Roof Survey **Report**

Imperial War Museum, Duxford
Duxford Airfield, CAMBRIDGE
CB22 4QR, England

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Project Reference: B172642/1

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1 Introduction

Further to our site inspection we have prepared the following survey report based on the current condition of the existing roof/s. This survey report is based on our visual inspection of the roof/s together with our exploratory core test samples. It should be noted that core test samples are taken to identify the existing roof construction to deck level and to provide an indication of the roof condition. Due to the limited number of core samples that can be practically taken on a roof, Bauder Ltd cannot be held responsible for any changes in roof build-up in areas where core samples have not been taken.

1.1 Description of Building and Weather Conditions

Building use – Public
Height in Storeys: 1

The weather conditions at the time of our survey inspection were overcast.
The Roof surface at the time of our survey was wet in places.

1.2 Roof Access

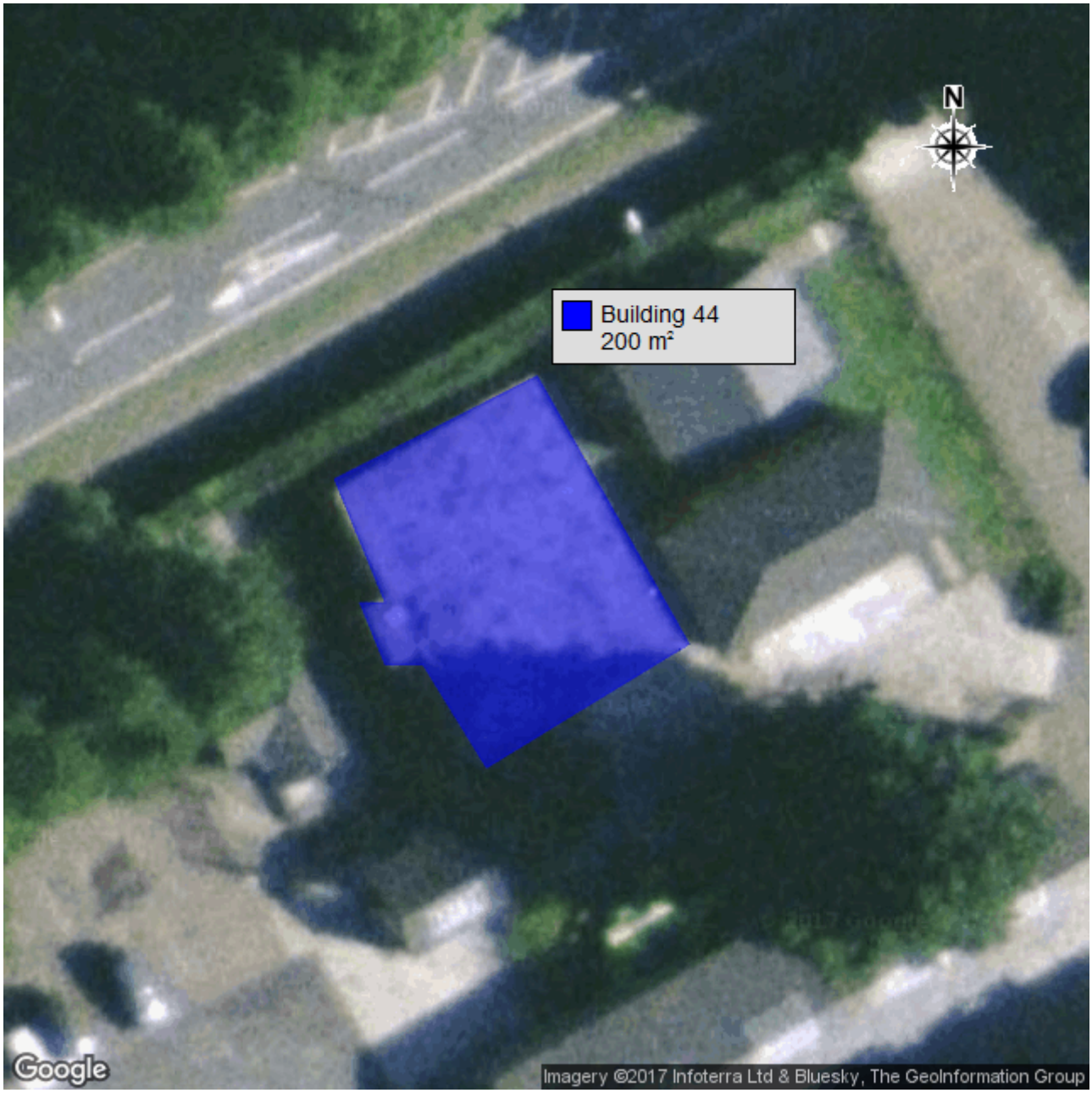
Roof access was gained externally using a single storey surveyor's ladder.

1.3 Confirmation of Client brief

To carry out an evaluation and produce a condition report for the roof areas concerned, together with specification proposals for renewing the waterproofing system.

1.4 Roof Plan

1.4.1 Building 44



Any measurements displayed on the map above are approximated and are therefore not to be used in tenders.

2 Existing Roof Construction

2.1 Core Sample Analysis

Core samples are taken as a method of confirming the existing deck and waterproofing system construction and provide indicative feedback regarding general condition. Please note that the findings are representative only of the particular location tested and this is used to give general guidance as to the likely overall condition and deck construction.

2.1.1 Building 44

No. of core samples taken: 1

Construction Type: Warm Roof

Surfacing: Self finished waterproofing
Waterproofing: Mastic Asphalt
Insulation: Not applicable
Screed: Bitag screed (Expanded clay/ bitumen binder)
Vapour Control: Bituminous membrane vapour control layer
Roof Deck: Concrete
Internal inspection: There is no ceiling internally and the underside of the structural deck is fully exposed.

Condition of core sample: The deck is dry.

Image of core sample

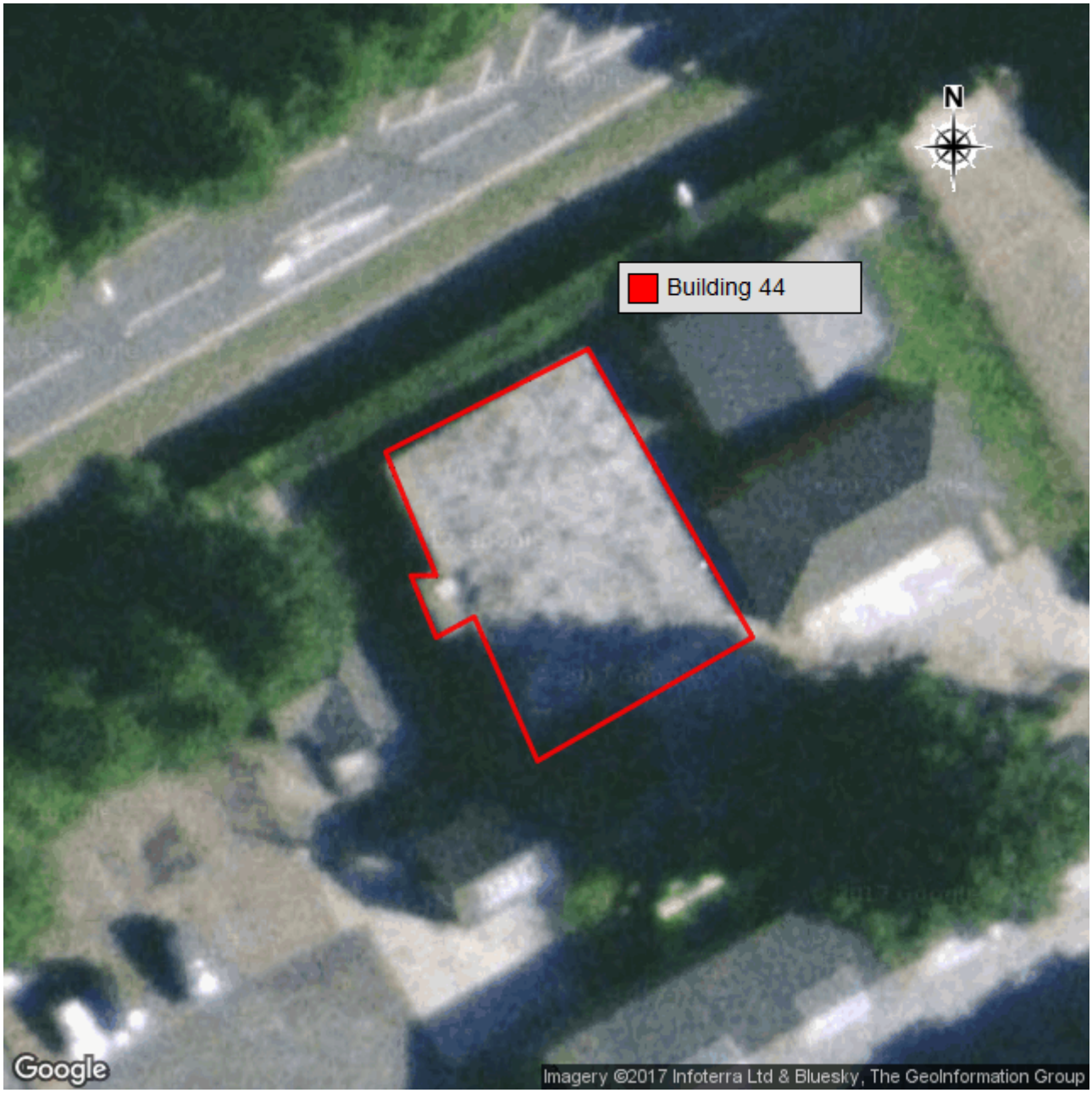
Close up image of lightweight screed

3 'Torch-Free' zones

The application of torch-on materials to or in the vicinity of combustible deck materials does not conform to the recommendations of BS8217:2005, clause 7.3.2.1, paragraph 3, or the advice given in the 'Safe2Torch' document produced by the National Federation of Roofing Contractors. When encountering an area which contains combustible material a minimum 900mm deep zone of the flat area around the material and any detail flashing to the material itself there is a requirement for 'TORCH-FREE' detailing. In these instances an appropriate alternative Bauder self-adhesive membrane should be used as described in: 'TORCH-FREE' & 'TORCH-SAFE' zones - ALTERNATIVE MEMBRANES AND APPLICATION. The Torch-Safe zone detailing and method of application will be described in the Additional Items section and the 'TORCH-FREE' & 'TORCH-SAFE' zones section of the Bauder specification and further shown in the Bauder 'TORCH-FREE' & Bauder Bituminous detail drawings. It is recommended that anyone preparing a specification should follow the 'Safe2Torch' guidance to avoid the use of a direct torch-on application in these areas. This report should be read in conjunction with the Bauder Specification.

Bauder has identified the following as 'TORCH-FREE' zones:

3.1 Building 44



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- Timber / Other combustible materials.

4 Issues and Considerations

4.1 Building 44

4.1.1 Decks

The decking is believed to be in a good condition and of a suitable construction type to be reused as part of the roof refurbishment.

4.1.2 Existing Waterproofing

Image of the underside of the deck shows a number of leaks

Overview of roof area

Evidence of splits in the asphalt at the upstand to rooflight

Extensive liquid repairs show an evidence of water ingress

Further evidence of damaged waterproofing to the perimeter detail

The existing waterproofing system is constructed as a cold roof, comprising of mastic asphalt, on a loose laid sheathing applied directly to the deck.

The condition of the existing waterproofing is of concern. The material covering is coming to the end of its serviceable life and demonstrating signs of age, fatigue and fragility that could lead to serious failure.

Any water ingress would affect the upgrade potential of retaining the current system as part of an overlay solution. Investing in refurbishment works now offers the opportunity of minimising costs by using the existing waterproofing as a component of an overlay system.

The asphalt is showing all the typical defects consistent with a covering of this age including; surface oxidisation, cracks, splits, blows, slumping and signs of repair.

4.1.3 Falls

Overview image of roof shows falls are minimal so some standing water does occur

Current roof falls are minimal, but appear to be generally functional. Should ponding water be deemed undesirable there is an opportunity whilst re-waterproofing to enhance the existing falls utilising tapered insulation.

4.1.4 Drainage

The existing external rainwater system is in very poor condition and should be replaced.

4.1.5 Upstands and Details

Requirements for waterproofing at upstands and details

Codes of Practice (BS 8217: 2005) dictate that the minimum height for waterproofing upstand detailing is 150 mm, taken from the finished surface. Perimeter kerbs should be a minimum height of 50 mm above the finished surface and detailed with a welted drip detail or edge trim.

There should be no mechanical penetrations to kerb waterproofing or need for secondary weathering. Kerbs that are weathered with mechanically fixed metal capping or concrete copings are categorised as 'abutment upstands' and must comply with the minimum height requirement of 150 mm.

This minimum height rule applies equally to upstands to roof lights, pipes, vents and door and window thresholds.

Waterproofed upstand detailing is usually weathered with lead or metal counter-flashings, metal capping and cladding. Termination bars should only be used when fixing to concrete abutments, where no provision exists for other forms of secondary weathering.

The existing rooflights are aged and should be replaced or removed all together

Access hatch covers a manhole cover and therefore must be retained. The kerbs must be dressed in new waterproofing.

Screed vent to be removed

4.1.6 Rooflights

Rooflights designated by the client being redundant should be removed as part of the roof refurbishment works and the openings in-filled as part of the roof refurbishment work. Please be aware that these units may contain asbestos in the internal linings, rope seals or glazing putty.

4.1.7 Safe Access

At present these roofs were found to have no provision for safe access and egress. If the roof is deemed to be a place of work, and if there is any foreseeable reason for access, it is the responsibility of the employer (building owner) to provide a safe place of work.

Should these roof areas have a requirement for the design of a system to provide safe access and egress, a specialist company should be consulted to provide a comprehensive access strategy that is compliant with the working at height regulations 2005 and the hierarchy of risk management. This is to say;

- Eliminate the risk – Design out the need to work at height

- Guard the hazard – If working at height is unavoidable a collective/passive means of protection should be used.
- Guard the worker – If collective/passive means of protection are not feasible a PPE based system should be used.
- Fall restraint systems – The system and the associated PPE prevent the worker from reaching all fall hazards
- Fall arrest systems – The systems and associated PPE could result in the worker reaching the fall hazard.
- Where appropriate the access strategy should incorporate a suitable rescue plan.

5 Proposals

5.1 Building 44

- The existing deck is to be re-used.
- The condition of the existing waterproofing is considered suitable for receiving an overlay system.
- The external rainwater system is in poor condition and should be completely replaced as part of the roof refurbishment works.
- We propose that a new free-standing guard rail system is installed to provide and meet safe access and egress requirements for this roof. We would suggest specialist advice is obtained to provide a suitable specification for these items.

5.2 Proposed Waterproofing System

Building 44

Bauder Total Roof System (BTRS)

The Bauder Total Roof System (BTRS) includes the most advanced bitumen membranes currently available. The system offers the highest levels of performance supported by the most comprehensive guarantee in the market. For maximum flexibility our membranes are manufactured using highly modified SBS elastomeric bitumen and very high tensile reinforcing layers that means this sophisticated waterproofing system offers the ultimate flat roof solution.

Where required the system will include Bauder PIR insulation with a choice of either glass tissue or aluminium facing offering versatility in installation methods for both the insulation and the membranes. Bauder insulation provides excellent thermal performance and has outstanding dimensional stability and compressive strength, achieving an "A" rating in the BRE Green Guide. BTRS is suited to both new build projects and the refurbishment of existing buildings.

Guarantee Information

This system is supplied with a 20 year guarantee that covers products, workmanship, design, consequential damage and financial loss. Full terms and conditions are available by request.

Key Features

- Insulation and waterproofing products are all manufactured by Bauder resulting in complete system compatibility and single source responsibility.
- Robust and extremely durable waterproofing that minimises the risk of physical damage and is capable of withstanding foot traffic.
- This BBA certified system with FAA fire rating has been extensively used in the UK for over 30 years with proven durability in service. This provides complete peace of mind to specifiers past and present.
- 5mm cap sheet with high tensile strength and choice of 3 colours.
- Bauder site technicians monitor and sign off each installation and provide up-to-date inspection reports directly to our clients via email.
- Bauder provides installation training for our approved company operatives ensuring the highest quality of workmanship is maintained.
- Reliable application in both high and low ambient temperatures – enables all year round installation.
- Reduced rain noise to gain an extra credit under point 5 of section Hea of BREEAM education 2008 for most projects.

6 Health & Safety and Construction Design Management

Bauder believes in promoting a strong safety culture at all times. Our Staff will adhere to the appropriate risk assessments and method statements as required under the Health and Safety at Work Act 1974 and Work at Height Regulations 2005. It is the client's duty of care to advise of any specific health and safety issues pertaining to the project as required under the Work at Height Regulations 2005.

As part of our duty of care we would like to draw attention to the following information:

The HSE Guide H&S in Roof Work (HSG33) states that **all** roofs should be treated as fragile unless declared otherwise by a competent person. Please refer to the Work at Height Regulations 2005 provision 9 for information on working with fragile/suspected fragile roof areas. Under the Health and Safety at Work Act 1974 Sections 3 and 4, it is the responsibility of employers and anyone who controls the work of others to ensure so far as it is reasonably practicable that persons are not exposed to risks that impact on their health and safety. Appropriate control measures must be in place before any work or contact with a fragile/suspected fragile roof area commences.

Safe access and egress to a roof is a major risk and requires careful planning. In particular, the following are likely to be fragile:

- Non reinforced fibre cement sheets e.g. asbestos
- Corroded metal decking
- Woodwool slabs
- Rotten chipboard or similar
- Stramit
- Slates or tiles
- Old roof lights
- Glass (including wired)

Specifying non fragile rooflights will help reduce the risk of falls from height. A non-fragility rating is required by the HSE (Health and Safety Executive) in order to comply with CDM (Construction Design and Management) Regulations 2015.

We draw your attention to your duties under the Construction (Design and Management) Regulations 2015. Regulation 4, Client's duties in relation to managing projects states that the client must make suitable arrangements for managing a project, including the allocation of sufficient time and other resources. Regulation 5, Appointment of the Principal Designer and the Principal Contractor states that where more than one contractor will be working on a project at any time, the client must appoint a Principal Designer and a Principal Contractor.

Please note that although Bauder will assist with the roof waterproofing system design, we will

not undertake the role of Principal Designer.

It is always the responsibility of the contractor to carry out a risk assessment on all aspects of the contract. The 'Safe2Torch' checklist is solely for guidance for the safe installation of torch-on reinforced bitumen membranes and use of gas torches in the workplace.