure, range of consultants and others to be engaged on the project should be identified.

3.3 The design team

The design team should have the appropriate expertise to advise on work at height from the concept stage (**3.4**) through to the detailed design stage (**3.5.3**) to achieve the following benefits:

a) minimizing the need to work at height;

b) provision of suitable safe access for work at height;

c) the selection of proprietary or bespoke equipment and solutions for access;

d) improved buildability;

e) minimizing the possibility of disruption and increased cost to the design, planning and construction process;

f) minimizing disruption and costs associated with maintenance and cleaning.

*NOTE 1 The design team would benefit from the inclusion and input from the following at the appropriate stages: client; client's facilities management (see Clause **9**); principal contractor, architects, consulting and contractor engineers; CDM coordinator; relevant specialist suppliers/contractors/consultants. Multiple roles can be provided by one (or more) person depending on the size, nature and complexity of the project.*

NOTE 2 The CDM coordinator and principal contractor are roles defined and set out in the Construction (Design and Management) Regulations 2007 [3].

Designers should have an understanding of the work methods required for construction, cleaning and maintenance, particularly if the work methods are complex or unusual.

Where there are parts of the design that could create significant risks during construction or future maintenance, they should be highlighted on the design (see Clause **4**) by the design team for those who have to manage them.

Designers should be assisted by the CDM coordinator to facilitate this process if a CDM coordinator has been appointed for the project.

3.4 Concept design

The design team should develop a concept design that meets the design brief (see **3.2.2**). This should start with initial proposals for the overall shape of the building, structural form, cladding and building services.

Based on these initial proposals the design team should identify construction, maintenance and access processes where work at height is required and manage these within the design process to avoid or minimize the risk. Where the design team does not have the competence to address these issues within the design process themselves, a specialist should be consulted.

To allow work at height to be carried out safely measures to mitigate and manage risk should be taken, which might include changes to the shape, form and materials to be used for the building and the envisaged provision of access equipment. The design team should prepare sketches and images that include potential work at height solutions, for approval by the client.

NOTE The following might have an impact on the way work at height is carried out and could lead to refinement of the basic shape and form:

a) the height and form of the building or structure, including elevations, atria, roofs, etc.;

b) the "footprint" and the shape(s) of the plan and surroundings of the building or structure;

c) the ratio of glazing to general cladding;

d) the largest area/size of glazing and therefore the weight of the glass and or cladding panel to be installed or replaced;

e) the topography/geographical area in which the building is to be situated might influence the frequency of cleaning and light duty maintenance that might be required;

f) conditions and load-bearing characteristics of the ground during construction and lifetime of the building.

By this stage, and where appropriate earlier in the design process, designers should be identifying and evaluating work at height issues; a document, such as Table A.1, can be used to list project specific characteristics and record designers' rationale for selecting particular equipment and techniques for work at height.

The information available to the design team at this stage should allow decisions to be made about the type of access systems that can be incorporated into the building and their basic requirements included into the design process. The design team should also advise the client on the proposed cleaning and maintenance strategy that could be used throughout the working life of the building.

By the end of this stage the concept design should have been developed into strategic proposals for the overall shape, structural form, cladding and building services. These should include identification of any permanent access equipment necessary for the maintenance and cleaning of the building. Outline specifications and preliminary costs should also have been established. There should be formal agreement with the client of the concept design.

3.5 Design development

3.5.1 General

During the design development stages given in **3.5.2** and **3.5.3** the concept design should be developed to produce more definitive information.

During these design stages the design team should continue to identify and assess features that might influence work at height, recording significant issues.

Table 1 and Table A.1 give examples of building and topographical design characteristics affecting the selection of access equipment for regular maintenance of external surfaces that the design team should take into account.

NOTE 1 As the project develops Table A.1 can be used to record relevant decisions and information for designers, consultants or contractors. This can be supplemented by Table B.1, which gives examples of means of access for work at height.

NOTE 2 The information recorded in Table A.1 might be useful when compiling any information required for the operation, ongoing maintenance or future alteration of the building. Relevant information from Table A.1 can be included in the health and safety file, which can assist owners, tenants and contractors involved in the maintenance of the completed building, as well as future designers and contractors undertaking alterations or decommissioning.

NOTE 3 Attention is drawn to the Construction (Design and Management) Regulations 2007 [3], which sets out requirements for the health and safety file.

Table 1 **Design characteristics affecting the selection of access methods**

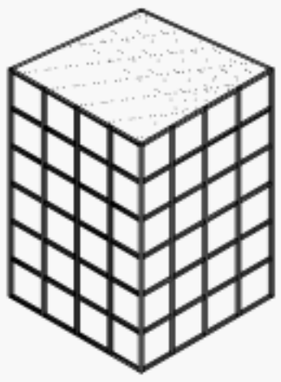
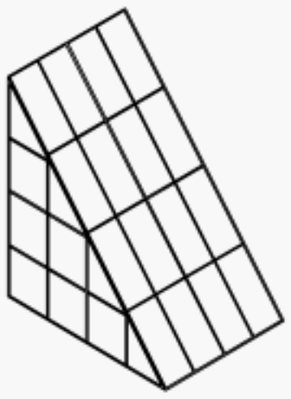
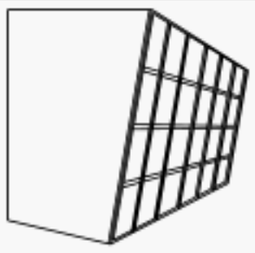
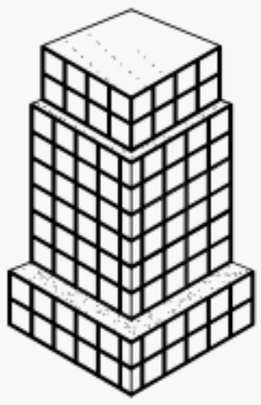
Building and site characteristics	Example	Limitation of access methods
Standard design		
	Vertical plane walls	Can use most methods, however: • Gantries rarely used • 3 or 4 floors for long poles • Ground based systems are typically used up to 6 floors, e.g. MEWPs • Suspended systems are typically used for 6 floors and above • Height greater than 40 m requires restraint ties for suspended equipment • Manually operated suspended equipment is limited to buildings up to about 15 m
Complex surfaces		
	Slope back (including roofs)	Access from ground requires outreach Access from above applies loads to surface unless suspension system provides outreach; cradles generally require mullion guides Gantry system might be applicable where it can span length of slope
	Slope out/negative incline	Access from above might require tie back system
	Step back	Access from below requires outreach to access upper sections Careful selection of MEWP might be required to reach all areas Access from above might be unable to reach whole facade in a single drop; jib supporting cradle might allow cradle to be moved out to accommodate step Separate access arrangement might be required for each section of wall; this requires intermediate roofs to provide suitable access to access equipment

Table 1 **Design characteristics affecting the selection of access methods**

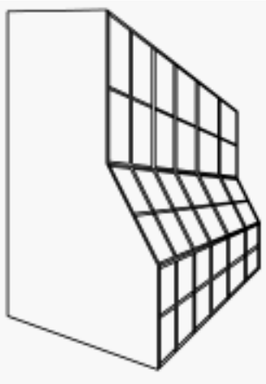
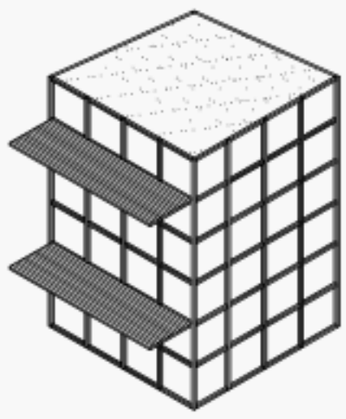
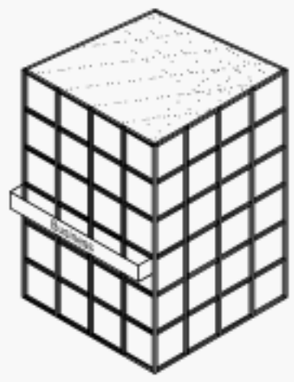
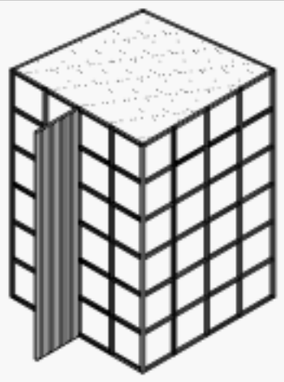
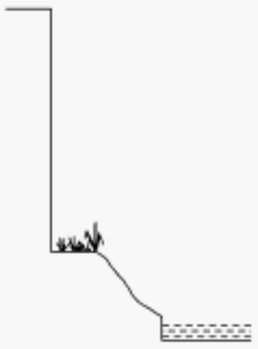
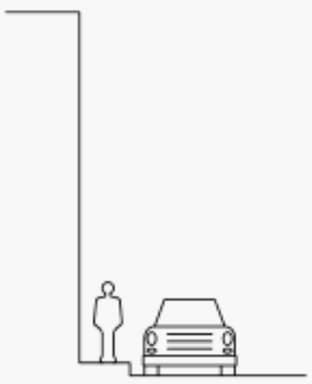
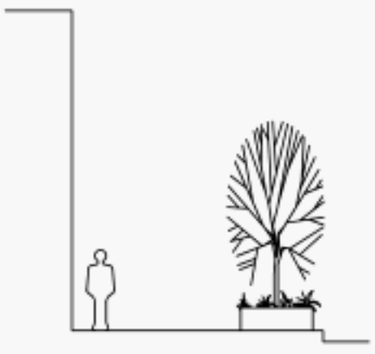
Building and site characteristics	Example	Limitation of access methods
Obstructed walls		
	Canopies, sloping glass roof below vertical wall	Access from below requires outreach Means of exit from bottom of drop required when using rope access Means of emergency escape needed at bottom of drop when using cradles
	Horizontal projections, e.g. brise soleil, roof overhangs, supporting structural members, etc.	Might obstruct ground-based access methods Prevents close contact with facade using suspended access but can be overcome with special techniques, e.g. poles or counterweighted cradles Suspended access requires outreach to pass outside line of shading Cleaning might require use of wash poles from access equipment Maintenance (e.g. glass replacement) might require temporary removal of shading to gain close access to facade Brise soleil could be designed to provide a working platform, with other safety equipment Cradles require safety cutouts in case of catching on projections during raising and lowering Access might be required for maintenance of brise soleil
	Signage	Might obstruct access Might require maintenance
	Vertical projections, e.g. brise soleil, columns	Might interfere with movement of access equipment along facade, especially gantries Problem avoided with cradles by raising before moving

Table 1 **Design characteristics affecting the selection of access methods**

Building and site characteristics	Example	Limitation of access methods
Surrounding ground		
	Soft ground, planting, water feature, slope, weak floor/ground	Unsuitable for ground-based access unless outreach from hard level area is possible Means of exit from bottom of drop needed where using industrial rope access above water When using cradles above water provision of emergency escape is required at the bottom of the drop Deep water requires special measures, e.g. rescue arrangements
	Trafficked areas including pedestrian	Closure of area during maintenance is required unless access from above can be used and a canopy can be provided to catch falling objects, depending on the nature of the work vertical netting might be required to contain debris For public areas the Highway Authority might place restrictions on work (including areas that only affect pedestrians)
	Obstructed areas, e.g. trees, street furniture, adjacent buildings, narrow doorways/stairs	Might prevent vehicular access to facade for ground-based equipment
Surface characteristics of facade		
—	Fragility Strength	All equipment except gantries might bump against the facade: cradles need suitable buffers, MEWPs need to be carefully operated
	Marking Staining	Might be caused by rubbing of cradles moving up and down in same position
Roof characteristics [A)]		
—	Load capacity	Cradle systems and gantries impose significant loads on structure
	Varying level	Might prevent the same equipment being used for whole facade
	Continuous access to edge	Lack of continuous access might require cradle suspension rail or long jib to support cradle
	Storage area	Required for maintenance equipment

[A)] Only applicable to suspended access methods. There should be safe means of access to the roof and any suspended access equipment (see **10.5.4**).

3.5.2 Scheme design

At this stage the design should meet the client's brief, be approved by the client and be suitable for the submission of a detailed town planning application.

Detailed decisions should be made about access equipment and working practices for work at height that affects the appearance or function of the building.

The design team should continue to identify hazards and progress the risk management process. The lead consultant should be satisfied that there are no insurmountable problems ahead concerning the integration of the specialist/consultants proposals for work at height provision into the overall design concept.

The client's formal approval should be obtained for the design and the budget prior to the start of the detailed technical design stage (see **3.5.3**); this prevents costly and disruptive changes occurring later in the project that might have implications for safe work at height. Any value engineering process carried out at this stage should ensure that the safety objectives with regard to work at height are not compromised.

Where the design team has chosen a particular methodology for implementing the design, which is part of an unusual construction or maintenance process, and which might include specific temporary work provision or sequencing, the proposed methodology should be communicated, as appropriate, to those who are:

a) involved in further design development; and/or

b) carrying out the construction and maintenance work.

NOTE 1 This might need advice from a specialist consultant or subcontractor.

*NOTE 2 If the project is to be passed to other design teams for detailed design or production information (see **3.5.3** and **3.6**), this would be an appropriate stage of the design development to do so. There would need to be clear communication with the other design team of the strategies and provisions in the design relating to work at height.*

3.5.3 Detailed design

At this stage the approved design should be developed with technical details. Input from consultant team members should be monitored, coordinated and integrated, including hazard and risk management information.

This design stage should also aim to:

a) provide details that aid buildability;

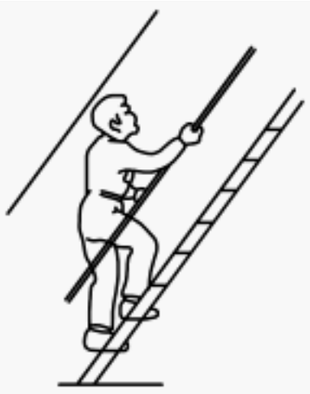
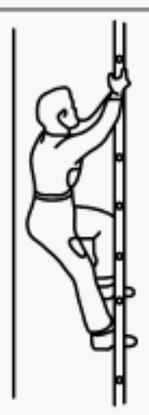
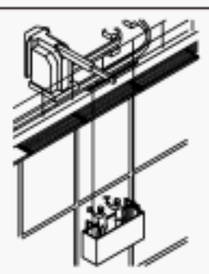
b) inform temporary work designers of any specific, unusual or significant requirements to be taken into account by the contractor during the construction phase to minimize the exposure of operatives to work at height.

A building maintenance and cleaning access strategy (see **10.1**) should be finalized. This should include, for example:

1) space for manoeuvring equipment/machinery;
2) ground and floor loadings;
3) platform capacities;
4) glass/facade panel replacement strategies including access and egress for cleaning operatives;
5) access for maintenance personnel (see Table 2 and Figure 2 to Figure 6);
6) arrangements for inspections;
7) storage for facade access systems.

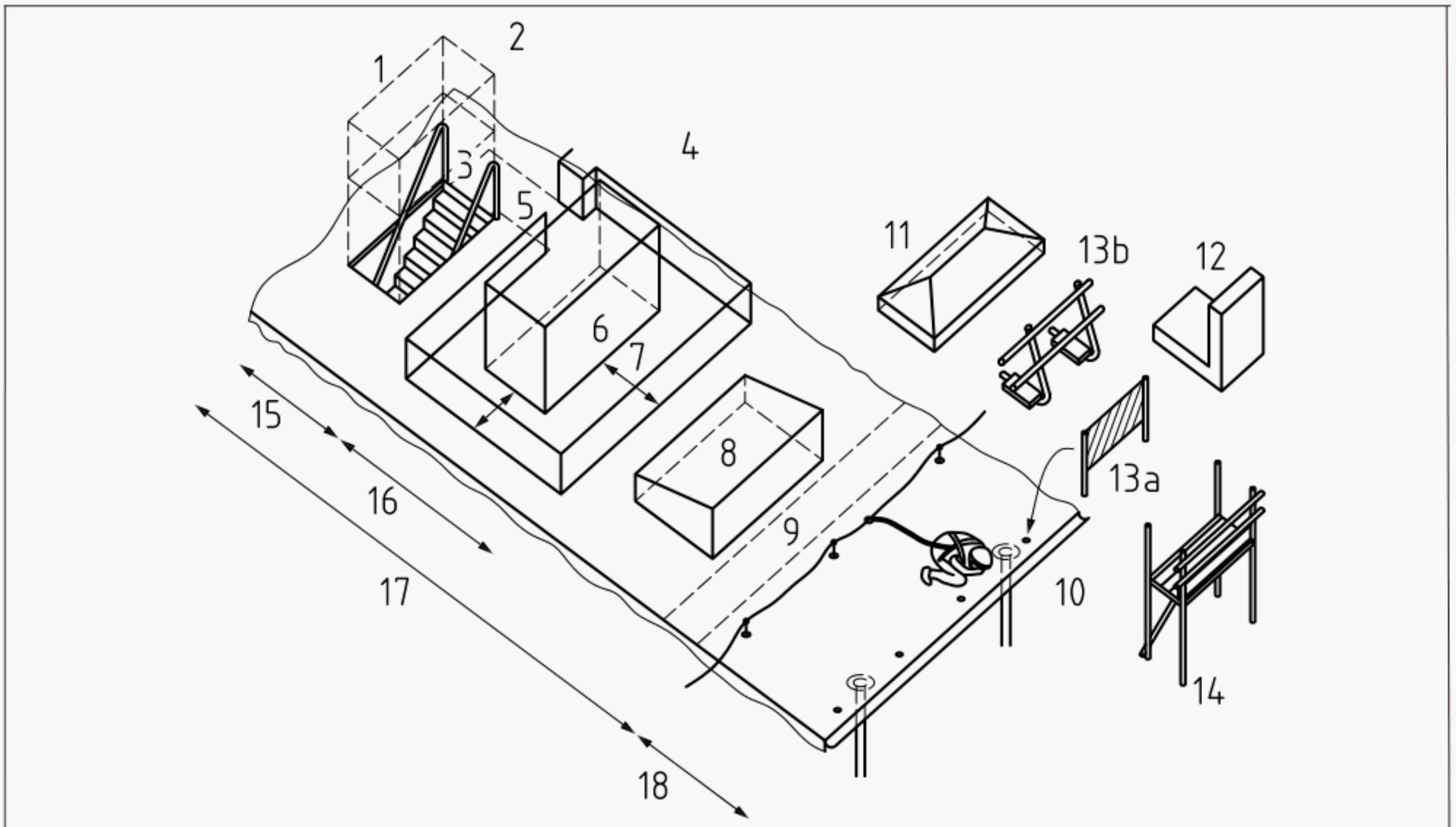
If specialist access equipment is required, specialist suppliers should be included in the design process.

Table 2 **Typical methods of permanent access to roof for maintenance**

Access type	Criteria for use	Standard
Ramp 	0°-10° Useful for plant removal and where low, gradual changes of level required.	—
Steps (straight or spiral) 	10°-38° Preferred type of access for regular maintenance, operatives carrying tools, tool boxes, spare parts and equipment.	BS 5395-1 BS 5395-2 BS 5395-3
Stepladders/ companionway ladders 	38°-75° Where less frequent access is required and only small tools and equipment need carrying in hands-free type carriers. Falling risks to be mitigated if adjacent to stairwells or low parapets.	BS 4211
Ladder 	75°-90° Where very low frequency access is required with minimal tools and equipment. Fall arrest systems and harness to be used and also intermediate platforms.	BS 4211
Lifts, BMUs 	Where specifically designed lifts or BMUs can be used for lifting tools, materials, spare parts and plant to maintenance areas without the need for carrying them.	BS 6037-1

NOTE This table has been adapted from C686, Figure 2.2, [6] with permission from CIRIA.

Figure 2 **Flat roof maintenance access: typical section of part of a roof**

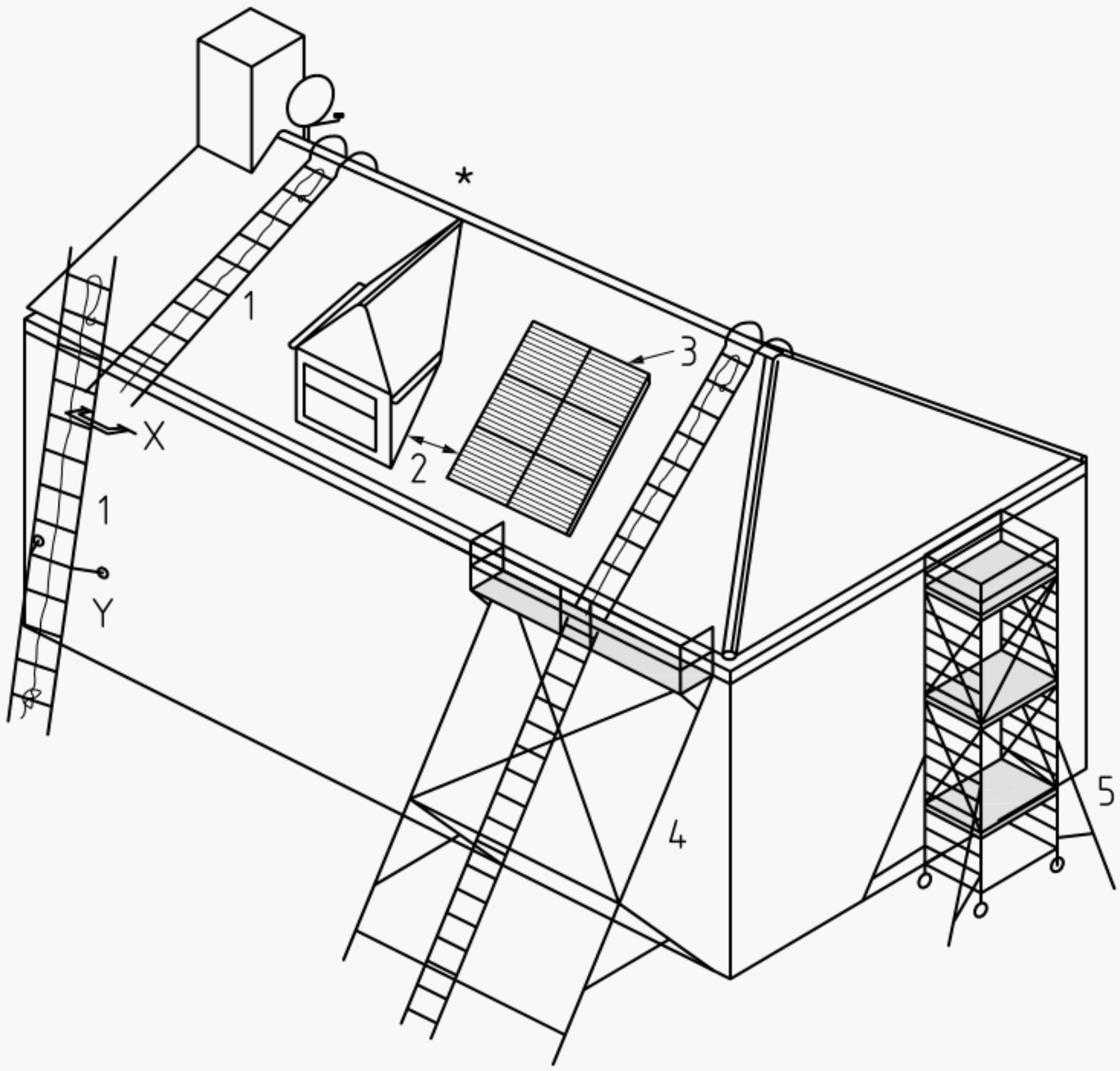


Key

1 Weather protective enclosure to access stairs
2 Gated protection to bottom or top of stairs, signage to indicate restricted work area
3 Roof access staircase in safe location, allowing operatives, tools and equipment to be carried up (or hoisted)
4 Plant and enclosure [A)]
5 Designated walkway from stairs to plant
6 Roof plant
7 Enclosed plant maintenance zone
8 Roof lights (fragile) [B)]
9 Walkway zone, non-slip finish, e.g. roof light cleaning zone/access
10 Rain water outlets or gutter [C)]
11 Alternative roof lights (non-fragile) [D)]
12 Permanent edge protection
13a Temporary edge protection: fitted into prepared sockets (during construction)
13b Temporary edge protection: counter weighted (during construction, maintenance and repair) [E)]
14 Temporary perimeter scaffold and barrier (during construction, maintenance and repair)
15 Access to roof zone
16 Protected enclosure zone, no harness or attachment required
17 Zone where attachment to a fall protection system is not required
18 Fall prevention zone, with edge protection or work restraint (harness/lanyard/anchor system) attachment required, appropriately delineated [F), G)]

[A)] If it is a modular plant, crane access is required for installation, replacement or removal.
[B)] If this is less than 950 mm high, or where a risk assessment determines for the specific circumstances, edge protection or non-fragile glazing should be used.
[C)] Rain water outlets and gutters should be set back from the edge where possible.
[D)] The design team should specify non-fragile roof lights where lower than 950 mm from roof level or where risk assessment requires it for specific circumstances, e.g. for a refurbishment project where they are replacing existing lights.
[E)] This type of system is often used permanently.
[F)] The width is dependent on a risk assessment of local environmental conditions but should be not less than 3 m.
[G)] The harness zone is for low frequency access and low intensity use: training is required.

Figure 3 **Access to low-rise pitched roofs for short duration construction work**



Key [A)]

* Permanent roof anchors may be designed and installed for maintenance access [B)], see Figure 6.

1 Leaning ladder restrained by tensioned strap to temporary or permanent anchors Y [C), D)] and fitted with a stand-off device at eaves level. Roof ladder lashed to leaning ladder at X

2 Access space [E)]

3 Solar panels

4 Proprietary lightweight access platform with roof ladder

5 Scaffold tower

[A)] Users of the equipment in 1, 4 and 5 should be trained and competent in the use of the equipment and techniques.

[B)] For further details on anchors see BS EN 516, BS EN 517 and BS EN 795.

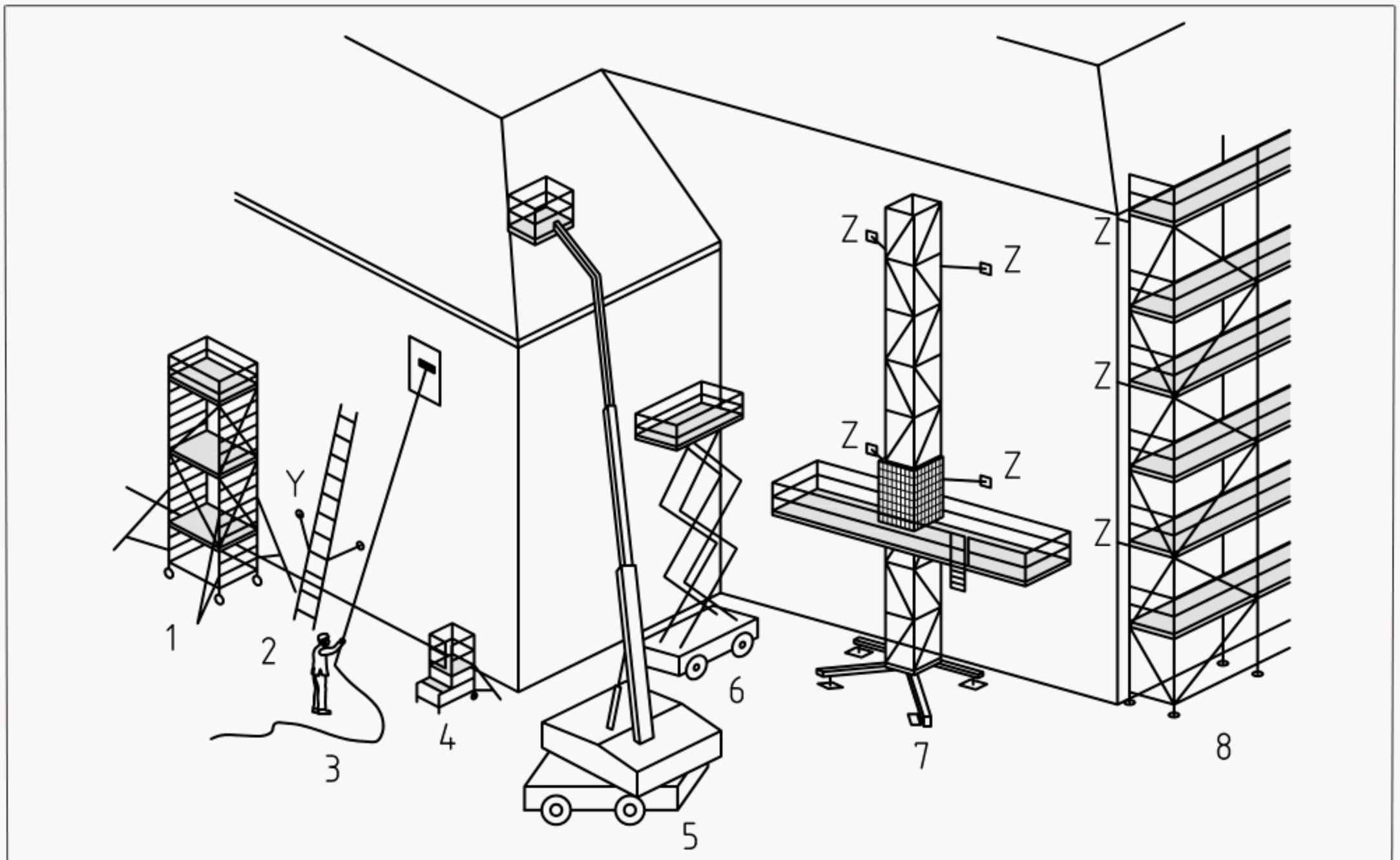
[C)] Ladders should be used with a proprietary fall arrest system (see **2.5**).

[D)] Ladder anchors should be located at all positions where ladder access might be required.

[E)] Where solar panels are to be installed, space should be left for access to areas where maintenance can be expected, e.g. ridge, dormer window gutters, flashings.

NOTE Short duration work is lightweight minor repair/maintenance work, taking minutes on the roof to carry out.

Figure 4 **Ground- and floor-based equipment**

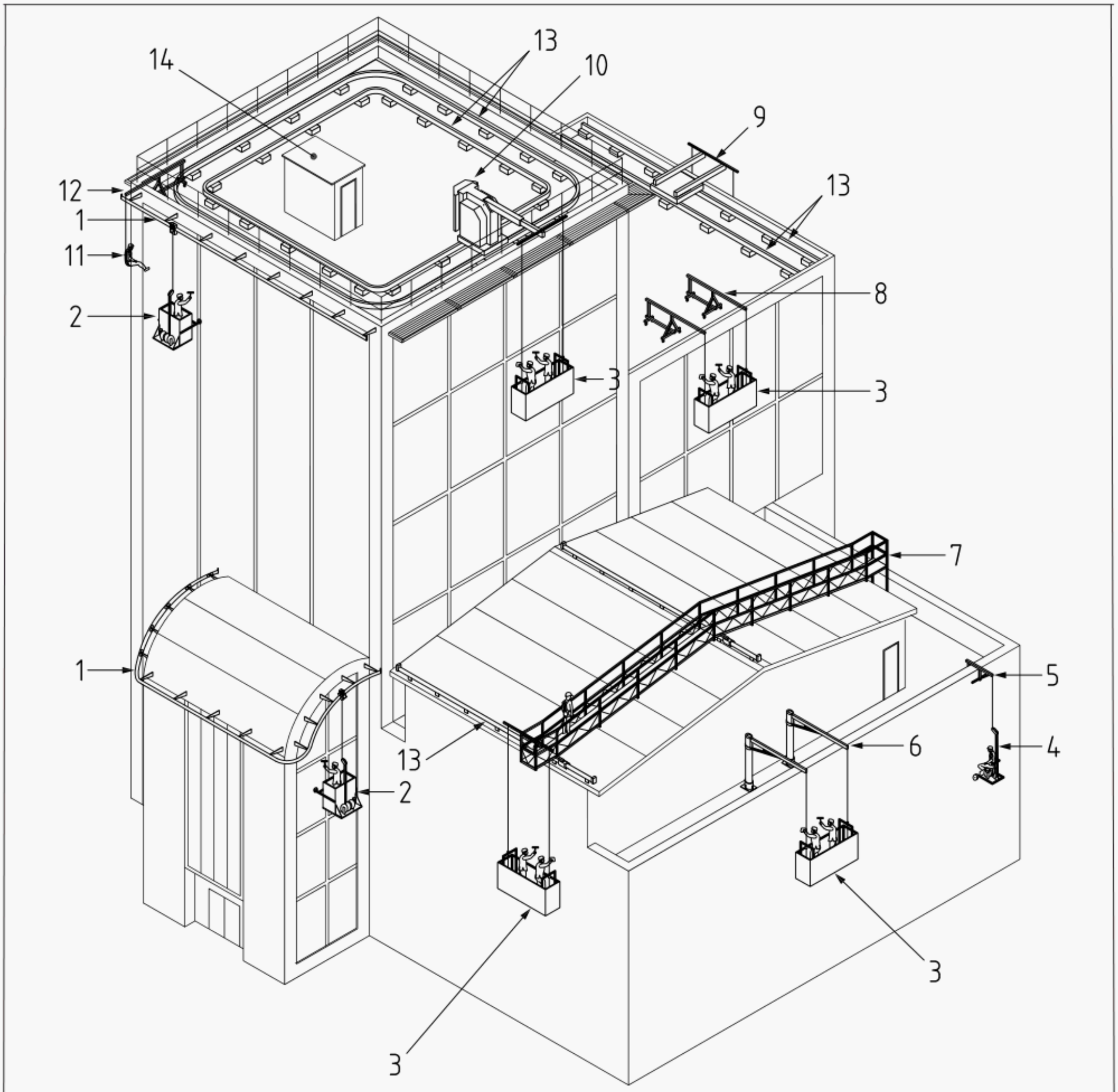


Key

1	Mobile tower scaffold	Y	Ladder tie
2	Portable ladder	Z	Tie to structure
3	Long reach pole		
4	Low level platforms (podium steps)		
5	MEWP: boom		
6	MEWP: scissor lift		
7	Mast climbing work platform (ground fencing omitted)		
8	Scaffolding		

NOTE Ground and supporting surface to be suitable for the loads imposed by the access equipment.

Figure 5 **Building-mounted access equipment**



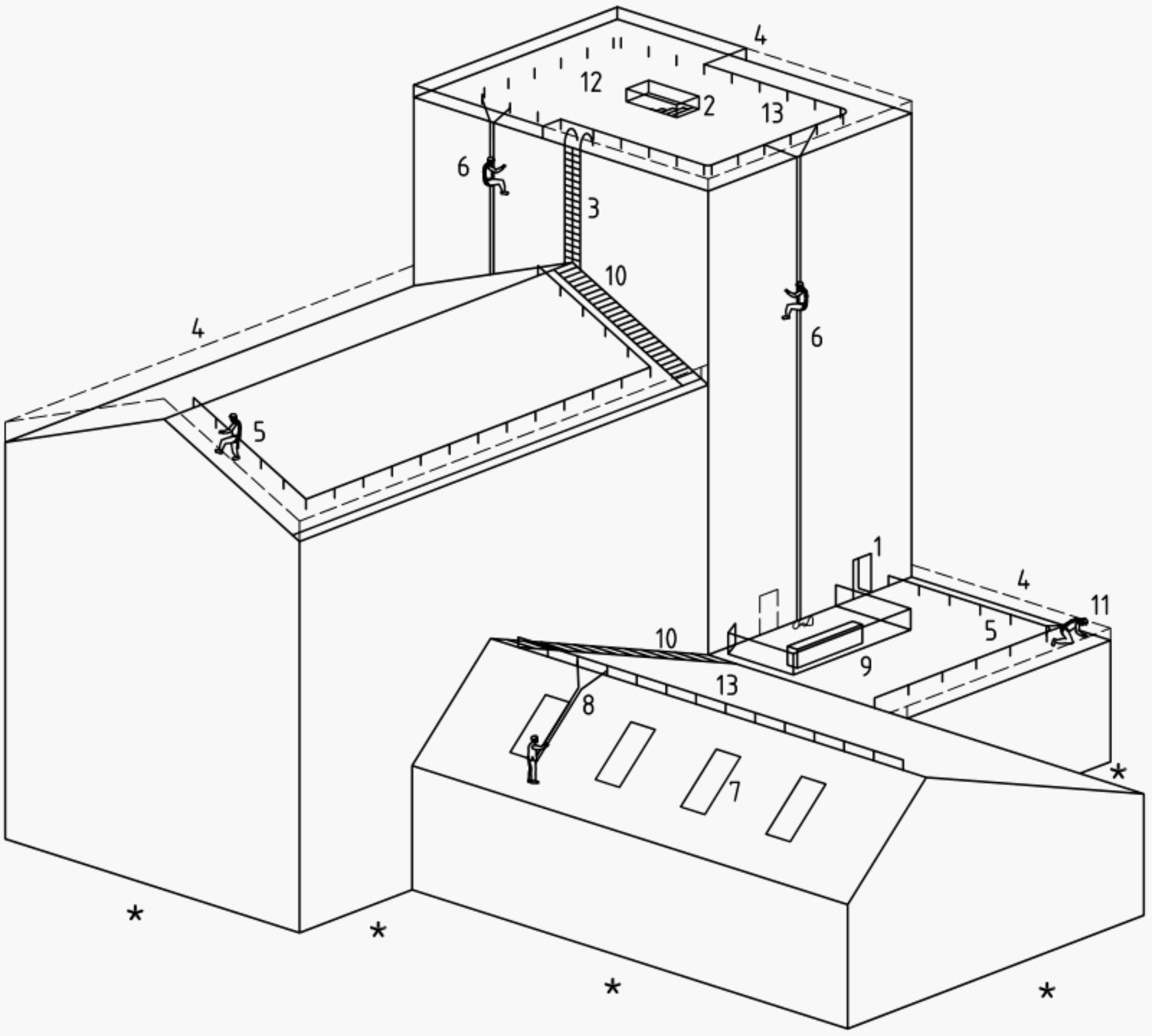
Key

1	Monorail	8	Counterweighted mobile jibs	[A] A method for operatives to reach the facade should be specified during design, e.g. long-handled tools, counterweighted cradles, etc.
2	One man cradle	9	Low profile roof trolley	
3	Two man cradle/BMU	10	Fully powered BMU with outreach to suit brise soleil [A]	
4	Powered seat	11	Industrial rope access technician	[B] Details of anchor requirements for rope access are given in BS 7985. Also see Table B.1 for rope access.
5	Parapet clamp	12	Counterweighted jib provided for rope access [B]	
6	Davits	13	Track	
7	External gantry	14	Roof access with enclosure	

NOTE 1 Specialist design is needed for rope access.

NOTE 2 Access to building mounted access equipment from a safe place including a safe means to transfer to and from the equipment to the building is needed. A means for lowering the suspended equipment to a safe place at ground level or to part of the building where there is access for the operatives to access the building or a means to continue down to the ground level is also needed.

Figure 6 **Building-based personnel access systems**



Key

* Access from ground preferred in these areas unless other factors prevent

1 Access doors or openings

2 Roof access with stairs and edge protection to opening

3 Vertical access ladder with fall arrest system

4 Edge parapet as preferred option

5 Anchor line (see **2.1**)

6 Rope access system [A)]

7 Non-fragile roof lights and roof

8 Rope access work positioning [A), B)]

9 Plant enclosure

10 Inclined roof access used with fall protection system

11 Work restraint system [A), C)]

12 Rope access anchors [A), D)]

13 Anchor line with support posts specifically designed for rope access [D)]

[A)] Specialist design is required for anchors for rope access (see BS 7985) and fall arrest, work restraint and work positioning (see BS 8437). Also see **10.5.2** and Table B.1 for rope access, work positioning and work restraint.

[B)] Where work positioning is carried out without eaves or gable edge protection present, an independent safety line attached to a separate anchor should be used in conjunction with the main working line.

[C)] When a flexible anchor line is used for work restraint, deflection of the anchor line should be taken into account.

[D)] Parapets and building perimeter edges should be designed to prevent rope damage, i.e. no sharp edges.

3.6 Production information: pre-construction stage

The fundamental principles of the aesthetic, structural and dimensional design of the building should have been agreed by this stage and only minor changes should be undertaken.

At this stage the following should be prepared and finalized for tender:

a) detailed information for the construction phase;

b) risk management documentation (pre-construction information);

c) information for options on temporary fall protection systems (e.g. Figure 2, Key 13 and 14) where unusual and significant work at height is required.

NOTE 1 Where the shape/form of the building design demands unusual or specific requirements of the temporary works and access systems, the design team might need to have a greater input into its design.

NOTE 2 The main contractor and specialist subcontractors are usually responsible for designing temporary works, including access and fall protection for the safety of those working on the temporary works.

The information provided by specialists should be analysed and integrated into the design.

NOTE 3 If detailed specialist contractor information is not available at this stage, this can result in late changes after contract appointments are signed causing disruption to the procurement process.

3.7 Tender

3.7.1 Tender documentation

At this stage tender documentation should be prepared in sufficient detail to enable tenders to be obtained for the project. Preconstruction information should be included to enable tenderers to make allowance for temporary works, protection and safety measures.

Where there are unusual work at height hazards that present significant risks, relevant information should be provided and highlighted in the tender documents and drawings.

NOTE 1 Significant risks are not necessarily those that involve the greatest risks but those including health and safety risks that are:

a) not likely to be obvious to a competent contractor or other designers;

b) unusual;

c) likely to be difficult to manage.

A list of itemized health and safety critical items should be included in the invitation to tender documents. The itemized costs in the tender return should be used for assessment.

NOTE 2 It is recognized that including too much generic information in the tender documents is unhelpful.

3.7.2 Tender appraisal

Potential contractors and/or specialists should be identified and evaluated. Returned tenders should be appraised and then recommendations should be made to the client by the design team on their suitability. Returned tender documents should be specifically analysed to identify how contractors address work at height issues. In the case of design and build this should include the appraisal of the design and build contractors proposals regarding any operational work at height requirements. Specific questions relating to work at height should be asked at contractor interviews.

Alternative proposals for work at height submitted by contractors should be evaluated.

Any value engineering process should refer back to the recorded design decision and rationale to ensure that the work at height objectives have not been compromised.

3.8 Construction phase

The contractor should utilize the information provided by the design team about significant risks arising from the design to manage those risks during the construction phase.

Where significant design changes are proposed during the construction phase, these changes should be reviewed to take into account the impact on safe work at height. Where the contractor is responsible for completing the design, the contractor and specialists should provide detailed fabrication drawings or alternative designs as early as possible after being awarded the work. The design team should review and assess these against the detailed design to ensure that the objectives of the design, including safe work at height, are met.

On practical completion, information relevant to safe work at height practices for cleaning and maintaining the building should be given to the owner/occupier/user of the building by the design team; this might include information provided/developed by specialist suppliers of equipment.

NOTE Typically this information is included in the health and safety file.

4 Communication

Designers should communicate their intentions with regard to the management of safety risks (as with other aspects of the design) to the rest of the design and construction team, using building information modelling (BIM) systems, drawings, sketches, written schedules and specifications in an agreed format.

Information should be provided in a format that is clear to the user and focuses on the significant health and safety risks present. This should be achieved by means of symbols and written annotations on project drawings (see Figure 7).

Generic, trade competency or trade interface related and obvious health and safety risks should not be highlighted in this way unless the context makes them unusual. Residual significant risks should be highlighted on drawings to enable the contractor to plan for and manage these risks. Where there is complexity, a more detailed register for coordinating health and safety risks, referenced to the drawings, should be used.

NOTE 1 The register can also perform a useful administrative, tracking and management function.

NOTE 2 Standardized visual tags or symbols can be used that follow established safety signage to identify and communicate the significant health or safety hazards (see BS ISO 7010).

Figure 7 **Symbols**

a) Use to avoid or refrain from a particular action (red on white)

b) Use to indicate a required particular action by the contractor (light blue)

c) Use to convey some relevant information (light blue)

d) Use to warn of significant hazards or information that is unusual (yellow background with black)

NOTE See BS ISO 7010 for safety symbols.

5 Designing for the safety of operatives working at height

Designers should avoid significant, foreseeable hazards and risks being incorporated into their designs. Where hazards cannot be eliminated, suitable control measures should be incorporated to manage the risks associated with these hazards to an acceptable level; this relates to the construction process, operation, maintenance and cleaning of the building.

The design intent of the building sometimes means that work at height hazards cannot be eliminated; the designer should ensure that safety is prioritized by selecting methods of work that reduce the risk of a fall to an acceptable level.

NOTE Attention is drawn to the Work at Height Regulations 2005 (as amended) [2], which refers to the height safety hierarchy that can be used in the selection of suitable control measures.

Designers should address work at height risks in accordance with a) to c) and Table 3.

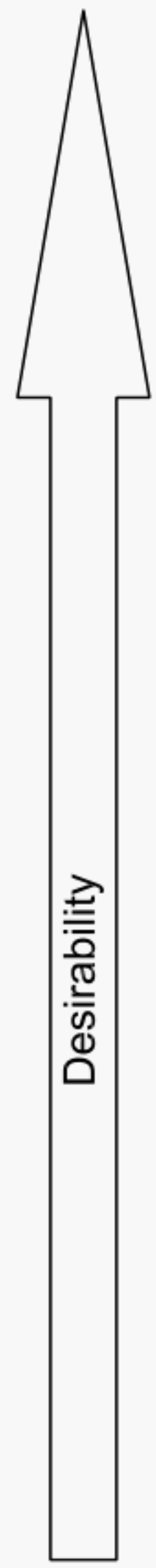
a) Avoidance: where possible the design team should avoid the need to work at height.

b) Prevention: where avoidance is impractical, the design team should incorporate measures that prevent falls or that prevent operatives accessing a position from which a fall could occur. The design team should select permanent measures ahead of temporary ones and collective measures that protect all from falling, ahead of personal ones that only protect an individual. The design team should recognize that passive measures (measures requiring no action on the part of those protected) offer greater safety benefits than active measures (measures which require specific action on the part of the user to be effective).

c) Mitigation: where fall prevention is impractical, the design team should select measures that minimize the height and the consequences of a fall, again selecting collective measures ahead of individual ones and permanent ahead of temporary. If a fall arrest or work positioning system is selected, the designers should ensure that rescue is possible (see **10.5.7**).

Table 3 **Work at height control measures**

Control measures	Examples of control measures	Desirability
Avoid the need to work at height [see a)]	Offsite prefabrication: modular construction, precast concrete, unitized curtain walling, steelwork assemblies. On site assembly at ground level: steelwork assemblies. Use of low maintenance materials and equipment: self-cleaning glass, fibre optic lighting, glass reinforced plastic/polyester mansards and chimneys. Ground/floor-based maintenance: lowerable light systems, long-reach washing poles, items requiring regular maintenance reachable from floor/ground level. Inclusion of temporary protection measures: offsite pre-fixed handrails/guardrails to stairs and roof edge beams. Remote access solutions: robotic equipment.	Most
Prevents falls: collective [see b)]	Parapets, guardrails, BMUs, MEWPs, scaffolds, tower scaffolds, safety decks, no fragile surfaces, podium steps.	
Prevents falls: personal [see b)]	Rope access, anchors and anchor lines for work restraint.	
Minimizes the height and consequences of falls: collective [see c)]	Safety nets, perimeter catch fans, crash decks, scaffold fans. All rigged as close as possible.	
Minimizes the height and consequence of falls: personal [see c)]	Harness, lanyard, anchor or anchor line-based fall arrest methods: window cleaner anchors, ladder fall arrest systems, retractable fall arrest blocks.	
Minimize the consequence of falls: collective [see c)]	Remote soft landing systems (air bags, bean bags), safety nets fitted at low level.	
Minimize the consequence of falls: personal [see c)]	Personal injury reduction (inflating suits).	
No fall protection: personal	Ladders, step ladders, hop-ups, stilts.	
No fall protection: collective	Unguarded edges, platforms, stages, loading docks.	Least



In selecting appropriate control methods, the design team should take into account the nature and frequency of the work and the make up of the work team. The aesthetic impact on the building and its function, alongside the other considerations of cost and practicality, should also be assessed.

6 Buildability

The ability of the contractor to ensure that work at height is carried out safely is influenced by the design; throughout the design process design teams should aid and improve the buildability of their designs.

Designers should ensure their designs are buildable.

NOTE 1 Designs that are buildable can improve safety by:

- *reducing the need for work at height;*
- *reducing the time spent on work at height;*
- *ensuring materials can be handled with the most appropriate equipment;*
- *ensuring work can be carried out from a place of safety on the building without the need for additional access equipment.*

NOTE 2 The design of facades, for example curtain walling, can have a significant effect on the ease with which they can be constructed.

Prefabrication can reduce the time needed to work at height; designers should be involved in devising safe methods of installing prefabricated units or assemblies with specialist contractors/designers.

NOTE 3 Prefabricated cladding units may be installed from within the building thus reducing the need for work at height.

NOTE 4 Particular challenges are associated with large units or those with projecting shading (brise soleil).

Specialist contractors experienced in the design and installation of prefabricated elements should be consulted before the design team finalizes the design to avoid access difficulties during construction and later for cleaning, maintenance and repair.

Prefabricated structural components, e.g. stairs, bridges, etc., should be designed so that barriers or guardrails can be attached prior to installation. Where this cannot be achieved barriers or guardrails should be designed for ease of installation; their fixing positions and form should not conflict with the permanent works.

NOTE 5 Methods, equipment and preparation for temporary access for work at height, during the construction phase of a project, are normally within the control of the principal, or main contractor, in conjunction with their subcontractors.

Permanently installed access equipment should be incorporated into the structure of the building during construction (i.e. anchor points for rope access and fixings for BMU track systems and BMUs); early provision of this permanent equipment during construction can provide the contractor and end user with a safe and reliable access system.

7 Occupiers and end users

NOTE 1 Those involved in work at height can range from specifically trained specialist contractors who regularly undertake work at height, visiting contractors who might be competent to work at height but might not be familiar with the building or its safety systems, to building users and occupiers who might have no experience or training to work at height. This varies and is dependent on the building type, tenure arrangements and nature of the client organization.

The design team should evaluate what tasks need to be carried out at height and who is likely to undertake them. The design team should then select equipment and systems of work that are appropriate for the assumed level of competence of those likely to carry out work at height.

The design team should communicate information about how work at height can be undertaken safely, in a format appropriate (see Clause **4**) to those likely to carry out work at height.

The level of competence required to use the selected control measure, and the potential behaviour of those involved, should be used to determine what preventative measures are to be provided and also what level of information should be provided by the design team to users. To reduce the risks associated with work at height, the design team should balance the level of protection against the user's competence.

NOTE 2 This requires considerable negotiations and consultation with the client's end user and is not always possible at design stages.

8 Balancing capital and life cycle costs

Capital costs only represent a proportion of the total lifetime costs of running and maintaining premises and the ongoing costs for cleaning and maintenance should be included when design options are presented to clients by designers.

NOTE 1 Where work at height is required, the cost of carrying out the work is affected by the direct cost of providing access equipment and the efficiency with which the work can be carried out from the access provided.

NOTE 2 Ongoing costs associated with gaining access to roofs, facades or plant rooms can be reduced through design, e.g. a permanent staircase might initially be more expensive to provide than a ladder but might allow work to be carried out more efficiently and avoid the need for an assistant or material hoist when work is required.

The design team should select materials and components based on stability, durability, weathering, insulation and fire resistance. The design team should utilize performance data on the anticipated life of the materials and maintenance regimes from the supplier or manufacturer.

Where permanent access equipment is provided for work at height (e.g. BMUs, anchors and anchor lines), ongoing costs for inspecting and maintaining such equipment as well as the operational costs for the use of equipment should be included in life cycle costs of the building. Similarly, the costs of hiring in temporary access equipment (e.g. MEWPs) should be added into the life cycle costs of cleaning, repairing and maintaining the building.

NOTE 3 The lettability of a building is influenced by the long-term life cycle costs, which depend on the effectiveness of cleaning and other maintenance activities to the internal and external fabric of buildings, including facades, roofs, windows, internal finishes, heating and ventilation services, etc.

NOTE 4 For further information on life cycle costing see BS ISO 15686-5.

NOTE 5 For low-rise buildings, e.g. a two-storey dwelling house, the choice of a pitched roof with a tile that has an anticipated life of 60-80 years provides significant savings over the costs of maintaining a flat roof covered in roofing felt that might require replacement every 15-20 years, but the capital costs for the pitched roof would be greater.

9 Facilities management

The facilities management team should be involved in the design and decision making process (see **3.3**); this team manages or carries out the cleaning, maintenance and repair using any equipment and physical measures provided. The facilities management team have valuable knowledge and skills that should be fed into the design process at an early stage to help produce a practical, cost-effective strategy for cleaning, maintenance and repair.

NOTE It is preferable for this to be the end user or occupier's facilities management team.

10 Maintenance strategy

10.1 General

The design team should develop a maintenance strategy to ensure that all foreseeable maintenance can be carried out in a manner that provides an acceptable level of safety for the circumstances. This should be taken into account at the scheme design stage (**3.5.2**) to ensure that provision for access for work at height can be accommodated in the design and that external access arrangements satisfy town planning considerations. This should be done in three stages:

1) identification of work that might need to be carried out;

2) selection of access methods to allow this work to be carried out;

3) design of the building to allow the proposed access equipment to be used.

NOTE Where access is difficult or unsafe, there is a high probability that the building or element that is difficult to reach is unlikely to be maintained, leading to early failures and a shortened life of the building.

The maintenance strategy should be finalized during the detailed design stage (see **3.5.3**).

10.2 Maintenance operations

The design team should identify maintenance operations that are likely to be required during the life of the building; these depend on the nature of the structure and the materials used but might include:

a) cleaning:

   1) frequency depends on materials used and nature of structure, for example:

      i) glass might require cleaning monthly or quarterly;

      ii) metals and paint finishes might require cleaning quarterly or annually;

      iii) stone, concrete and brick might not require regular cleaning;

   2) personnel access at height might not be required to external surfaces if:

      i) windows are cleanable from inside the building;

      ii) water-fed long poles can be used;

b) inspection:

   1) regular inspection, e.g. for statutory, insurance and warranty purposes; where regular inspection is not required the designer should still allow for inspection to investigate possible defects and deterioration, such as sealants;

c) routine maintenance:

   1) moving equipment, e.g. mechanical blinds, that is either part of the structure or supported by the structure might require access for maintenance;

   2) changing lightbulbs and accessing surface mounted machinery, e.g. CCTV cameras, burglar alarms, etc.;

d) isolated repair:

   1) isolated repairs might be required at unplanned intervals to rectify accidental damage and faults, including broken glazing units, local sealant failure and broken window hardware;

e) widespread repair:

1) replacement of glazing units;

2) replacement of gaskets;

3) replacement of sealants;

4) replacement of finishes.

10.3 Maintenance considerations

The following factors affect maintenance and should also be taken into account:

a) selection of materials: maintenance requirements are related to material type and quality;

NOTE 1 For example low quality materials might be cheaper at the time of construction but require replacement after a short period in service. Self-cleaning materials, for example self-cleaning glass, might allow longer intervals between cleaning cycles, and the use of long life lighting reducing frequency of access.

NOTE 2 Environmental considerations and energy performance might result in the selection of materials and components that do not provide optimum durability and might result in the selection of materials that impose greater requirements in respect of future maintenance i.e. require ongoing maintenance and earlier replacement than would otherwise be the case than if designers were selecting the components or materials on the basis of durability alone.

b) size of components:

1) determines the capacity of lifting equipment required for replacement;

2) might determine whether the proposed permanent access equipment for general maintenance is sufficient or whether additional lifting equipment is required;

3) large components might not fit within lifts or might be too large to handle and install from within the building after false ceilings and floor finishes have been fitted, e.g. this could undermine proposals to replace glazing from inside the building;

c) detailing to avoid dirt accumulation, e.g. cornices and drip features, might increase intervals between cleaning;

d) fixed features and equipment, e.g. bird protection measures, aerials, masts and brise soleil, might require maintenance or affect maintenance of the building;

e) access to plant.

Where plant or equipment is located at roof level and access is required on a regular basis, (in order to maintain the plant, replace individual components or replace whole items of the plant) permanent access should be provided; this might require the provision of a staircase up to and onto the roof or plant room because of the risks associated with carrying tools and components up and down ladders.

10.4 Selection of access equipment

Work at height requires a means of access that can reach the required area(s) of the building and provide a suitable work place for the operations to be carried out; where this cannot be achieved the design should be re-examined.

NOTE 1 Where handling replacement components and the additional weight reduces the outreach of access equipment to less than that required, the component weight could be reduced or separate lifting equipment could be provided. Alternatively, the capacity of the access equipment could be increased by providing purpose designed equipment rather than using proprietary products or the design of the building could be changed to reduce the required reach.

The building and topographical design characteristics that affect the selection of access equipment for regular maintenance of external surfaces are given in Table 1 and should be taken into account by the design team. Where relevant, the features in Table 1 should also be taken into account when selecting access methods for maintenance of elevated internal surfaces such as in atria.

NOTE 2 The typical capabilities and limitations of normally used access equipment are given in Table B.1.

The decision making process for a maintenance strategy should take account of the control measures for work at height set out in Clause **5**. The design team should focus on activities that are high risk and potentially difficult to manage.

NOTE 3 For example, the construction of a brickwork external wall to a normal two-storey house requires conventional scaffolding that can be managed by a competent contractor. However, if the same house is built in a different location, e.g. adjacent to a river or there is bespoke cladding requiring cranage, the work at height considerations would require more detail and specialist input.

Designers should understand the implications of incorporating features that require more complex, costly bespoke access solutions rather than those using standard equipment and techniques.

The nature of the work should be taken into account when selecting means of access.

NOTE 4 For example, standing at ground level or on a floor and using long reach tools might be appropriate for general cleaning, but other tasks might require the worker to be within touching distance of the surface and to be able to exert significant force.

Where the design team or contractors intend to use the same access equipment for cleaning and also maintenance or repair, or during construction to carry components, they should select equipment that is suitable for the combination of personnel and materials, and that the materials can be carried and handled in a manner that does not put personnel at risk.

An assessment of the plant and equipment required to carry out component replacement throughout the lifespan of the building should be undertaken and the following should be taken into account when being selected:

a) the nature of the components and how they are handled, fixed and released;

b) whether access is internal or external for the movement and handling of replacement components and associated equipment;

c) minimizing disruption to the occupants of the building, e.g. noise of BMU or cradle moving on the roof, and potentially also disruption of traffic and pedestrian movement around the building.

10.5 Design of the building and surrounding area/landscaping to allow the proposed access equipment to be used

10.5.1 Mobile ground- and floor-based access

The design team should ensure that:

a) sufficient space is provided at ground or floor level for use of the envisaged plant and equipment;

b) there is sufficient width and height around and through the building externally and internally for plant and equipment to access the required areas;

c) ground and floors and their surface finishes are adequate for the loads imposed by the plant and equipment proposed;

d) hard flat surfaces are provided for the use of the equipment (unless the equipment is designed for use on slopes);

e) obstructions restricting use, e.g. bollards, overhangs, power lines, soft landscaping and water features, are taken into account;

f) securing points for ladders are provided whether permanent or temporary.

10.5.2 Rope access

Where light duty inspection and maintenance is to be carried out using rope access, expert advice should be sought to confirm installation and operational requirements. The design team should provide:

a) sufficient and suitably positioned anchor points or means of anchorage of adequate strength for separate attachment of ropes to allow both horizontal and vertical movement across the area to be accessed;

b) edges over which ropes pass should have a shape, texture and temperature that do not damage the ropes;

c) safe access and egress to and from the anchor points for the attachment of the operative's ropes, supervision of the work and inspection of the anchors.

NOTE Light duty can include window cleaning sealant or gasket replacement, survey inspections, etc.

10.5.3 Mechanical structure mounted access

Where maintenance is to be carried out using bespoke access systems, such as cradles, BMUs, travelling gantries, etc., that allow operatives to be moved horizontally, vertically or telescoped in or out to achieve the best working position for efficient maintenance, the design team should ensure that:

a) sufficient space is provided for transverse movement of the equipment;

b) facade obstructions are minimized to reduce the complexity of access equipment;

c) outreach is minimized to reduce the weight of the equipment and the loads imposed on the building;

d) safe access and egress to and from the equipment is achievable;

e) safe access is provided to inspect and maintain the equipment itself;

f) the supporting structure is sufficient to sustain the loads imposed by the equipment, the operatives and the loads being carried;

g) where cradles are intended to be lowered over heights of more than 40 m, they have restraint in the form of cradle guides or discrete anchor points attached to the facade (see BS EN 1808);

h) the equipment can be removed/replaced safely in the future.

10.5.4 Roof access systems

10.5.4.1 General

Where operatives have to gain access to the roof of the building to carry out maintenance duties, the design team should:

a) evaluate the nature and frequency of the work to be carried out to determine the measures required to provide operatives with safe access to and from the roof and to their place of work on the roof;

NOTE 1 This could include the provision of stairs to the roof, parapets, guardrails or edge protected walkways.

NOTE 2 Advice on safe access and safety in carrying out work on roofs can be found in HSG33 [7]. Further advice is provided by the Advisory Committee for Roofsafety [2)].

b) assess the implications of interaction with and disruption to the buildings' occupiers when the use of common areas, stairs and lifts are to be used for access to the top of the building;

c) ensure that where hatches provide access to the roof, provision is made to prevent falls through the opening, e.g. by providing guardrails around the opening, and to prevent the ingress of water;

d) ensure that where ladders provide access to the roof, the frequency of use, the need for users to safely carry materials, tools and equipment for maintenance has been taken into account;

NOTE 3 Where materials, tools or equipment are too big or heavy to carry up ladders other provision is needed to raise them to the roof, for example, provision anchor points/lifting beams for hoists, lifting blocks and tackle, use of cradles/BMUs where installed, craneage, etc.

NOTE 4 The use of inclined and vertical ladders inhibits a person's capacity to carry tools and equipment to and from the roof.

e) ensure that where ladders are used to access roof hatches that provision is made to allow the hatch to be opened and closed from a safe position, e.g. by the inclusion of an appropriately sized and positioned platform, and access to and egress from the ladder to the roof can be made safely, e.g. by providing suitable handholds above the hatch level;

f) ensure that where there are long vertical ladders proprietary ladder safety systems are used, and that the bottom of ladders are not adjacent to unprotected edges where a fall could continue;

NOTE 5 Caged or hooped ladders do not provide an effective means of fall protection.

g) ensure that measures are provided to prevent unauthorized access to the roof, e.g. access to stairs or ladders being prevented by locked doors;

h) ensure that signs are placed at the start of roof access routes stating that unauthorized access to the roof is prohibited, and when specific equipment has to be used to access the roof, e.g. a harness and lanyard attached to an anchor or anchor line, signs should state this and also that such equipment should only be used by appropriately trained operatives;

i) ensure that there is safe access to and egress from the place(s) where a person can attach to and detach from an anchor or anchor line;

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2) The advice can be found at www.roofworkadvice.info.

j) ensure that where practicable the anchor or anchor line should be positioned and used in a manner that prevents a fall from the roof;

k) ensure that, where the use of MEWPs is proposed that there is sufficient level hard standing, and that they have sufficient reach and load carrying capacity;

l) eliminate the hazard of a fall through the roof by selecting non-fragile materials. If fragile elements are to be present they should be positioned or protected to prevent people encroaching onto them, and prominent warning signs should be placed at the approach to where the fragile surface is situated. A safe method of access to clean, maintain or repair/replace fragile materials should be used;

m) sloping or horizontal glazing should not be walked on unless specifically designed for this use. If there is a risk of construction/maintenance workers dropping tools onto materials that break under impact from tools, then the tools should be tethered to the worker.

All roof access systems should be periodically inspected.

NOTE 6 Substituting ladders for staircases, for example as part of a value engineering exercise, at design and construction stages can increase the difficulty and time taken for future maintenance activities, increasing lifetime costs and placing limitations on the type of maintenance equipment that can be used.

Existing stairs and lifts via common areas should be utilized, without disruption to occupants, to gain access, at least, to the top occupied levels.

10.5.4.2 Provision of edge protection

If there is a risk of persons falling from the roof where the design requires access to roof level, edge protection should be provided.

NOTE The nature of the edge protection is influenced by the use of the roof, who has access to it, the purpose for access and the frequency of access.

Designers should determine:

a) whether general access is to be provided onto the roof for the occupiers or limited only to maintenance personnel;

b) whether fragile elements are to be present in the roof [see **10.5.4.1**l)];

c) whether there is a need for plant and equipment to be located at roof level and regular access is required or whether it could be located elsewhere to remove a need to access the roof;

d) where plant and equipment is located on the roof, what provision is required for the safety of those installing and maintaining it, replacing components or whole items of the plant;

e) whether fencing/guard rails can be provided around the areas of plant and equipment and access route(s) over the roof to them, and whether access to all other areas of the roof can be prevented;

f) whether infrequent access is required for the purposes of gutter cleaning, maintaining roof lights, lantern lights or other installations at roof level;

g) whether the whole of the roof should be provided with edge protection.

There is no need for perimeter edge protection (e.g. parapet walls, balustrading) where access to the roof is very infrequent, however, the design team should assess how safe access can be achieved, for example for foreseeable maintenance.

Some roof coverings provided with a guarantee require annual inspections and/or cleaning and the design team should evaluate whether such requirements can be met without walking on the roof.

10.5.5 Access from within the building to external glazing

Where it is intended that maintenance of glazing is to be carried out from within the building, the design team should ensure that:

a) windows are of a type and style that allow cleaning and maintenance to be carried out safely from within the building;

NOTE 1 Cleaning of external glass from inside is only possible where a high proportion of the glazing is openable and fitted with suitable hardware. For further information see BS 8213-1.

b) any necessary anchors are provided for use during cleaning and maintenance;

NOTE 2 For further information see BS 7883.

c) any components that would need to be handled within the building are of a size and weight that can be accommodated;

NOTE 3 If glazing is to be replaced from inside the building, the size of panes are to be restricted to sizes that can be handled within the building. Larger sizes can be handled during construction before the installation of internal fit out and the ability to construct does not necessarily mean that subsequent replacement is possible.

d) restrictions on the use of the internal space that would be required to facilitate cleaning and maintenance are acceptable to the client.

10.5.6 Heavy duty ground-based access

Where it is intended that heavy duty work, such as the replacement of cladding, roof coverings or mechanical plant, requires the use of heavy duty access equipment, such as craneage, MEWPs, scaffolding or mast climbers, the design team should ensure that their stability can be accommodated by provision of a suitably robust supporting surface, and in the case of scaffolding and mast climbers provision is made on the building for the attachment of necessary ties.

10.5.7 Emergency evacuation and rescue plan

Emergency evacuation and rescue plans, for example in the event of a fire or a person becoming incapacitated, should be prepared by the occupier and users of the access equipment for those in suspended access equipment, carrying out rope access, working on roofs or in plant rooms. The design team should ensure that provision is made in the building to enable such evacuation and rescue.

10.5.8 Protection of finishes

Designers should specify cladding and finishes that can withstand likely impact and wear, and equipment or techniques that minimize damage and wear, for example:

a) buffers fitted to a cradle can protect cladding, however, it can be difficult to prevent damage from a MEWP with positioning dependent on the skill of the operator;

b) protective coverings to floors.

10.5.9 Equipment storage

The design team should incorporate adequate provision for the storage of the equipment when it is not in use and a suitable route to the working position.

10.5.10 Low-rise buildings

NOTE Where access is not normally required except for infrequent maintenance or repair, access to traditional pitched, mono pitch, curved or flat roofs on low-rise buildings relies on ground-based temporary access (e.g. scaffold, tower scaffold, MEWPs, ladders). Similarly so does the cleaning, maintenance and repair of gutters, downpipes, facias, windows and elevation features, e.g. timber cladding, tile hanging, brick and rendered surfaces.

The design team should evaluate the characteristics of the surrounding ground to ensure that it can support and allow enough room for access and use of appropriate access equipment for maintenance and cleaning tasks at the particular location (see Figure 3).

Annex A (informative) Project information

In Table A.1 an example of project specific characteristics is given; these characteristics can be used when determining the methodology for work at height on a building. This table is also an example of how this project information can be recorded and is a useful way of recording why certain decisions have been made.

Table A.1 **An example of a project information table**

Questions	Information	Comments	Design options
1) Is there adequate access around the building?	Public roads Private roads Other	• This information is relevant as there might be a plan to utilize roads or other public or private areas, to enable construction and maintenance operations to be carried out from MEWPs or a scaffold to provide safe access for operatives • This might require road closure, traffic control measures or exclusion zones	
2) Is commercial traffic present?	Yes No	If yes the predicted volume, frequency and times are required, and these could determine or limit working time for maintenance	
3) Is car parking to be included?	If yes, is parking to be: a) underground? b) surface only? c) multi-story? d) a combination of all of the above? No	This information is relevant as there might be: a) a plan to enable construction and maintenance operations to be carried out from MEWPs to provide safe access for operatives b) plan to utilize space in car park for access or store/park items of access plant during the working life of the building c) loading restrictions on the ground/structure	
4) Is there soft landscaping, sloping ground, water features adjacent to the building?	Yes No	If yes, how does this affect access of ground-based access equipment, e.g. need for longer reach equipment, use of MEWPs with telescopic jibs rather than scissor lifts	
5) What are the maximum height, width and characteristics (internal and external) of features requiring maintenance?	Project data	From this data the designer can start to assess the need for access equipment	
6) What are the shapes of areas to be maintained?	Vertical, inward/outward sloping, curved, stepped elevations	From this information the designer can start to assess practical means of access	

Table A.1 **An example of a project information table**

Questions	Information	Comments	Design options
7) What is the total surface area (in m^2) of the facade requiring cleaning or maintenance?	a) glass b) cladding other than glass c) other structural components	From this information the designer can start to assess the duration of facade cleaning	
8) How many maintenance cycles per annum are required?	This number is influenced by the local environment at the site, the use of the building and the properties of cladding materials	Use determines the need for and frequency of maintenance cycles on an aesthetic basis. The requirement to have the glazed areas cleaned for example could also be influenced by the materials used and the need to ensure no deterioration is caused by airborne pollution, etc.	
9) What is the estimated size, weight and position of the largest panel of glass or cladding panel to be installed or replaced in the facade and roof?	Size, weight and position required	This information helps the design team to start to formulate a glass, facade panel, roof cladding replacement strategy for the planned lifetime of the building	
10) Do internal surfaces need access for regular maintenance operations? e.g. atrium areas, glazed roofs of atria, entrance halls staircases, etc.	Yes No	If yes, the surface areas to be maintained and the frequency of their maintenance need estimating. Practical steps required to gain access are to be evaluated	
11) Does the roof or wall cladding need periodic inspection? [A)]	Yes No	If yes, could have an influence on the means and methods of access	
12) Do operatives need to gain access to the roof area (or upper level in the case of a working structure)?	Yes No	If yes, the design team assesses the processes involved and can begin to identify the areas that require access and the steps needed to prevent (or if not practicable, minimize) the risk of falling	

[A)] Manufacturers may stipulate intervals to maintain guarantees.

NOTE The list is not comprehensive as each project presents its own characteristics and requirements to be addressed.

Annex B (informative) Access methods

Table B.1 gives methods commonly used to work at height and indicates the type of work appropriate to each method, locations that can be accessed and some limiting considerations for designers.

Table B.1 **Access methods**

	Permanent cradle	Mast climbing work platforms	Scaffold
Type of Work	Primarily for light maintenance and cleaning work but can be used for other light tasks towards the end of construction	Tends to be used for construction, major maintenance and refurbishment	Construction and medium- to long-duration maintenance work
Capacity	Typically two people plus tools, can be designed to suit greater needs	Flexible, can be designed to provide access for several workers, can be used for material transport	Potentially high, depends on design
Wall type	Primarily vertical, can be used on sloping facades and to cover overhangs if appropriately designed with counterweights	Vertical and sloping with special design, usually facade vertical and unobstructed	Any
Height and extent of facade	No height limit, manual reach limited to 850 mm from one suspension location, suspension unit can be rail mounted to cover whole facade	- As high as building, length of platform typically 5 m to 10 m but can extend round entire building - Using a number of independent sections at various locations around a building allows for more flexible working	Height dependent on component limitations, configuration and load conditions, length unlimited
Ground & Structure loadings	Support structure designed to take loads applied by cradle system	Hard standing required at mast base locations, requires regular ties to structure over the full height of the mast	Ground needs to be able to support point loads
Considerations	- Maintenance requirements, restraint and wind anchors, safe access arrangements - Safe landing area required to provide access/egress to cradle basket and cradle mechanisms for use, maintenance and inspection - Limited in range of operation due to complexity of facade or cradle operation complex due to nature of facade - Users require training in the use of harness and lanyard for fall arrest - Users trained in operation and rescue procedures if cradle breaks down in use	- Faster facade access from below rather than from above - Easier to bring materials for repair work - Installation, use and maintenance by trained operatives - Might require base enclosure and exclusion area below - Use of lanyard attached via lanyard to platform might be required	- Specific design required - Time consuming to erect, requires pre-planning, erected by trained and competent personnel - If over 4 m high, tied to structure at frequent intervals for stability - Might be clad to reduce the environmental impact of the work to affect the programme or to weather protect - Requires inspection before use, weekly and after alteration or adverse weather - Might require road/footpath closure: local authority permission - Exclusion or public protection measures might be required
Programme implications	Not available before completion of roof structure, early availability of track can assist construction and inspections prior to handover	- Easy to move to different areas within the height of the facade over the width of the platform and return for later tasks - Coordination required between trades sequence and timing - All work in vertical zone for the width of the platform completed before dismantling the mast	- Taking the needs of the whole project within the scaffold design into account can reduce the need for frequent adjustments - Scaffold might require adjustment for certain trades
Standards applicable	BS 6037-1	BS 7981	BS EN 12811-1 TG20 [8]

Table B.1 **Access methods**

	Temporary cradle	Permanent gantry	MEWP: scissor lift
Type of work	Construction and medium- to long-duration maintenance work, suitable for light and medium duty work	Normally used for cleaning and maintenance work but can be designed for use during construction	Construction and all maintenance
Capacity	Typically one to four people plus tools	Typically two people plus tools, normally custom designed, load capacity can be increased	Varies, up to 2 000 kg, can be used to transport some materials
Wall type	Vertical	Limited, more appropriate for roofs and sloping glazing	Vertical only, can be used for local access to overhanging facades
Height and extent of facade	- No limit , can be designed to provide two working levels - Depends on size of cradle, normally static and requires movement of suspension points to cover whole facade	Rail positioning limits extent of movement	Up to 30 m, limited reach (typically 5 m) from one location but can traverse length of facade if suitable ground conditions provided, some machines limit travel at height
Ground & Structure loadings	Cladding and roof structure to take weight of cradle, counterweights and user loads	- Structure designed to carry load applied by gantry and guide rails - Often mounted on rails	- All ground needs to be stable and firm - Some machines can access poor ground and are then stabilized using legs or self-levelling chassis but all require a firm surface, before elevating
Considerations	- Installation designed, installed and used by trained and competent personnel - Components have to be taken to the roof level - Roof structure able to support weight of cradle/counterweights and user loads - Safe means of access and egress required - Daily and weekly inspection requirements - Users require training in use of harness and lanyard for fall arrest - Users require training in operation and rescue procedures if cradle breaks down in use	- Installation designed, installed and used by trained and competent personnel - Roof structure able to support weight of the gantry and the user loads - Safe means of access and egress required - Regular inspection and maintenance requirements	- Machine able to access directly below the work location - Trained and competent operator required - Adequate access for machine to places of work - Access at ground level only - Risk of trapping operatives by overhead obstructions - Provide exclusion zone around the machine
Programme implications	- Easy to move to different levels within the height of the facade and to return for later tasks - All work in vertical zone for the width of the cradle completed before suspension points moved	Easy to move to different areas of facade and return for later tasks	Easy to move to different areas of facade and return for later tasks
Standards applicable	BS 5974	BS 6037-2	BS 8460 CPA 1002 [9]

Table B.1 **Access methods**

	MEWP: boom	Scaffold tower	Rope access
Type of work	Light and medium duty work both for construction and maintenance	Light and medium duty work both for construction and maintenance	Light duty work both for construction and maintenance
Capacity	Typically two people plus tools	Typically two people plus tools	One person with a working line and back up safety line each with its own anchor, can use a larger number of anchor points and lines to allow a larger team to work
Wall type	Vertical and steeply sloping (up and over access possible with articulated boom)	Vertical, for local access to overhanging facades	Vertical and sloping only, overhangs possible but require additional specialist techniques
Height and extent of facade	- Typically up to about 40 m although larger truck mounted platforms are available - Reach limited (typically 4 m) from one basket location but significant movement of basket from single location and entire facade can be reached with careful planning and suitable set up locations	- Height up to 8 m externally and 12 m internally, can be extended by tying to structure - Reach limited (typically 3 m) from one tower location but entire length of facade can be reached by movement of tower or by use of multiple towers and bridging units	- No height limit, although rescue and maximum rope length to be assessed - Limited reach from each suspension position but can reach whole facade by moving ropes
Ground & Structure loadings	- All ground is to be stable and firm - Some machines can access poor ground (e.g. track mounted machines) but all require a firm and level surface when elevating	A firm and level surface available	Structure and anchor points designed for imposed loads, including fall arrest from equipment failure
Considerations	- Machine can reach directly from the base to the work area, over ground level obstructions or over poor ground (and over obstructions and protrusions with articulated boom) - Trained and competent operator required - Adequate access required to machine set up location - Access from ground level only - Risk of trapping operative from overhead obstructions, exclusion zone around the machine and below work area - Great care needed near overhead services (e.g. electrical cables)	- Need to be erected by trained and competent personnel - Can be mobile, but needs level firm surface to move, user descends to move - Some towers are prone to improper assembly, e.g. omission of guardrails and braces - Space may be needed for outriggers	- Suitable anchors required at roof level and safe access required to them - Trained and competent operatives required - Limited capacity for handling tools and materials - Rescue methods and procedures required
Programme implications	Easy to move to different areas of facade and return for later tasks	Low height towers are relatively easy to move on a firm level surface	- Easy to vary workforce by providing additional anchors and ropes, allowing work to be carried out in several locations - Allows adjacent workers to operate at different heights
Standards applicable	BS 8460 CPA 1002 [9]	Operator's Code of Practice [10]	BS 7985 BS ISO 22846-1 BS ISO 22846-2

Table B.1 **Access methods**

	Work restraint	Work positioning	Ladder: portable
Type of work	Light weight work, during construction or for maintenance during lifetime of building	Light weight work during construction or for maintenance during the lifetime of the building	Vertical only
Capacity	Single or multiple user from appropriate anchor system	Single or multiple user from appropriate anchor system	One person
Wall type	- Not applicable - For horizontal surfaces, such as roofs	Sloping surfaces where the user is supported by ropes in tension to partially support the user	Light duty work both for construction and maintenance
Height and extent of facade	- Height unlimited - Extent: anchor points, or anchor line systems can be positioned to provide required coverage and prevent a person reaching a zone where the risk of a fall exists	- Height unlimited - Extent dependent upon number and layout of anchor points	- Up to about 6 m - Limited reach from one ladder (650 mm) location but entire length of facade can be reached by frequent movement of ladder
Ground & Structure loadings	- Strong enough to sustain forces imposed by user(s) on anchor(s) - Surfaces to be walked on are capable of supporting the weight of the user(s), plus tools and materials	- Strong enough to sustain forces imposed by user(s) on anchor(s), - Surfaces to be walked on are capable of supporting the weight of the user(s) plus tools and materials	Needs firm level ground at foot of ladder
Considerations	- Users require training in use of combination of anchors, lanyards and harnesses for the particular location - Combined system of anchor, lanyard and harness prevents operatives reaching an edge from which they could fall - Anchors, lanyards, harnesses, connectors require visual and tactile inspection before use, and periodic inspection related to use and environment and manufacturers' instructions - Safe access to the anchor point(s)	- A working rope and a safety back up rope is to be used anchored above the user(s) and rigged to prevent falls from edges - Users require training in use of a combination of anchors, suspension lines and harnesses, descent and ascent equipment for the particular location - Anchors, ropes, connectors, harnesses require visual and tactile inspection before use, and periodic inspection related to use, environment and manufacturers instructions - Safe access to the anchor points	- Provision made for securing ladder to the facade, user to maintain three points of contact at all times - Difficulty carrying tools/materials, max. weight: 10 kg - Easily destabilized - Use of proprietary ladder securing and fall protection system - Prone to misuse - Users trained
Programme implications	Can use temporary or permanent anchors for use during construction or maintenance work	Can use temporary or permanent anchors for use during construction or maintenance work	Easy to move to different areas of facade and return for later tasks
Standards applicable	BS 7883 BS 8437	BS 7883 BS 8437	INDG402 [11] MISC613 [12]

Table B.1 **Access methods**

	Work restraint	Work positioning	Ladder: portable
Type of work	Light weight work, during construction or for maintenance during lifetime of building	Light weight work during construction or for maintenance during the lifetime of the building	Vertical only
Capacity	Single or multiple user from appropriate anchor system	Single or multiple user from appropriate anchor system	One person
Wall type	- Not applicable - For horizontal surfaces, such as roofs	Sloping surfaces where the user is supported by ropes in tension to partially support the user	Light duty work both for construction and maintenance
Height and extent of facade	- Height unlimited - Extent: anchor points, or anchor line systems can be positioned to provide required coverage and prevent a person reaching a zone where the risk of a fall exists	- Height unlimited - Extent dependent upon number and layout of anchor points	- Up to about 6 m - Limited reach from one ladder (650 mm) location but entire length of facade can be reached by frequent movement of ladder
Ground & Structure loadings	- Strong enough to sustain forces imposed by user(s) on anchor(s) - Surfaces to be walked on are capable of supporting the weight of the user(s), plus tools and materials	- Strong enough to sustain forces imposed by user(s) on anchor(s), - Surfaces to be walked on are capable of supporting the weight of the user(s) plus tools and materials	Needs firm level ground at foot of ladder
Considerations	- Users require training in use of combination of anchors, lanyards and harnesses for the particular location - Combined system of anchor, lanyard and harness prevents operatives reaching an edge from which they could fall - Anchors, lanyards, harnesses, connectors require visual and tactile inspection before use, and periodic inspection related to use and environment and manufacturers' instructions - Safe access to the anchor point(s)	- A working rope and a safety back up rope is to be used anchored above the user(s) and rigged to prevent falls from edges - Users require training in use of a combination of anchors, suspension lines and harnesses, descent and ascent equipment for the particular location - Anchors, ropes, connectors, harnesses require visual and tactile inspection before use, and periodic inspection related to use, environment and manufacturers instructions - Safe access to the anchor points	- Provision made for securing ladder to the facade, user to maintain three points of contact at all times - Difficulty carrying tools/materials, max. weight: 10 kg - Easily destabilized - Use of proprietary ladder securing and fall protection system - Prone to misuse - Users trained
Programme implications	Can use temporary or permanent anchors for use during construction or maintenance work	Can use temporary or permanent anchors for use during construction or maintenance work	Easy to move to different areas of facade and return for later tasks
Standards applicable	BS 7883 BS 8437	BS 7883 BS 8437	INDG402 [11] MISC613 [12]

Figure C.1 **Template of options matrix**

Designer Options Matrix: **Hazard and Risk Management** Project: <GUIDANCE TEMPLATE>			Work stage: <Insert>				Facade Cleaning and Maintenance Date: <Insert>		
Hazard: Falls from height	**ELIMINATE or AVOID risks by:** (During early design stages)		**REDUCE or MINIMIZE risks by:** (During all design stages)				**Information:** To be provided with the design	**Control risks:** Contractor or client management systems	**Other specialist guidance and comments**
Generic options > Building form v	No access or ground-based manual systems	Clean from inside	Ground-based systems	Building-based systems	Other suitable systems	Other approaches or combinations	Specialist design and client input	Control methods by operator	References
Safe systems of work available to resolve > External and internal facade areas v	Self cleaning glass, robotic systems, sprinklers, etc. Do not clean Can we change the form?	Inward opening Cleanable windows from inside, prevent falls out	Long water fed pole from ground Power hose Reach and wash	BMUs Cradles Simple and counter-weighted travelling gantries Roped access	MEWP Scaffold	Combinations of safe systems Can the form or details be modified to improve safety?	Cladding and window design Client control Facilities management implementation	Training of operatives Weather restrictions Maintenance of kit	e.g. CWCT, CIRIA, British Standards, Building Regulations, etc. or hyperlinks *(ICONS or photos)*
Team sign-off status	Client		Architect		Structural Engineer			Services Engineer	
Others	Principal Contractor		CDM Coordinator		Project Manager			Cost Consultant	

Figure C.2 **Example of options matrix**

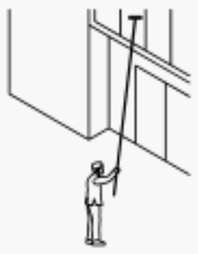
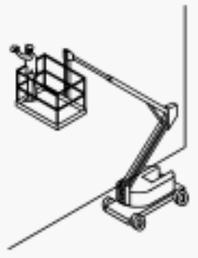
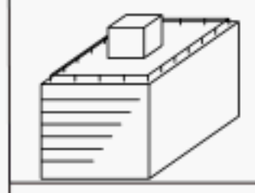
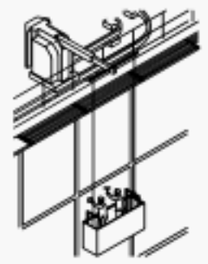
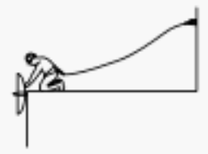
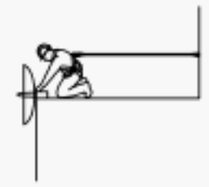
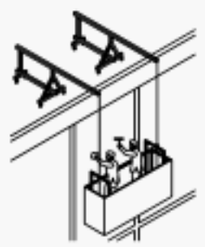
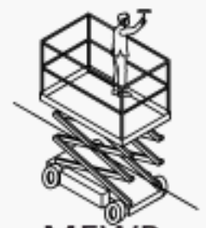
Designer Options Matrix: **Hazard and Risk Management** Project: <GUIDANCE TEMPLATE>			Work stage: <Insert>				Facade Cleaning and Maintenance Date: <Insert>		
Hazard: Falls from height	**ELIMINATE or AVOID risks by:** (During early design stages)		**REDUCE or MINIMIZE risks by:** (During all design stages)				**Information:** To be provided with the design	**Control risks:** Contractor or client management systems	**Other specialist guidance and comments**
Generic options > Building form v	No access or ground-based manual systems	Clean from inside	Ground-based systems	Building-based systems	Other suitable systems	Other approaches or combinations	Specialist design and client input	Control methods by operator	References
Safe systems of work available to resolve > External and internal facade areas v	Self cleaning glass, robotic systems, sprinklers, etc. Do not clean Can we change the form?	Inward opening Cleanable windows from inside, prevent falls out	Long water fed pole from ground Power hose Reach and wash	BMUs Cradles Simple and counter-weighted travelling gantries Roped access	MEWP Scaffold	Combinations of safe systems Can the form or details be modified to improve safety?	Cladding and window design Client control Facilities management implementation	Training of operatives Weather restrictions Maintenance of kit	e.g. CWCT, CIRIA, British Standards, Building Regulations, etc. or hyperlinks *(ICONS or photos)*
Domestic house 	X	 Opening windows	 Long poles	 Roped access	 Telescopic MEWP	 Ladders at lower levels (up to 9 m)	X	Approved training methods required	

Figure C.2 **Example of options matrix**

Small commer-cial residential 	X	X	X Too high	 BMU withoutreach	 Mobile scaffold tower	 Work restraint	 Work restraint plan		
Industrial units 	X	X	X	 Fixed and travelling cradles	 MEWP	 Work positioning (requires rescue plan)	 Fall arrest (requires rescue plan)		
Team sign-off status	Client		Architect		Structural Engineer		Services Engineer		
Others	Principal Contractor		CDM Coordinator		Project Manager		Cost Consultant		

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