Loss Prevention Standards – Asset Class(es)

Zero Falls Roof Considerations - Planning to Construction (RIBA Stages 0 to 6)

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This Loss Prevention Standard provides guidance and support on the key hazards and areas to consider when planning a Zero falls roof installation.

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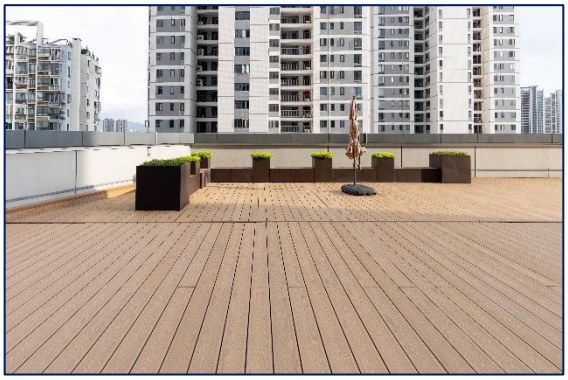
Introduction



Zero falls roofs are a form of flat roofing, typically used when the roof is to be used as an amenity space, such as a terrace or planted area or where used in conjunction with blue/green roof systems. By definition a zero falls roofs is one where the pitch is between 0 and 0.7 degrees, the fall being necessary to aid drainage.

Water related damage, due to issues such as ponding and back falling, present the main risk concerns, and the risk management guidance within this Loss Prevention Standard can help reduce the risks of such incidents.

Note: The focus in this document is towards property loss prevention and related risk management guidance and is not intended to address liability exposures. The presumption is that all regulatory requirements, such as Fire Risk Assessments, have been met.

Design Considerations

- The Principal Designer should engage with the client, members of the Design Team and the Contractor/sub-contractors as early as possible in the design stage, preferably at Concept stage.
  - ✓ This helps ensure all stakeholders are fully conversant with the requirements of any local or national regulations, standard or guidelines such as BS6229:201 - Flat roofs with continuously supported flexible waterproof coverings - Code of practice.
  - ✓ Stakeholders should also be aware that warranty providers typically deem the main contractor as being responsible for the correct installation of the roofing system once construction work commences, not the installer, sub-contractors etc.

- When checking the suitability of a roof system for a zero falls application, stakeholders should consider:
  - ✓ The design and installation of the roof slab.
  - ✓ Its deflection characteristics.
  - ✓ Potential drainage points, to avoid ponding and where necessary locate outlets at anticipated low points.

- It is also important for designers to recognise any low points and areas of high deflection that are not near rainwater outlets and cannot be moved in the early design stages.
  - ✓ This ensures appropriate means of dispersing water, and therefore reducing the potential risks associated with ponding water can be reviewed, and corrected e.g. increasing ballast, paving or green roof loading etc.

- Whilst BS6229:2018 requires the materials, design, and construction of a flat roof should be designed to a 1:40 fall to achieve 1:80 when constructed, some warranty providers and Building Control and inspection bodies require zero falls roofs be designed at 1:80 fall, and all necessary measures taken to avoid back-falls or local ponding.

Design

- The use of the amenity spaces for all areas of the proposed roof should be specified and these should include all identified additional dead loads placed on the surface e.g. terracing, planters along with mechanical or service plant.
- The roof slab structure should be in-situ reinforced concrete or rib-deck. Timber decks including Structural insulated Panel Systems (SIPS), beam and block or pre-cast concrete slabs may not be accepted by some warranty providers.
- Long-term deflection maps for each roof slab, and all loading stages with rainwater outlet locations overlaid should be prepared by structural engineers and reviewed to assess the structural performance of all roof systems. These maps will demonstrate where the maximum deflection is likely to occur and how the overall roof is drained.
- Any ballasting needs to be sufficient to stop floatation of the insulation/roof build-up, ensuring water is adequately displaced towards the rainwater outlets and drains effectively.
- The waterproofing system should be a BBA certified monolithic liquid applied hot/cold system or hot melt system certified as suitable for zero falls applications.
- The roofing system must be an inverted type system (i.e. not warm roof with an exposed waterproof membrane).
- Scheme-specific build ups and details for all roof areas identifying each component are required.
  - ✓ This should also include parapet wall details and any additional layers or build up.
  - ✓ Details are to include for upstand junction with all façades and ballasting.
  - ✓ Design details should be referenced on the roof general arrangement (GA) plan for each level and for any balconies or terraces.
- All Rainwater outlets should be counter-sunk and located as close to lowest points of deflection as far as practicable.
  - ✓ Peak flow calculations to BS EN 12056-3:2000 Gravity drainage systems inside buildings - Roof drainage, layout and calculation should also be created for each roof area with minimum two outlets per roof.
- Site specific wind uplift calculations to BS EN 1991-1-4:2005+A1:2010 Eurocode 1. Actions on structures - General actions - Wind actions should also be created to justify each ballasting type.
- All upstands should be 150mm above all finishing mediums.

Installation (Prior to installation of the waterproof layer)

- A survey of the cast roof slab must be undertaken before the waterproofing layer is applied, to check the required fall and surface 'flatness' will be achieved. This should include identifying the location of any backfalls.
- Any backfall areas identified should be corrected by either providing an additional outlet or overflow to that area, levelling with a membrane manufacturer-approved screed, or additional waterproofing layers.
  Note: If additional waterproofing layers are used, the maximum thickness should not exceed that as stated in the BBA certificate. The design engineers should confirm any additional loading will not exacerbate any issues.
- Following any corrective levelling, a subsequent level survey should be undertaken to check back falls have been removed.
- When using a hot melt layered waterproofing system, excessive material build up can occur around outlets preventing them from effective drainage. This should be checked as part of the installation process.
- Key stage inspections should be completed by the membrane manufacturer confirming correct installation as per their requirements.
  - ✓ Peel tests should be carried out as recommended by the membrane manufacturer.
- Waterproofing layer integrity testing should be carried out with no stored materials present at the time of testing or post-test.
  - ✓ If testing is carried out when materials are present or if materials are placed after testing, further testing may be necessary. The testing should include upstands.
  - ✓ Any necessary repairs to be re-tested.

Completion

- A report of the completed peel testing, with locations identified on the roof GA plan should be carried out by a suitably qualified person/company.
- Copies of the manufacturers inspections reports, and electronic test results of the waterproofing layer should be available for insurers and warranty providers upon request.

Additional Hazards

Other features that may present an increased risk of loss or damage include:

- Inadequate water and weather protection of the structure during construction.
  - ✓ Ensure the development is adequately protected vertically and laterally from poor weather.
- Waste and materials storage not appropriately managed.
  - ✓ Ensure such materials are stored at least 10m from the development.
  - ✓ Regular self-inspections can highlight issues requiring attention.
- Unknown or poorly repaired damaged areas.
  - ✓ Works progress including repairs should be regularly inspected for adequacy.
- Roof mounted photovoltaic/Solar panels. Ensure:
  - ✓ Systems are designed and installed by a competent and accredited company.
  - ✓ Safe roof access is provided to aid self-inspections and formal maintenance.
  - ✓ Penetrations are fire stopped, providing a fire resistance rating consistent with the construction.

Please refer to the suite of Aviva Loss Prevention Standards on roof mounted photovoltaic/solar systems for further guidance.

- Battery Energy Storage Systems (BESS).
  - ✓ Ensure BESS systems are located as far from significant site buildings and valuable assets as achievable. At least 10m is recommended.
  - ✓ Penetrations are fire stopped, providing a fire resistance rating consistent with the construction.

Hot Work and Water Damage

All roofing works are at risk of exposure from fire (smoke and water) and internal and external water sources (domestic, rain and flooding etc.). These risks should be managed and controlled during the construction works and mitigated in specific working and task based formal risk assessments. Formal hot work and wet work permit to work systems are required.

The following resources should be used:

- ✓ Aviva Hot Work Operations - Loss Prevention Standards
- ✓ Aviva Escape of Water on Construction Sites - Loss Prevention Standards
- ✓ Construction Insurance Risk Engineers Group (CIREG) - Managing Escape of Water Risk on Construction Sites (5th Edition, November 2019)
- ✓ Fire Prevention on Construction Sites Joint Code of Practice 10th Ed.

Construction Risk Management and Procurement Strategy Considerations

- Experience and qualifications of the designers, principal and sub-contractors, suppliers, and installers.
- Site prohibited items such as E-Bicycles, E-Scooters, smoking and vaping.
- Project sequencing and programming.
- Weather events – site based monitoring, mitigation strategies, protection, and emergency response.
- Logistics (including staging, storage, hazardous materials controls, waste management and housekeeping).
- Use of mobile plant - engine powered and electric (including charging and fuelling).
- Temporary loading of floor plates including mobile plant and material storage.
- Temporary and permanent fresh water supplies - leak detection, flow monitoring and automatic shut off devices.
- Charging and storage of lithium-ion batteries including power tools.
  - ✓ Please refer to the Aviva Loss Prevention Standard **Construction All Risks (CAR) – Lithium-ion Batteries** for further guidance.
- Physical and manned security arrangements combined with appropriate video surveillance systems (VSS).
- Temporary and permanent fire detection/suppression and firewater supplies installed as the works progress.
- Continued engagement with the Fire and Rescue Services (confirm public fire water supplies).
- External and Third Party risk exposures to and from the project.
- Emergency response and contingency plans to evolve as project progresses.

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Sources and Useful Links

- The Construction Insurance Risk Engineers Group (CIREG)
- BS EN 12056-3:2000 Gravity drainage systems inside buildings - Roof drainage, layout, and calculation.
- BS6229:201 - Flat roofs with continuously supported flexible waterproof coverings - Code of practice.
- BS EN 1991-1-4:2005+A1:2010 Eurocode 1. Actions on structures - General actions - Wind actions.
- The Fire Protection Association.
- European Technical Approval ETAG 31 and those as defined by the BBA in Building Bulletin 4.

Additional Information

- **Construction All Risks (CAR) – Lithium-ion Batteries**
- **Roof Mounted Photovoltaic Solar Panel Systems - General Considerations LPS**
- **Roof Mounted Photovoltaic Solar Panel Systems - Planning for Installation LPS**
- **Roof Mounted Photovoltaic Solar Panel Systems - Installation and Construction LPS**
- **Mass Timber - Planning and Design (RIBA 0-4) LPS**
- **Mass Timber - Construction (RIBA 4-6) LPS**
- **Mass Timber - Handover and Use (RIBA 6-7) LPS**
- **Escape of water on Construction Sites LPS**
- **Manual Firefighting Water Supplies LPS**

To find out more, please visit Aviva Risk Management Solutions or speak to one of our advisors.

Email us at riskadvice@aviva.com or call 0345 366 6666*

*The cost of calls to 03 prefixed numbers are charged at national call rates (charges may vary dependent on your network provider) and are usually included in inclusive minute plans from landlines and mobiles. For our joint protection telephone calls may be recorded and/or monitored.

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