

APPENDIX

B



ROOF PROTECTION

1. INTRODUCTION

1.1. Low-slope roofs are accessed and used for a variety of functions so they must be suitably protected from damage. Whether its glazing, cladding or modern roofing technology, **the full performance of the system will only be realized if it is protected from environmental and human actions.**

There are two important reasons to protect all roofing:

- To avoid damage during construction: modern construction often means tight programmes, multiple, overlapping trades and limited space for ground-level storage. It is also frequently desirable to achieve a dry interior early in the programme. All these can impact on the roof finish.
- To avoid damage due to access and loading during service: roofs require inspection and many also have secondary uses which require access. For example air handling services, renewable energy equipment and amenity features may be placed on the roof.

2. WHAT TO CONSIDER

2.1. Variable loads:

- Impact: objects may be dropped during construction and service. All types of roof system must be protected appropriately during each phase to resist such accidental events.
- Foot and equipment traffic: foot traffic and wheeled equipment causes cyclical point loading, which is likely to adversely affect most common insulation boards & membrane(s).

2.1.2. Static loads: in addition to snow loading these include landscaping ballast, plant and equipment, green roof planters, grey water storage tanks and the feet of ladders and stanchions.

2.2. WHAT ARE THE RISKS?

2.2.1. Impact: may puncture the roof membrane and cause local damage

2.2.2. Excessive foot and equipment traffic: may compress the insulation beyond design levels, causing permanent damage.

2.2.3. Static loads: in excess of design levels may also deflect the insulation, causing local ponded water or may stress the single ply membrane.

2.2.4. Contaminants: including volatile hydrocarbons, animal fats and dairy products may reduce the service life of the single ply membrane or contravene the conditions of the product warranty.

2.2.5. All the above: may reduce the service life of the roof system and increase maintenance cost.

2.3. HOW TO REDUCE RISK?

2.3.1. At the earliest possible stage, the likely use of the roof should be estimated in terms of:

- Preferred roof finish, e.g. pavers on pedestals or exposed single ply membrane. Pedestals create increased point loading yet this effect may be overlooked as roofs to terraces or podia are loaded.
- Function of access routes: maintenance and /or fire escape.
- Frequency of foot traffic.
- Likely activity, e.g. heavy tools for servicing HVAC equipment.
- Plant and equipment likely to be placed on the roof (rather than on a frame or plinth).
- Presence of contaminants in the environment, for example discharge from extract ventilation.

2.3.2. Good records: operation and maintenance records

2.3.3. Load-spreading: if design loads exceed the compression-resistance of the insulation load-spreading will be required.

2.3.4. Designated walkways: regular foot access to equipment or fire escapes should be designated by suitable slip-resistant finishes which clearly mark a route. These should be as direct as possible, avoiding obvious trip hazards, because users will inevitably take the easiest option.

3. PROTECTION DURING CONSTRUCTION

3.1. WHY PROTECT?

Whatever the waterproofing type, all roofs must be appropriately protected from damage.

3.2. WHAT ARE THE RISKS?

3.2.1. Safety: a poorly protected and managed roof is often a less safe one, more prone to slip and trip hazards.

3.2.2. Water ingress and patch repair

3.2.3. Delay to programme: water ingress or damage requiring repair will delay following trades and could have high consequential cost if insulation has to be dried out or replaced. **The client will be unsettled** and may legitimately ask why they are expected to be handed a new roof that has been repaired. Cost and delay will also be caused if it is necessary to undertake additional testing for integrity.

3.2.4. Reduced resistance to wind load: the attachment may be affected by repeated loading, especially if the single-ply membrane is adhered.

3.2.5. Inverted and green roofs: a damaged membrane may go unnoticed before the insulation and ballast are applied. Investigation and repair will then be very difficult.

3.3. HOW TO REDUCE RISK?

3.3.1. Plan: early consultation with Roofing Contractor & Consultant.

3.3.2. Select appropriate solutions: there are several options for temporary protection; select to suit site conditions, taking into account how much it will need to be moved as work progresses, the type and level of risk. Whichever option is selected, all points of access to the roof from scaffold or internally must be provided with protection which spreads loads and avoids damage.

3.3.3. Agree: at the pre-start meeting, to ensure that all factors have been taken into consideration and agreed with the roofing contractor.

3.3.4. Manage: whilst specification is important, effective management of the construction process is vital. This is a shared responsibility between main and roofing contractor and sub-trades which must be reflected not only in the terms of the Contract but also in the day-to-day monitoring of the site. In particular:

- A permit-to-work system with controlled access to the roof should operate wherever other trades will be working at roof level.
- A site diary should be kept, including a photographic record filed by roof location.

4. ROOF MANAGEMENT

4.1. CONTRACTUAL RESPONSIBILITY FOR PROTECTION

There is clear historic evidence that in the event of dispute regarding responsibility for defects and consequent loss during construction, evidence in the form of site records and liability as defined in the Contract play a key role in the outcome. However, in relation to protection of the works during construction, responsibility is often unclear and/or the terms of the Contract are breached by the action of one or other party.

Examples include:

- Main contractor accessing the roof for scaffold alterations or to allow work by following trades without the express consent of the roofing contractor.
- Roofing contractor failing to protect their own work from actions by their own trades people and sub-contractor(s).

4.2. TESTING

It may be appropriate to test the completed roof (or its completed phases) by electronic methods. In the event of a failure to protect during construction, testing (if feasible) is likely to be essential.

5. CHECKLISTS

5.2. TEMPORARY AND PERMANENT PROTECTION

Options for temporary and permanent protection:

- Re-cycled plastic lattice matting
- Recycled rubber crumb matting
- Heavy duty rigid plastic sheets
- Fibre-reinforced polymer-cement sheets
- Plywood or OSB c/w Rigid Insulation
- Membrane product tile or sheet

When considering any loose-laid protection materials, consult the roofing manufacturer as a separation/isolation layer may be required.

5.3. PRE-START AGENDA

AGENDA ITEM	ITEMS TO BE AGREED	INCLUDED	COMMENT
1. Access to the roof.	<ol style="list-style-type: none">1. Step-off points2. Likely changes3. Security measures4. Confirm permit to work		

AGENDA ITEM	ITEMS TO BE AGREED	INCLUDED	COMMENT
2. Protection during roofing package	1. Confirm responsibility 2. Method 3. Phasing/changes during works 4. Temporary rainwater drainage		
3. Transfer* and storage of materials for the roofing package	1. Type 2. Estimated load and volume 3. Location 4. Protection measures		
4. Transfer of other materials**	1. Type 2. Estimated load and volume 3. Location 4. Protection measures		
5. Other trades	1. Sequencing 2. Protection 3. Responsibility for protection 4. Avoidance of contamination		

AGENDA ITEM	ITEMS TO BE AGREED	INCLUDED	COMMENT
6. Testing	1. Roofing contractor attendance		

* To the roof

** Typically, HVAC ductwork

Use the following checklist to ensure that site operations are suitably managed to minimize risk of damage to the roofing system:

SITE RECORDS	Roof status. Photographs (referenced to location) Weather records: rainfall, wind, ambient temperature	
STORAGE OF ROOFING MATERIALS	Load-spreading Protection Access	
STORAGE OF NON-ROOFING MATERIALS	Load-spreading Protection Access	
MEMBRANE INTEGRITY TESTING (IF REQUIRED/ SPECIFIED)	Clear obstructions to avoid exclusions Coordinate with scaffold/edge rails Roofing contractor to be in attendance	

5.5.CONTRACTUAL ARRANGEMENTS

1	Is it clear who is responsible for moving temporary protection to suit new access locations?	
2	Does roofing contractor have sole possession of the roof whilst installation is in progress?	
3	If the roof system is sub-sub-contracted, is it clear which party is responsible for protection?	
4	Under what circumstances may other (non-roofing) trades access the finished roof?	
5	Which party is responsible for protection once the roof system is at practical completion?	

5.6. TOOLBOX TALK

To ensure that all protection methods are effective, all trades that either need to access or work on a roof system should be educated in how to respect the waterproofing. Attendance at the following Toolbox Talk is recommended as part of the overall strategy and may be included in the process to obtaining a permit to work on the roof area.

TOOLBOX TALK: RESPECTING THE ROOF

Who should attend? All trades that will have access to the roof area(s).

Objective: less risk of leaks; keeping to programme; fewer call-backs; safer working.

Outline: this talk outlines the reasons why the roof should be respected and the methods which can be used to prevent damage to the single ply membrane and other vital materials in the system.

Risks:

- Damage to single ply membrane: puncture, cut, tear., burn/melt.
- Damage to insulation/cover-board: crushing or loss of facing.
- Less resistance to wind load: adhesive bond weakened by compression.
- Slip and trip hazards.
- Programme delays.
- Manufacturer warranty may be delayed.

Personal responsibility:

1. Access the roof only via designated route.
2. Never work off an unprotected roof.
3. If in doubt, check what protection should be in-place before starting work.
4. Never store materials on the roof before checking on protection arrangements.

5. If you see damage or protection is missing, report it immediately.

Site operations:

1. Wet trades: load-spreading and full waterproof protection required.
2. Brick and block laying: load-spreading and full waterproof protection required.
3. M&E installation: load-spreading and protection from swarf (*fine chips or filings, or other material produced by machining operation*) required