

BRE Client Report

Chalcots Estates, Camden

Prepared for: Astrid Kjellberg-Obst
Date: 8th June 2020
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1 Introduction

- 1.1 BRE has been instructed by Astrid Kjellberg-Obst, Interim Project Director, London Borough of Camden, 5 Pancras Square, London N1C 4AG.
- 1.2 The inspection work is described under proposal number P116025 and was issued on the 27th August 2019. The proposal was signed and returned by Astrid Kjellberg-Obst on the 12th September 2019.
- 1.3 The contents of this report are based on the visual inspection of the documentation provided to us and a window sample installed at Burnham Tower. No other intervention work was carried out and no calculations or testing undertaken to prove structural, environmental or fire performance.
- 1.4 Any comments, conclusions or recommendations within this report shall not be construed as providing a particular solution, but rather as assistance to a suitably qualified design consultant, carrying the correct levels of indemnity insurance, to develop an appropriate response.



2 Background

- 2.1 BRE understands that as part of the re-cladding of 5 blocks of Chalcots Estate, Adelaide Rd, London NW3 3JW, new aluminium windows are proposed.
- 2.2 Camden issued a briefing note (dated 22nd July 2019) to BRE explaining the history behind the currently installed windows and the reasons to replace them, with observed defects including:
- faulty release of restrictors (possibly by tampering)
 - detachment during high winds of windows (stated as a consequence of the above)
 - inadequate purge ventilation
- 2.3 Within their due diligence in advance of purchase, Camden Council have commissioned a series of studies to investigate the most appropriate new window arrangement. The findings have indicated that a tilt and turn system potentially provides the best solution.
- 2.4 Some of the residents of the Chalcots Estate however have expressed concerns regarding the use of tilt and turn windows, including concerns about safety implications for children and elderly occupants. The height of the proposed window sills being one of the main issues.
- 2.5 Camden have asked BRE to provide an independent review of the design and feasibility studies, prepared for the Council by various entities during their due diligence exercise. The table below summarises the documents originally supplied by BRE for review:

Document	Rev	Date	Author
Chalcots Estate Recladding Glazing Options assessment	1	19/02/18	Arup
Chalcots Estate Recladding Windows Systems Update	F	18/09/18	Arup
Window Risk Assessment	n/a	04/12/18	Frankham
Window Design Proposal – Overview for the BRE (ppoint)	n/a	11/07/19	Camden
Window Risk Assessment Burnham Bray etc.	n/a	17/07/19	Frankham
Deaths from falls from windows: evidence	n/a	Undated	Not Stated

Table 1: Original documentation issued to BRE

- 2.6 Subsequent to issue 1 of this report, Camden issued further information to BRE, shown in the below table:



Document	Rev	Date	Author
Façade Specification Section 1	01	23/5/18	Arup
Façade Specification Section 3	01	23/5/18	Arup
Window and Curtain Wall 'options for your block'	n/a	undated	Camden
Summary of feedback from recent engagement events	n/a	undated	Unstated
Chalcots Estate windows and panel engagement feedback	n/a	3/7/19	Camden
Fire Safety Programme update	n/a	23/7/19	Camden
Chalcots Estate Timeline of Programme of Works	n/a	undated	Camden
Chalcots Estate Recladding, Window System Options	A	14/5/18	Arup
Window Options review (excel spreadsheet)	n/a	Undated	Unstated
Window Design Chronology (pdf)	n/a	Nov 2019	ARCADIS
Health and Safety General Risk Assessment (Option 1)	n/a	24/10/18	Camden
Health and Safety General Risk Assessment (Option 3)	n/a	24/10/18	Camden
Window Risk Assessmnt Burnham Bray(Arup Comments)	n/a	17/07/19	Frankham
Window Risk Assessment, Self-engaging restrictor	n/a	19/11/19	Frankham
Window Risk Assessment, 90 Degrees	n/a	19/11/19	Frankham
Window Risk Assessment Burnham Bray etc.	A	19/11/19	Frankham
Risk Register for: Chalcots Estate Re-cladding	P03	Nov 2019	Camden
Window system Options 03/19 Update / 4 Towers	n/a	Mar 2019	Arup

Table 2: Documentation issued to BRE subsequent to publication of revision 1 of this report.



2.7 Subsequent to issue 2, further commentary and data were returned to BRE as follows:

Document	Date	Author
Emails to BRE with explanation and below attachments	17/02/20	Camden
Issue 2 BRE Report Overview with SK Comments	13/01/20	Camden
Issue 2 BRE Report Comments (AKO & SK)	13/01/20	Camden
Issue 2 BRE Report Comments (AKO & Arup)	31/12/19 & 15/01/20	Camden and Arup
Issue 2 BRE Report Overview	06/01/20	Camden
Window Design Feedback/ Survey Overview	12/19	Camden
Issue 1 BRE Report Comments (Arup, Camden, Arcadis)	10/19	Camden
Windows engagement breakdown	06/08/19	Camden
Executive Decision Chalcots Window Design	10/04/19	Camden
Chalcots Estate Recladding window system options Update	11/03/19	Arup
Window Engagement Spreadsheet **	07/18	Camden
Window and curtain wall survey pro-forma *	Pre-06/18	Camden
Windows Feedback Blashford Delivery (pro-forma) *	Pre-06/18	Camden
Chalcots Estate Recladding window system options	18/4/18	Arup

Table 3: Documentation issued to BRE subsequent to publication of revision 2 of this report.

* = Blank pro-forma sheets have not been reviewed as part of this report

**= This workbook contains multiple spreadsheets and has not been reviewed. Summary data issued to us has been used in our assessment.



3 Discussion

3.1 General

- 3.1.1 The initial briefing note supplied to BRE by Camden clearly identifies safety in use as the fundamental priority in our investigation and also in the procurement of a new window system for installation at Chalcots Estate.
- 3.1.2 In pursuit of an acceptable solution, the Council have undertaken early engagement with the Estate's residents and explained the reasoning behind the currently preferred system.
- 3.1.3 Arup have provided consultant services which have included suggestions for the topics of resident surveys and subsequently the interpretation of the results to inform their design. Camden have administered the surveys and also conducted viewings of show flats and sample windows to demonstrate what is proposed in the final design.
- 3.1.4 Wates appear to have been appointed, or are the preferred main contractor, to undertake the new cladding works including the installation of the replacement windows. Wates in turn have engaged Frankham as their design consultants, indicating that a design and build type contract is anticipated. Frankham have published risk assessments for the windows in use (as discussed in this document), the results of which have been used in the presentations to the residents.
- 3.1.5 The BRE discussions held with Camden suggest a close working relationship has developed between the Council, consultants, main contractor and residents during the procurement phase.
- 3.1.6 In providing an independent review of the documentation supplied to us, which was set out in the previous issues of this BRE report, further particulars have been issued to us, which have inevitably caused us to revise some of the details of our original assessments. In some cases, the documents issued to us subsequent to issue 1 pre-dated the information used to compile our opinion and this has resulted in material changes to our assessments. Where this has occurred, we have attempted to make clear that a change has been made within the text.
- 3.1.7 Our approach has been to review and comment on all of the individual pieces of information issued to us to inform our opinion and also to demonstrate that we have carried out a wholesale review. Where we have considered a piece of information not to be relevant to our task, we have attempted to state it.
- 3.1.8 The assessment carried out by us is a critical analysis and as a consequence it has generated responses from both Camden and the wider project team. Issues 1 and 2 of our report included factual corrections and challenges to our findings which would be expected and where relevant we have attempted to incorporate them into this current version (issue 3).
- 3.1.9 These exchanges have assisted us in providing a more relevant critique of the elements forming this particular design journey.
- 3.1.10 Camden requested that the formatting of our issue 2 report was changed in order to transfer the document commentaries and site visit notes to appendices. This has been done and incorporated into issue 3.



3.2 Specific Questions Raised by Camden

General

- 3.2.1 On the 1st November 2019, Camden sent a response to the content of issue 1 of this report, requesting particular topics be addressed.
- 3.2.2 The questions raised by Camden subsequent to release of issue 1 are still relevant to the following versions and have been transferred to this 'Conclusions' section. Additional comments have been added to our responses where subsequent information in advance of revision 3 has been sent.

Questions

"Principle/ Approach about aiming to new built standards (as opposed using existing standards)"

- 3.2.3 We presume this refers to the various climatic and dimensional considerations undertaken by the Consultants and Contractor in relation to the Building Regulations and which are addressed individually below under Camden's original headings.
- 3.2.4 Should the comment be in specific reference to statutory requirements, then at the point of submission of the Building Regulation application, the design should follow the recommendations of the currently published Approved Documents. This may be most currently relevant in relation to fire (ADB), but assessment of this is outside of the scope of our appointment.

"Choice of Window Type"

- 3.2.5 At the time of writing, the option for windows at Chalcots that is preferred by the project team and the residents is (generally) the bottom hung, inward opening tilt/ turn window. Camden and Arup have carried out exhaustive technical studies and consulted with residents directly to establish a favoured window type.
- 3.2.6 Numerous requirements were considered which had to be prioritised by Camden in order to narrow the window types best suited to the development. This appears to have not been an easy exercise on the basis that you 'cannot please everyone all of the time', but the evidence suggests that the selected system captures the majority of the residents' wishes. Ultimately this is not a technical exercise, but an interpretation of Camden's assessment of their residents' needs.
- 3.2.7 Arup have provided a comprehensive performance specification for the windows themselves and carefully considered the location and height of the building whilst compiling their requirements. Wind loadings, materials, testing and structural performance, among other subjects, are fully described and providing the criteria are adhered to by the design and build contractor then a performance compliant system should be achieved.
- 3.2.8 Outside of their specification, Arup have additionally carried out studies in relation to Building Regulation compliance, including, but not limited to, purge ventilation, overheating and dimensional distances to control hardware for the windows. These studies confirm compliance with the recommendations of the Building Regulations approved documents and, where not, reasoning behind variations and ways to mitigate the effect in their discussion(s) with Building Control. It is essential that the Contractor, having responsibility for the design, post-appointment, engages at an early stage with Building Control and seeks agreement for the use of these windows.



- 3.2.9 We have no further comments to make on the selection of the window type except where discussed below.

“Validity of overall risk assessments”

- 3.2.10 On the 17th February 2020, Camden provided a statement to BRE that:

“I can also confirm that Wates, Arup, Arcadis and Camden have discussed the risk assessments and are sourcing a self-engaging restrictor with [a] tool as [a] child proof feature.”

- 3.2.11 A further statement was issued by Camden on 31st March 2020, updating BRE on the topic as follows:

“There are different risk assessments being used by the Parties involved. The organisations are currently working on a joint risk assessment, including with focus on an agreed position regarding the restrictor key usage.”

- 3.2.12 These statements by Camden reflect a positive on-going engagement with the Project Design and Contracting team in establishing a common risk assessment for the development. We will be happy to review the final agreed position once available.

“Overheating and purge considerations and calculation”

- 3.2.13 Arup have carried out comprehensive exhaustive studies regarding the above for typical windows in kitchens, living rooms, bedrooms and bathrooms. Please note that BRE have not carried out any calculations to assess the data provided with the various documents supplied to date.

- 3.2.14 The studies by Arup have necessarily had to address not only the aspects, orientation and heights of each of the blocks on the estate, but also consider each room type. The consequent spreadsheets have been periodically updated and issued, each version informing the type of window best suited to their environment and, as the options narrowed, more detailed analysis of G and U values.

- 3.2.15 Our understanding from what has been provided to us is that the ability of the residents to sequentially open the windows in either a tilt or turn orientation fulfils the requirements of the Building Regulations for purge ventilation and also provides the ability for the residents to cool their environments as required.

- 3.2.16 We therefore have no further comments to provide on this subject. Should Camden wish to have the data calculations specifically examined, BRE or other third party facility can carry this out as part of a separate appointment.

“Dropped sill, restrictors and opening triangle (fall from height assessment and proposed solutions)”

- 3.2.17 Please refer to the ‘Overall risk assessment’ discussion above for comments on restrictors, opening triangle and risk of falls from height.

- 3.2.18 The dimensional studies carried out by Arup and preferred solution of dropping the sills appears to comply with the recommendations of the approved documents for both the barrier height and location of controlled hardware. Please note these comments are provided strictly in relation to the dimensional recommendations and not the issues arising from furniture locations etc. which form part of the risk studies discussed elsewhere.



3.2.19 We have no further comments to provide for the dimensional proposals for the sill and barrier heights of the windows.

“Windows restrictor”

3.2.20 We understand that work is on-going to locate and specify a self-engaging restrictor. We are not therefore in a position quite yet to conclude an assessment of the final version.

3.2.21 Please refer to the notes above for additional commentary on the restrictors.

3.2.22 We have retained the commentary from issue 2 in order to assist in the search for the new restrictor. Once information is received and we are able to examine the performance characteristics, we will amend the below text (or remove it completely).

- *Testing has been carried out on one of the restrictors currently proposed for the tilt/ turn windows, however it is not known if this restrictor will be ultimately used or substituted/ combined with a self-engaging version.*
- *The tested version, as discussed in previous sections, appears to have been classified for use in situations as those at Chalcots estates, including child safety and durability. It should be noted that these components will require periodic maintenance in order to retain the reassurance of the certificate and that alteration of the mechanism by residents is also likely to affect any warranty cover.*

In addition to responses to the above items identified by Camden we would offer the comments in the following sections.

3.3 Design Responsibility and Risk Management

3.3.1 Under a design and build contract, responsibility for integrated cladding design is passed to the main contractor who is then tasked with ensuring that specialist sub-contractors similarly accept this obligation. Risk management of the type used by Frankham should form part of all pricing and tender documentation in design sub-contracts.

3.3.2 Failure to properly assign co-ordinated design responsibility down the design supply chain is frequently the cause of our (BRE) failure investigations. The breakdown can occur at any point, but particularly where the Main Contractor excludes this responsibility during their own value engineering exercises.

3.3.3 Similarly, the breaking-up of sub-contracts into packages, without co-ordination responsibilities being applied to each, frequently results in failures, particularly in the area of weathertightness. This can also occur in the risk arena, where risk assessments are not updated during the detailed design phase, resulting in installations with unacceptably high levels of risk.

It is therefore of critical importance that the risk assessments initiated by Frankham are constantly revisited by all parties from design to installation and supplemented/ updated as appropriate.



3.4 Cleaning

- 3.4.1 Camden and Arup have confirmed that residents will not be responsible for cleaning the outside of their windows and that this task will be undertaken by a professional cleaning company using new plant and rails placed on the roofs of the various blocks. Examination and comment of these provisions does not form part of our brief.
- 3.4.2 There is mention however of 'spot-cleaning' in a few places within the information supplied for issue 3 of this report. BRE understand this to mean that residents will be able to fully open a window in turn mode and clean the external glass whilst the sash is within the room space.
- 3.4.3 Our question remains regarding how this will be addressed within the risk assessments. It appears to us that reaching the glass under the top rail of the sash will require the use, for instance, of steps or chairs. In our opinion, the risk assessments published so far do not address this risk or how mitigation might be applied.

3.5 Purge Ventilation and Additional Sashes

- 3.5.1 Purge ventilation formed one of the primary concerns for residents in relation to cooling in the flats. We understand that the small windows proposed may be re-designed to accommodate a second opening sash. We would strongly suggest that the effect of this would alter many of the calculations (such as weathertightness) that have been undertaken and a risk assessment would have to be re-written.
- 3.5.2 We understand that forced extraction may be an option for windows placed within the kitchens where ducts are available.



4 Conclusions and Recommendations

On the basis of a review of the documentation provided to us by Camden and 1 No. site visit we conclude that:

- 4.1 Camden have undertaken serious engagement with their residents at Chalcots Estate and produced relevant information for consideration by the design team in developing a user-acceptable window system.
- 4.2 Arup, as façade engineers, have assisted Camden in the interpretation of the resident data and adopted the findings into their design proposals. They have also published a project-specific performance specification for use by the Contractor's (Wates) own façade designers.
- 4.3 Wates have, in turn, appointed Frankham as risk assessors, and together with Arup and Camden produced overall risk assessments for the windows. At the time of writing (issue 3), BRE are aware that agreement appears to have been reached on a coordinated approach to the risk assessments, including the window restrictor type, and BRE would be happy to provide an assessment of these once received.
- 4.4 A strategy or protocol for resident spot-cleaning of windows appears to be at an early development stage and requires a conclusion. Our understanding is that residents will be able to undertake this task by fully opening the sashes and will only be able to undertake spot cleaning on the glass presented from within the room. This procedure should be incorporated into the risk assessments being provided by others. We further understand that any other type of spot-cleaning to the outside of other fixed panes will not be promoted by Camden to its residents.
- 4.5 As a consequence of the work undertaken by Camden and the design team, we have no further comments in regard to the dimensional arrangements for the new windows or their compliance with the recommendations of the approved documents in relation to barrier heights, sill heights, purge ventilation, overheating or positions of controlled opening devices.

We recommend that:

- 4.6 The risk assessments for the current window proposals are published to formalise the assessments between parties. In this respect, assuming Frankham to be the Risk Assessors for the Main Contractor, the documents should be treated as living, evolving documents and provided to the Employer at the conclusion of the works.
- 4.7 As part of the design and risk mitigation process, that the work carried out by Arup in regard to furniture placement around opening windows is adopted into the resident manuals and resident training undertaken.
- 4.8 Specifically, a strategy/ protocol for the safe resident spot-cleaning of windows when open to 90 degrees is undertaken by the project risk assessors and adopted into the overall risk assessment.



Appendix A Issue 1: Arup Chalcots Recladding Glazing Options assessment, rev 1

- A [Please note that some of the commentary in this section relates specifically to the original issue of documentation to BRE (table 1) and may be revised in later sections of this report as a result of the subsequent release of data to BRE (tables 2 & 3)]
- A.1 This document was produced by Arup and was published on the 19th February 2018.
- A.2 The introduction briefly explains the history of the towers that make up the Chalcots Estate, with a description of each: number of floors, original construction dates (1960s) etc. The re-cladding exercises, containing the existing windows to be replaced, are stated as having been carried out during 2007-2009.
- A.3 The system described is the Royal S50 manufactured by Schüco.
- A.4 As a result of surveys of the installed Schüco system and analysis of the window types, all opening sashes are determined to be top-hung open-out. Restrictors limiting the opening to 100 mm can be released by the occupiers to a maximum opening of 300 mm. The latter dimension is stated to be necessary for purge ventilation.
- A.5 An analysis of the fixing methods used for the existing system is included. The analysis makes reference to a dead load of 270 kg for a type B window.
- A.6 The introduction is followed by an option selection section. A summary table at the beginning divides the options into two types:
- 1) Repair/ refurbishment
 - 2) Replacment
- A.7 Each option is further divided into sub-sections which capture the various systems available to replace the current installation. These are:
- Leave the windows as installed (no refurbishment)
 - Repair/ refurbish the Schüco Royal S 50 system
 - Replace with a Stick Curtain Wall system
 - Replace with a Unitised Curtain Wall system
 - Replace with a Window Frame system
- A.8 Each sub-section is placed in a matrix with a 'pros and cons' commentary.
- A.9 The document is a draft and assumed to have either been revised or superceded at a later stage. The revision provided to us is confusing and uses the term 'option' interchangeably, leaving a first-time reader slightly lost as to which version of a proposed façade system is being discussed. For the sake of brevity, we have arranged our headings under general topics with section numbers from the original document stated in brackets.



Refurbished Façade: Spandrel Insulation (section 3.1)

- A.10 The point being made on page 9 is that Arup propose, in the event of a refurbished façade and retention of the Schüco system, that the Celotex insulation existing behind the spandrels is removed due to combustibility.

Refurbished Façade: Brackets (section 3.2)

- A.11 Again referring to retention, this section does not discuss brackets except to state that many types have been used across the towers.
- A.12 The main statement is that a full survey is needed and that membranes will need replacing. The insulation is also identified as being combustible.

Refurbished Façade: Fire stops and cavity barriers (section 3.3)

- A.13 There are multiple points made within this section:
- a) The extent, condition and detailing of existing fire breaks is unknown
 - b) The existing window system would need to be completely dismantled to refurbish
 - c) Sufficient and reliable fire protection cannot be guaranteed

Refurbished façade: Spandrel Cleaning (section 3.5) Note: section 3.4 is missing

- A.14 The cavities behind the existing spandrel panels are full of builders debris, including the possibility of asbestos, all of which will need to be removed.
- A.15 This section refers to the currently installed top-hung windows having been the subject of previous failures, but provides no detail.
- A.16 This section also includes a proposal (in the retained option) for the window frames to have stainless steel cables attached to the top corners to guard against future falling as a result of detachment.

Refurbished façade: Ironmongery Inspection (section 3.6)

- A.17 As part of the proposed scope for window retention, Arup propose that each window is systematically inspected and a condition schedule provided for each item of ironmongery.
- A.18 Regular maintenance, including lubrication is proposed.
- A.19 The installed window system, across all blocks, is stated to have been altered in a number of cases with non-original components, complicating any on-going window maintenance strategy.
- A.20 An existing ironmongery classification schedule is also proposed.

Refurbished façade: Mitigation of Condensation Risk (section 3.7)

- A.21 Arup identify concerns within the currently installed system in relation to an existing 'considerable thermal bridge' created by the unbroken attachment of a continuous steel support angle.
- A.22 In a retention situation, Arup suggest that the problem should be addressed by:
- a) Insertion of insulation material in and around the bracket
 - b) Complete replacement of the bracket with a thermally broken version.



Refurbished façade: Glass Units Replacement (section 3.8)

- A.23 This section forms part of a non-essential proposal to replace all of the insulated glass units (IGU) to improve:
- a) Energy performance
 - b) Sash performance
 - c) Life expectancy
 - d) Sealant performance (by replacement)

- A.24 Subsequent to the discussion of the refurbishment options, the document then progresses to a review of replacement options.

Replacement Option: Options comparison chart (section 4.0)

- A.25 Arup discuss three different re-cladding options to façade replacement in this section, describing advantages (pros) and disadvantages (cons) of each. Using Arup terminology these are:
- a) Stick curtain wall
 - b) Unitised curtain wall
 - c) Window frame system
- A.26 In comparing each system, the Arup author explains the qualities of each system in general terms such as cost, life expectancy, installation time etc.

Replacement Option: System selection (section 4.1)

- A.27 Having discussed the advantages/ disadvantages in the previous section, Arup recommend that a customised hybrid system is used, combining the advantages of the unitised and frame systems.
- A.28 In making this recommendation, Arup provide the following reasons (Arup headings used for clarity):
- a) *"Buildability speediness: Panels are pre-assembled and installed on site by hanging the units."*
 - b) *"Infill panel and replacement: 'Beads can be placed outside or inside depending on the preferred replacement options.'"*
 - c) *"On-site assembly: Lighter modules could be installed directly from mast climber. Heavier modules need spider crane."*
 - d) *"Quality control: Panels assembled in factory"*
 - e) *"Estimated cost: ~ £550/ sq m"*

Replacement option: Unitized system: Alternative 1 (section 4.2)

- A.29 Section 4.2 contains detailed hand sketches of a proposed unitised system. Two alternatives for different sized units are shown.



- A.30 In both cases, the essential sections remain the same, with the existing masonry left in place to the inner wall, a large unfilled cavity and the new external skin, including the window.
- A.31 The plan detail shows, for the first time, a proposal for fixing the unitised system to the existing concrete structure. Generally, large structural brackets are fastened to the front (external face) of the existing blade walls and cantilevered horizontally into the structural opening. These brackets then serve as the primary support for the cladding components, which utilise 'hook' profiles to facilitate hanging for the utilised system.
- A.32 No membranes are shown on these details.

Replacement option: Unitized system: Alternative 2 (section 4.3)

- A.33 This alternative differs from 4.2 in that rather than floor-to-floor spans, the brackets attached to the blade walls are more frequent, meaning that the panels making up the unitised systems are smaller and lighter. The fixing method remains unchanged (hooks).
- A.34 Membranes are shown on the plan detail, providing protection away from the interior, being sealed to the front of the blade walls and attached to the edge of the window frame.

Replacement option: Unitised window frame system details (section 4.4)

- A.35 Section 4.4 presents a more finalised version of the hand-drawn details, showing 3 no. structural brackets per floor on which the unitised system is suspended.
- A.36 The larger number of brackets and consequent reduction in unitised panel size, as suggested by Arup, allows for greater flexibility during construction. A distinction is made, structurally, between the spandrels and windows, allowing different components to be assembled out of sequence and presenting the opportunity to leave existing cladding components in place until ready.
- A.37 Membranes continue to be shown and there is a statement on the plan sketch that glass (meaning the IGU) can be replaced from the inside with the spandrel being replaced from the outside. It is assumed this refers to the in-service replacement of the new system.

Replacement option: Window opening types alternatives (section 4.5)

- A.38 Having discussed the differing cladding systems, Arup proceed to discuss the different ways in which the windows associated with the new unitised system could be opened.
- A.39 The proposed alternatives are all open-in:
- a) Bottom hung
 - b) Turn and tilt
 - c) Top hung

- A.40 No recommendation is made on the type of opening in window in this section. The data shown comprise different sizes/ weights etc. of various Schüco frames as extracts from their (Schüco) catalogue.

Replacement option: Disassembly Methodology (section 4.6)

- A.41 Section 4.6 discusses a method of disassembly of the currently installed units using hand-drawn isometric graphics. Two floors are shown, with workmen, storyboarding the installation of internal protection and subsequent removal of cladding components from the outside.



A.42 Protection is suggested by the installation of a polycarbonate sheet across the window opening internally (presumed to be provided so that the occupants can remain resident during the works) and the removal of the façade via mast climbers and/or portable hoists located on the roof.

A.43 The time allowed per flat for the whole process is 2-5 days. Within this document, the radiators, currently installed below the windows, remain unaffected and retained in position.

Replacement option: Tenant protection installed from the inside (section 4.8) note: 4.7 missing

A.44 This section adds a small amount of detail to section 4.7 but offers no alternative methodology to the disassembly process.

Replacement option: Window module disassembly for the outside (section 4.9)

A.45 The description within this very short section states that existing mast climbers are available for the external disassembly process.

Replacement option: Installation methodology (section 4.10)

A.46 Having discussed the methodology for disassembly, this section describes the installation of the new cladding components using similar graphic techniques.

A.47 Anchors are installed to the existing concrete walls to fix the large cladding brackets in place, fire stops are installed and the spandrel/ window frames suspended on the cladding brackets.

A.48 The replacement time allocation is stated as approximately 4 hours per flat, including the removal of the internal polycarbonate protection and refurbishment of internal finishes.

Replacement option: Assembly process from the outside (section 4.11)

A.49 This section again makes use of graphic isometrics to explain a possible external installation process. It adds more detail to sections 4.9 & 4.10.

A.50 Different craneage options are discussed.

Replacement option: Progress (section 4.12)

A.51 The final sheet of this document details a suggested programme to the Client and states an anticipated works time per flat of 5-10 working days from installation of internal protection to completion of all external works.

A.52 A further table is incorporated on this sheet entitled 'External façade glazing – works on factory' which appears to break-down the contract into:

- a) Construction documentation
- b) Visual mock-up
- c) Performance mock-up and testing
- d) Approval
- e) Material procurement
- f) Factory assembly of units.



A.53 No time is allocated to each of these proposed phases.

Summary

- A.54 Our examination of this first document issued to Camden on the 19th February 2018 shows that it was clearly meant for discussion purposes only and possibly represents 'work in progress' by Arup.
- A.55 The content is focused in the main on two types of approach to the towers. The first involves the merits of retaining the current glazing system and the second the advantages of complete replacement.
- A.56 There is no technical detail available for comment. The proposal discusses, in general, the way in which the design and installation could be approached, but limits this discussion (at this stage) to headline issues such as available systems, indicative costs, construction methodology and window opening type.
- A.57 Arup appear from this documentation to have used Schüco components in their reports as the replacement system, however we understand that no system has been specified for use.
- A.58 The drawn details are understandably general in nature, showing arrangements in principle.



Appendix B Issue 1: Arup Recladding Window Systems Options - Update

B [Please note that some of the commentary in this section relates specifically to the original issue of documentation to BRE (table 1) and may be revised in later sections of this report as a result of the subsequent release of data to BRE (tables 2&3)]

B.1 This document was produced by Arup and published on the 18th September 2018, 7 months after the previously discussed document. The version that we have examined is revision F.

B.2 Within the introduction, Arup state that:

“This report was produced as an update to the previously issued window system options report. We have focused on the two preferred options only (option 1 and option 3)”

Arup have clarified (29/04/20) that this document is not an update of the report referred to in Appendix A. The Appendix A report investigates options for refurbishment and replacement whereas Appendix B compares window types with each other.

For the purposes of this section, option 1 will refer to a newly installed outward opening, top-hung window.

B.3 The introduction also makes clear that resident surveys have been carried out in addition to investigations of overheating and window opening restrictions.

B.4 The G-value (a measure of how much solar radiation is allowed through the glass) of the units is discussed and explanations of the values chosen for the project stated.

Assessment criteria (section 2.2) Blashford Tower

B.5 There are a number of tables contained within this sheet that publish the results of resident surveys, comparing various properties of each system: new top hung (option 1) v new tilt and turn frames (option 3).

B.6 The tilt only windows (option 1) are described as opening outwards, whilst the tilt and turn versions as opening inwards. The properties of each system that Camden considered critical to each were submitted to residents and their responses tabulated. Summarising:

Rank	Property	Priority (%)
1	Purge ventilation	32%
2	Overheating	
3	Performance, weather, acoustics	25
4	Resident safety	12
5	Cleaning and maintenance	11.5



6	Ease of operation	8
7	Solar protection	6
8	Public safety	5.5

Table 3: Survey Results

- B.7 It is not clear how the questions were presented or how the results were collated. There are references to 'Top 4 most important criteria that residents recognise as important' but no description of how many residents responded or whether the answers were weighted.
- B.8 There is a cell presented at the end of each option (1&3) which, we presume, attempts to present a proposed solution by calculating a 33 % v 61 % preference for the tilt and turn option. The text states that these figures are '% of the residents which voted for each window option'.
- B.9 Arup provide a commented summary table which discusses recurring resident comments, which corresponds to some of the criteria within the survey table. The recurring comments are:
- *Most of the residents are not concerned with the proposal of splitting the larger window, however some of them are worried that the view will be disrupted.*
 - *Residents recognised that inward opening windows would interfere with curtains.*
 - *New windows should be able to dampen out the noise from rail track.*
 - *Properties on the southern elevation at the upper floors have high sun exposure and tend to get very hot: Sun reflection and ventilation are important parameters.*

Assessment Criteria (section 2.3) All Towers

- B.10 This sheet replicates a large amount of the previous sheet (section 2.2). It is not clear how the statistical data were collated or how many residents were questioned. We note that individual results from the residual towers is not included within the documentation, but collected under the one heading 'all towers'.
- B.11 In the 'all towers' version, the option 1 v option 3 ratio has changed to 41% v 47%, but these results are confused by the statement that the figures refer to '% of residents who voted for each window option including residents who did not specify their block'.
- B.12 The results continue to be not easily understood by there being no change in the priority % values shown in table 1 (exclusively related to Blashford Tower) above. The data suggest therefore that the residents of all towers perfectly matched those for Blashford Tower, but rendered a completely different value for overall choice of system.
- B.13 The recurring comments portion of this sheet states the following:
- *Being able to clean the outside of the windows. Residents have needed to clean smear marks on the outside of their windows due to waste being thrown out of open windows above their property.*
 - *Properties that are south facing or on upper floors become overheated and require good ventilation to mitigate the heat gain.*



- *Safety concerns with regards to window openings and the safety risk to residents.*
- *Safety concerns regarding high winds forcing outward tilting windows off the restrictor and/or slam shut.*
- *Resident concerns regarding making good of decorations as well as curtain and blinds.*
- *Some residents misunderstood the functionalities of the restrictors. More clarity is requested regarding this.*
- *Residents wanted clarity regarding the programme timelines and a clearer understanding on the methodology and impact on residents' homes during the intrusive works. Residents were informed that this information couldn't be confirmed until after a contractor has been appointed in the Autumn.*

B.14 These recurring comments are followed by a set of conclusions shown at the bottom of the sheet.

- *Overall, the feedback suggests that the residents believe good ventilation and comfortable room temperature is the most important factor for day-to-day use. Residents also want to make sure a safe option is installed with restrictors that are effective.*
- *The safest and most useable options have to be considered prior to a decision on which windows to install.*
- *The decision will need to take into account the needs of the most vulnerable residents and families as well as those properties most affected by heat gain due to their position in the block.*
- *The results of surveys correspond with the Council's initial view that either option 1 or 3 are the most suitable. The consultation event feedback forms showed more than 40 % of residents preferred either option 1 or 3 and the resident-led feedback forms for Taplow and Burnham expressed a preference for option 1.*
- *The technical evaluation criteria were established by Arup in consultation with Camden to identify the most suitable window type for the Chalcots Estate. Based on the detailed analysis in this report Option 3 better meets these criteria.*

B.15 The data presented on this sheet are rather confusing for us in not showing a distinctive journey (in our opinion) from test data to final choice. The text does not discriminate between blocks and it is not clear exactly how many residents were actually polled.

Overheating 4 Towers (section 3.1)

- B.16 Section 3.1 comprises a spreadsheet analysing different window specifications for options 1 and 2. Variable inputs include G-Values, restrictor variants and shading.
- B.17 The results of each variant are provided against each of the living spaces within a typical flat and then compared with pass/ fail criteria arising from the publication 'TM59 Design for the assessment of overheating risk in homes'.
- B.18 The only options shown to pass this method of assessment are those in option 3 (tilt/ turn), identical in all respects excepting a differing G-Value.



Overheating Blashford (section 3.2)

- B.19 This section repeats the exercise shown above in section 3.1, excepting it applies to one tower only, in this case Blashford, which contains a differing layout to the other towers.
- B.20 In this exercise, option 3 passes in 4 examples using differing U values and restrictor openings. Option 1 passes using a G value of 0.3 and 300 mm restricted opening.

Residents safety / Top hung (section 4.1)

- B.21 Section 4.1 discusses various aspects of a top-hung open-out window sash.
- B.22 The proposal states that the opening sashes can be operated with a handle and a key. The handle is only able to allow the sash to open outwards up to 100 mm, with an extension to 300 mm using the key.
- B.23 A warning is published by Arup within this section that opening the window further than 300 mm is not considered safe, as it would encourage residents to lean too far to retrieve the handle.
- B.24 Arup further state that:

“All window options comply with building regulations Part K2 (Guarding design) and part K5.3 (Safe opening and closing of windows)”

The suggestion of this proposal is that the opening sash can provide trickle ventilation at 100 mm and purge ventilation at 300 mm.

Residents safety / Tilt and Turn (section 4.2)

- B.25 With the tilt/ turn option, Arup state that variable openings can be achieved by handle, key and tool.
- B.26 Both tilt and turn operations are restricted, with the sash being able to be fully opened with the use of a key or special tool, potentially restricting this ability to the Landlord.
- B.27 All other properties are as declared in option 1.

Ease / safety of operation (section 5.1) Blashford

- B.28 This sheet is primarily dedicated to a drawn ergonomic study of the opening of a top-hung sash (option 1) and a tilt mechanism (option 2).
- B.29 The restraining criterion of these studies is their relationship with diagram 8.1 of section 8, part K5.3 of the Building Regulations.
- B.30 There is a warning contained in the text in reference to opening top hung, open-out windows beyond 300 mm:

“However, on the basis of the above regulations we would not recommend opening this type of window beyond a maximum of 300 mm. If this is exceeded residents might have to use step ladders or chairs to access handles or open windows.”

Ease / safety of operation (section 5.2) Taplow, Burnham, Bray, Dorney

- B.31 As section 5.1.



Appendix C Issue 1: Frankham Assessment: Window Risk Assessment 041218

- C [Please note that some of the commentary in this section relates specifically to the original issue of documentation to BRE (table 1) and may be revised in later sections of this report as a result of the subsequent release of data to BRE (table 2)]
- C.1 This risk assessment document appears to have been issued by Frankham on the 4th December 2018. It covers all potential window types to all towers on the Chalcots Estates.
- C.2 The initial commentary, up to item C on page 3 within this document is identical to that in the later Frankham risk assessment document “612827-FCG-Window Risk Assessment Burnham, Bray Taplow & Dorney 170719” and commented on by BRE.
- C.3 On page 3, Frankham describe the proposals they are reviewing:
- A permanently restricted 100 mm opening, bottom hung window and
 - A 300 mm (restricted to 300 mm with caretaker key option to override) side hung inward opening window.
- C.4 Using previously supplied information by Arup, Frankham state that the risk assessment is:
- “To consider if with (sic) there is a risk of falls through the 300 mm opening in this arrangement as proposed.”*
- A risk matrix is used at the rear of the assessment to estimate values.
- C.5 The assessment then proceeds and calculates that the overall risk rating is ‘high’. The individual risks, before mitigation, associated with each activity are described as follows:

Hazard	Description	Rating	Value
H1	Accidentally falling through the window opening	20	High
H2	Windows falling out	15	High
H3	Working at height for maintenance operatives	10	Medium
H4	Poor ventilation	9	Medium

Table 4: Individual hazard risks

- C.6 The assessment then moves through mitigation measures to reduce the individual risks and consequently the overall rating. These include:
- Tilt and side hung windows restriction to 100 mm opening in normal operation.
 - Tilt and side hung windows to have a further 300-400 mm restriction for purge ventilation



- Tilt only, bottom hung windows are restricted to 100 mm in normal operation
- Tilt only, to have a further 300-400 mm restriction for purge ventilation
- Inward opening (only) windows
- Maintenance only restrictor release (not occupiers)
- Improved G values to new glazing

C.7 Frankham consider that these new measures will reduce the risks as shown below:

Hazard	Description	Rating	Value
H1	Accidentally falling through the window opening	5	Low
H2	Windows falling out	5	Low
H3	Working at height for maintenance operatives	5	Low
H4	Poor ventilation	6	Low

Table 5: Changes to risk ratings post-mitigation

Using these mitigation measures, Frankham declare that the overall assessment gives a risk rating of (5) Low.



Appendix D Issue 1: Window Design Proposal

- D [Please note that some of the commentary in this section relates specifically to the original issue of documentation to BRE (table 1) and may be revised in later sections of this report as a result of the subsequent release of data to BRE (tables 2&3)].
- D.1 We believe that this document is part of a power point presentation originally assembled by Camden, but provided to us by Camden. The document is undated however the slide on the last page references a date of 11 March 2019.
- D.2 The presentation begins with a breakdown of the estate's occupancy profile including storeys and number of flats in each block. The scope described is for, among other things, windows, curtain walling and new roofs.
- D.3 Slide 6 refers to the current windows as not being energy efficient.
- D.4 Slide 7 lists 5 requirements for the new windows, compiled in part from feedback with residents:
- Safety
 - Ventilation
 - Help with overheating
 - Energy efficiency
 - Future proofing
- D.5 This slide also details the 'steps taken so far':
- Options appraisal for 8 options to fulfil the requirements
 - Compliance with regulation (sic)
 - In depth safety assessment
- D.6 Slide 8 presents the two options: Top-hung open out and inwards tilt and turn. For reasons not explained in the slideshow, but possibly discussed during the presentation, there are electronic mannequins placed on the window sills showing how falls from height could occur.
- D.7 It may have been that at this point that a concern was raised by residents that the top-hung open-out option was also capable of receiving detritus thrown through the window in the flat directly above.
- D.8 Slide 9 rehearses previous quotations from BS 8213 and the BRE paper "Falls from domestic windows" used in both the Arup and Frankham information discussed elsewhere in this report. Largest risks are falls from height experienced by children in the age group 0-4 years.
- D.9 Slide 10 is important in regard to the selected option. Arup in conjunction with Camden, the Contractor and the rest of the design team, declare the preferred options for each room as:
- Living room and bedroom: Tilt and turn with lowered sill
 - Bathroom: Tilt only (no lowered sill)



- Kitchen: Tilt only (no lowered sill)
- D.10 Slide 11 displays sketches of the conclusions of the previous slide (including lower sills) for the lounge and bedroom windows. There are comments however referring to the 'full' opening of the tilt and turn as being only available to the estate management, in other words the occupiers are not able to carry out this function. This appears in contradiction to the statement by Camden during our site visit.
- D.11 Slide 12 incorporates isometrics and a section, showing the proposal to restrict the small windows (bathrooms) to tilt only. The degree of restriction is noted as being able to be overcome by management.
- D.12 Slide 13. Ditto slide 12, except kitchen units in front of the windows are shown.
- D.13 Slides 14-16 describe the selection process leading to the selection of window types/ opening widths/ sill design.
- D.14 Slide 17 is an energy efficiency assessment.
- D.15 The information within this presentation is captured elsewhere in the other documents sent to us by Camden and commented on within this BRE report.



Appendix E Issue 1: Frankham Assessment: Burnham, Bray, Taplow and Dorney

- E [Please note that some of the commentary in this section relates specifically to the original issue of documentation to BRE (table 1) and may be revised in later sections of this report as a result of the subsequent release of data to BRE (tables 2&3)].
- E.1 The latest report provided by Frankham in our possession is “612827-FCG-Window Risk Assessment Burnham, Bray Taplow & Dorney 170719” We presume this was published on the 17th July 2019. Frankhams are stated as the ‘design advisors for Wates’ in the briefing note sent to BRE by Camden.
- E.2 The Frankham report is a risk assessment and does not address any other aspects related to the installation of windows at Chalcots Estates.
- E.3 The document discusses risks associated with two types of proposed windows:
- 1) Tilt and turn to living rooms and bedrooms (Frankham reference: option 1)
 - 2) Tilt only to kitchens, bathrooms and WCs (Frankham reference: option 2)
- E.4 Frankhams have completed this risk assessment by extensive reference to BS8213-1:2004, which is a current standard. The title is “Windows doors and rooflights. Design for safety in use and during cleaning of windows, including door-height windows and roof windows. Code of practice”
- E.5 The second document referred to by Frankhams and noted by them as “An industry survey and consultation” is actually “An assessment of the current position in Scotland regarding window opening light restrictors in domestic buildings” dated March 2017. Large sections of this document are quoted in the Frankham text.
- E.6 The testing of restrictors is addressed and gives comprehensive references for the strength and durability tests recommended by British Standards. It is not known if the proposed restrictors have undergone such testing.
- E.7 The table used (table 1) from BS 8213 is correctly stated by Frankham. We would point out the notes concerning the recommendations for catches and stays to be used while in cleaning mode.
- E.8 The further quotations from BS 8213 are relevant, including, but not limited to, restricting opening to 100 mm and not possible for manipulation by a child under 5 years old
- E.9 We would draw Camden’s attention to the commentary at the bottom of page 2 which identifies that when a window (sash) is opened beyond its restricted limit, that it is able to be returned ‘as soon as possible, to a position where the restrictor automatically engages’.
- E.10 Please note that the restrictor/ hardware standard quoted by Frankham (DD CEN/TS 13126-5) has been withdrawn and replaced by BS EN 13126-5: 2011 + A1: 2014.
- E.11 The risk assessment produced by Frankham and discussed here is clearly stated as being subject to alteration as a consequence of design development by a specialist sub-contractor:
- “The current status of this risk assessment and the proposed solutions is subject to detailed design and confirmation by designing (sic) by specialist sub-contractor, and will be revised if necessary, as the detailed design is concluded.”*
- E.12 Frankham go on to conclude that the agreed design, meaning the design arrived at by Camden and Arup, is the provision of a system which provides a guarding level of 1100 mm and an opening



that will not allow a 100 mm sphere to pass through. This latter requirement is stated as the reason for the lowering of the existing internal sills.

E.13 The option 1 risk assessment then proceeds with a preamble that includes the three agreed modes of operation:

- a) Tilt to a maximum of 100 mm
- b) Turn to a maximum of 300 mm
- c) Fully opened to 90°

In relation to item c) Frankham clearly state that this could only be management controlled (i.e non-occupant):

"Note this operation must not be able to be completed by residents and only trained LBC personnel for maintenance and checks at timings agreed, as the restrictor is not self-engaging."

E.14 The statement that the restrictor is not self re-engaging suggests that Frankham are aware that a restrictor has already been chosen and as a consequence it does not follow the recommendations of BS 8213-1:2004 (Annex B (normative) Safety Restrictors) as quoted above.

E.15 The last sentence within the preamble for option 1 states that:

"The above severely reduces the possibility of accidentally falling through the window opening".

E.16 A similar preamble is included for option 2, where a 'tilt only' bottom hung window version is installed. Within this risk assessment, all subject to the design by a specialist sub-contractor, the following operating modes are presented:

- a) Tilt to a maximum of 100 mm
- b) Further tilt between 32.5 - 40°
- c) Fully open to 90°

E.17 Similar warnings are provided with regard to maintenance personnel only being able to effect the full opening.

E.18 The preamble concludes with the same statement regarding the above severely reducing the possibility of accidentally falling through the window.

E.19 At the bottom of page 5 Frankham refer to parts of an Arup document which mention items of furniture that increase risk, such as beds next to windows. We believe the items discussed are those shown in the Arup Powerpoint document provided to us as part of this exercise. Having made the statement, we cannot find in the balance of the Frankham report any adoption of the risks posed by adjacent furniture into the risk assessment.

E.20 In the risk assessment calculations that are located in the last few pages, Frankham make the following statement:

"The proposed Current Overall Risk Rating is Low and Accordingly acceptable"

E.21 Both calculations have conclusions which state the following:



“We believe that through our design development and the above, we have reduced the Risk Rating as much as reasonably practical and have accordingly progressed the detailed design in accordance with the above. If the detailed design reveals any significant variations, we will revisit this risk assessment to ensure that the risk profile continues to be mitigated to the lowest level possible”.

This appears to confirm that Frankham are anticipating/ have been appointed as designers of the façade system to be used at Chalcots Estates, but not that they are the ‘designing specialist sub-contractors’ mentioned elsewhere.



Appendix F Issue 1: Façade Specification, Section 1, Arup

- F.1 The Façade Specification for the project was produced by Arup on 23rd May 2018. The two sections sent to us appear bespoke and targeted for use at the Chalcots Estates.
- F.2 We have examined the specification and note the following clauses (please note this list is not exhaustive):

Clause	Requirement	Comment
Section 1		
2.4 (m)	To supply all risk assessments	Clause applicable to works only.
2.4 (y)	Provide all information for Health and Safety file	
2.5	Contractor responsible for all interfaces	Eg: windows/ structure
2.6	Contractor responsible for developing and completing the design.	Design responsibility ultimately rests with the Contractor, not Consultant.
3.1	Note: Design life stated	Contractor should state design life of secondary components (7.2.5 of CWCT)
3.3.1	Note: wind loads etc. stated	Contractor must carry out wind load calculations. Minimum wind load pressures 800 Pa.
3.3.7	Note: Barrier loads stated	Applicable to window transoms.
3.3.8	Note: window hardware standards, including restrictors, quoted.	BS EN parts 1-17 quoted. Also BS 8213.
3.4.3	Note: Window serviceability loads quoted	



3.7	Ventilation: In accordance with ADF. Opening elements to be approved by fire officer. Window hardware to be submitted to EA for approval.	Building Regulations are applicable. Window hardware and stays to be approved by Employers Agent.
3.9	Note U value, G Value and light transmittance discussed.	Values are performance specified within the Contract documentation.
4.1	Specimens for off-site testing to be provided.	BRE cannot locate this list.
4.5.2	Solar and light performance to be assessed	BS EN 410 quoted.
4.6.1	Sample mock-ups and testing	Samples to be submitted for approval to EA. Test reports to EA approval.
		Existing test reports only applicable where installation is identical to this project.
4.6.2	Testing	Test to be carried out by an independent testing authority.
5.7	O&M Manuals	Certificate and test reports for components to be included.
		Maintenance and replacement report required for serviceable parts.
		Method statement for the replacement of components required.
Appendix A1	Warranties for materials, systems and assemblies to be provided with tender.	Clause e
Appendix A2.3	Ironmongery	Samples of all types of ironmongery to be provided.



	Performance tests for proposed window system	Performance test results required.
Appendix A2.4	Material certificates of conformity and guarantees	To be submitted by material suppliers.
Section 2		
1.1.1(b)	Note: Turn/ Tilt, inward opening windows specified.	
1.1.1(d)	Note: bottom hung open inward and tilt/ turn open outward also being investigated.	
	Note: All operable windows will be lockable with a key.	
1.1.2	Solar performance	G value and Visible light transmittance not declared in this version of the specification.
1.3	Note: bottom hung open inward and tilt/ turn open outward also being investigated (communal areas).	
	Note: All operable windows will be lockable with a key (communal areas).	
1.3.2	Solar performance (communal areas)	G value and Visible light transmittance not declared in this version of the specification.
3.2.2.2	Fixings and fasteners shall comply with BS EN ISO 3506-1 and BS EN ISO 3506-2	BS EN ISO 3506 -1 (Screws) BS EN ISO 3506-2 (Fasteners)

F.3 A risk assessment is also contained within section 3 of the specification under section B3.

F.4 Arup have considered the risks associated with any form of glass breakage and describe their consequent mitigation exercises to reduce these.



- F.5 We would recommend that a review of the 'severity of injury' section arising from breakage of the outer (toughened) pane is carried out by the author of the Arup report. It states that the 'severity of injury is likely to be extremely high' and also that on breakage the glass will stay in place, which may be a carry-through from the earlier description of a laminated pane.
- F.6 The matrices conclude that the risk of injury from breakage of the inner pane is 'tolerable' while from the outer pane is 'undesirable'.
- F.7 No risk assessments are contained in the sections of the specification sent to us which investigate the various risks associated with dislocation of the restrictors by operatives or dedicated resident key holders.



Appendix G Issue 2: Supplemental Information

- G.1 Subsequent to the first issue of this report, on the 22nd October 2019, further supplemental information was sent to BRE by Camden (table 2):

‘Windows and curtain wall options for your block’ (undated)

- G.2 This appears to be a mailshot sent to all residents of the Chalcots Estates, informing them of the current status of the window replacement scheme and inviting them to various open-houses and to fill in a survey of preferences.
- G.3 The leaflet clearly sets out the 4 window options being considered with their advantages v disadvantages (pros v cons).
- G.4 Option 3, Bottom/ side hung window, indicates that the window is in line with current safety regulations and does not encourage people to lean out of the window. It also says
“that adult supervision is needed when in the turn position”.
- G.5 This document is limited in technical detail presumably to ensure that the content is easily understood by all of the residents on the estate.

Summary of feedback from recent engagement events (undated)

- G.6 This document is a summary of results subsequent to survey collection and the events described in ‘Summary of feedback from recent engagement events’. We believe it was authored by Camden and/ or Wates.
- G.7 The events were held separately by Camden and Wates.
- G.8 The document makes clear that the Swiss Cottage Library event (by Camden) resulted in a total of 51 feedback forms being received and 64 comments posted on a feedback board, noting that the number of responses was small compared to the number of residents of the Chalcots Estates.
- G.9 Wide-ranging responses were received, with numerous comments on the window design, radiators, and works duration. No dominant, consistent theme arising from the resident consultation appears to have been obtained, however half of the residents commented that the events helped them understand the proposed changes to their radiators and window sills.
- G.10 The Wates drop-in events were attended by 102 residents, but the comments obtained appear to be more concerned with working conditions and estate management during the re-cladding exercise.
- G.11 Page 6 contains an appendix which is a summary of resident responses to the Camden event attendance. The results confirm the wide-ranging comments noted above.
- G.12 Page 8 ‘Appendix 2’ collects together common topics raised from both events, of which the majority discuss the proposal for new windows to be ‘negative’ or ‘neutral’. The proposal to lower the sill also appears to have been negatively received.

Chalcots Estate windows panel engagement feedback

- G.13 This note clarifies that it is updating the feedback received from the residents at the Swiss Cottage engagement event, online and also by post. It is dated 3rd July 2019.



- G.14 The number of respondents is 147, spread across the various blocks.
- G.15 The results of those who returned comments showed that the majority favoured a glazed panel above the reduced sill and a majority preference for lowering the small window sill in the living room.

Fire Safety Programme Update

- G.16 Please note that BRE will not be commenting on the fire issues contained within the above document, which is dated 23rd July 2018.
- G.17 Under section 4.1, the subject of the current (installed) windows is discussed and rehearses the particular problems of some windows detaching from their hinges and falling from height.
- G.18 The document states that the Council's consultant engineers have recommended that the windows (and cladding) should be replaced.
- G.19 The choice between the 4 options for the replacement windows is explained and the reasoning behind the final selection of 2: - a top-hung open outwards + a tilt/ turn inwards opening window.
- G.20 The results of the feedback from resident engagement is discussed and a statistic that 65 % of those who responded stated that the current windows kept people safe, are easy to use, work well with blinds and keep out the rain.
- G.21 Various other percentage values are stated showing that residents, on the other hand, did not think that their current windows perform well against some of the criteria.
- G.22 Under section 5.5, the top four most important criteria given by residents for any new window were:
- Letting in fresh air
 - Keeping out the noise
 - Keeping a comfortable temperature
 - Easy to use
- G.23 The event feedback is further discussed under section 5.13. In relation to the BRE investigation, the following comments are relevant:
- Residents being able to clean the outside of their windows
 - Safety concerns with regard to window openings
 - Safety concerns with regard to wind causing windows to slam shut
 - Misunderstanding as to restrictor operation and adult supervision

Chalcots Estate Timeline of the Programme of Works

- G.24 BRE have no comment to make on this document.

SCHÜCO General Accessories Data Sheet (ref:B11-58, 10.2019/14584)

- G.25 This appears to be a product sheet containing data related to various types of Schüco stays. Referring to the photographs taken of the sire sample, we assume the relevant model is the one referred to as 277441 (or 277442 if handed).



G.26 The data sheet states that this stay can limit the window swing to 89 mm or 100 mm. The data sheet and product suppliers (specifically 'Complete Aluminium Spares') state that the 100 mm limitation is for 'safety', the whilst the 89 mm is for 'safety of children'.

G.27 There is also a note which says:

'In accordance with the relevant construction regulations, additional measures must be taken for safety barriers on opening units'

This note is not further explained.

G.28 One standard is mentioned on the data sheet: EN 13126-5. The current version of this standard is BS EN 13126-5:2011+A1:2014. The title is "Building hardware – Hardware for windows and door height windows – Requirements and test methods – Part 5: Devices that restrict the opening of windows and door height windows"

G.29 There is a confusing statement on the data sheet that says that when the stay is tested under the above standard, it is tested 'for use (clause 8)'. We cannot find clause 8 in the standard. We believe this may be a reference to 'Digit' 8 which is a specific classification reference, which is discussed below in the ift Rosenheim certificate.

ift Rosenheim Test Certificate Nr. 15-001804-PR02 (PB-G05-03-de-02)

G.30 This test certificate is written in German, we have used a third party programme to translate the key points (Google translate).

G.31 The product tested was the restrictor stay described above (Schüco 277441).

G.32 The classification table produced is in a format generated by a harmonised standard, when the UK version of the table headings are used the results are thus:

1	2	3	4	5	6	7	8	9
-/-	5	200	0	3/5	5	-/-	5/6	1700/2100

Where:

Digit	Description	Result
Digit 1	Category of use	No requirements
Digit 2	Durability	Grade 5 (25 000 operation cycles. 3750 engage and release cycles)
Digit 3	Mass (sash)	200 Kg
Digit 4	Fire resistance	Grade 0



Digit 5	Safety in use	Grade 3/5 (
Digit 6	Corrosion resistance	Grade 5
Digit 7	Security	No requirements
Digit 8	Applicable Part	Grade 5/6
Digit 9	Test sizes	1700/2100

Chalcots Estate Recladding: Window system options, Revision A, 14 May 2018

- G.33 Previously, BRE commented on the update to this document under the first issue of this report. The original document (revision A) contains information not previously seen and commented on below:
- G.34 Section A2 & A3 (pages 9 and 10) refer specifically to residents' safety and the positioning of children's bunk beds adjacent to windows.
- G.35 Plans are provided that classify, by colour, different degrees of appropriateness for the position of bunk beds. There are also suggestions for the handling of windows to increase safety.
- G.36 The document also contains detailed studies analysing purge ventilation and overheating issues which are covered in the update document and so not discussed further here.

Window review options (Excel spreadsheet), undated, unauthored

- G.37 This document contains information regarding window options – it is a single spreadsheet and looks to be a work in progress. The information contained on the sheet appears to be discussed elsewhere within our report.

Window Design Chronology, November 2019, Draft by ARCADIS

- G.38 The ARCADIS document has been prepared for presentation and does not appear to contain any further information for comment to that described above.

Health and Safety General Risk Assessment (Option 1), 24th October 2018

- G.39 This risk assessment was produced at an early stage of the window design procurement and describes risks associated with 'open outwards' windows. We assume, being option 1, that the product is top-hung.
- G.40 The overall risk rating of the current (installed) system is calculated by Camden as 15 (High).
- G.41 A new open-outward, top hung solution is considered, with individual risks calculated as follows:

Risk	Risk Rating
Falling through the window opening	Low (5)



Windows falling out	Medium (10)
Working at height for maintenance	Medium (10)
Poor ventilation	Medium (9)

G.42 The overall risk rating is reduced under the new scheme to 10 (Medium).

Health and Safety General Risk Assessment (Option 3), 24th October 2018

G.43 This risk assessment compares the currently installed, top-hung, open-outwards windows with a new scheme to replace with inward opening windows.

G.44 The rating of the system repeats the previous assessment of 15 (High).

G.45 A similar assessment is carried out to the one above for the new windows, which reduces the overall risk rating to 'Low'. It should be noted that this risk assessment makes no reference to restricted openings or the positions of bunk beds, which may have altered the overall risk rating at a subsequent review.

612827-FCG-Window Risk Assessment Burnham etc. 170719 (Arup Comments)

G.46 Arup have commented on this document in a pdf version. BRE also commented during the previous issue of this report. We note that Frankham updates have been recently issued and therefore these updates only will be reviewed by BRE, the assumption being that both Arup and BRE comments have been considered whilst compiling the new Frankham documents.

612827-FCG-Window Risk Assessment Burnham etc. 191119 – Self engaging restrictor

G.47 This risk assessment has been calculated by Frankham and is the most recent assessment to have been undertaken. It appears to have been written in response to a request to examine the risk effect of adding a self-engaging restrictor to the tilt/turn inward opening window option.

G.48 The current overall risk-rating for the windows proposed by Frankham/ Wates is LOW (5).

G.49 The variation to this risk rating occurs, in Frankham's terms, where a self-engaging restrictor is substituted for the management-controlled restrictor proposed in their current design. Frankham have expressly stated that they would not endorse this arrangement, the restrictor being able to be overcome with a pointed object by the resident.

G.50 The overall risk rating using this arrangement has consequently changed and is now calculated as HIGH (17.5) and 'unacceptable'.

612827-FCG-Window Risk Assessment Burnham etc. 191119 – 90 degrees

G.51 This risk assessment by Frankham follows the wording of the self-engaging restrictor option even though the self-engaging restrictor does not form part of the assessment. We assume this assessment is based on the current proposal of the Schüco restrictor stay only, but with resident control of the disengagement tool, meaning the resident can open the window to fully 90 degrees by dislocating the restrictor.



- G.52 Similar to the above assessment, the overall assessment changes from LOW (5) to HIGH (17.5) and Frankham are fundamentally opposed to this option.

612827-FCG-Window Risk Assessment Burnham, Bray, Taplow & Dorney 170719 rev A 191119

- G.53 This is a revised risk assessment of the version discussed in our original report. Please note that we believe there is an error in the overall risk rating calculation on pages 6 & 8 (of 9) where the 'X' should be placed in the 'low' box.
- G.54 All of the options discussed in this risk assessment assume the resident does not hold the key to dislocate the stay and open the window 90 degrees. It also assumes that the operation to open to 300 mm for purge ventilation is a two-handed, resident key-operated system (this key not being the same as the one to enable 90 degree opening).
- G.55 A statement has been added to page 7 describing the further risks posed by leaving the window unattended in the purge position and the need for a formal resident discussion to take place as part of the on-site management process.

Risk register for: Chalcots Estate Re-cladding

- G.56 We have been provided with a further risk assessment carried out by Arup, which takes the form of a spreadsheet and demonstrates the effect of post-mitigation measures applied to the proposed window design. The windows are specifically discussed under section 8.
- G.57 The risks identified are as shown below:
- Opening window falling (during service/ use)
 - Persons (including children) falling out of window (during service/ use)
 - Overheating (current weather)
 - Overheating (Future weather data)
 - Ventilation (purge)
 - Glass (guarding) failure
- G.58 The calculation used by Camden in order to provide the risk numbers is not shown and it is difficult for us to make a direct comparison with the Frankham risk assessments.
- G.59 It is clear however that the risk ratings as calculated by Camden have reduced in the majority of cases, with no risk increasing as a result of the mitigation actions taken.
- G.60 The explanations discussed under both 'Design mitigation action' and 'Comments/actions' are generally the same as those discussed in both the Frankham documents and the previous design studies carried out by Arup.
- G.61 The exception appears to be item 008b, which describes the risk of 'Persons (including children) falling out of window during service/ use'.
- G.62 In relation to this risk, Camden have stated under Comments/ actions 'Management: LBC to implement protocol with respect to training, instruction and use of windows and keys, including the assessment of responsible persons in each apartment'.



- G.63 This statement suggests that the special tool for being able to release the window and enable it to be opened to 90 degrees will be held by the Resident, which Frankham currently consider a high-risk strategy.

Window system options 03/19 UPDATE / 4 TOWERS

- G.64 This options update includes numerous references and details previously issued across other documents and fully discussed within this report.
- G.65 The below commentary addresses items not previously discussed in these documents.
- G.66 The document has been updated as a result of engagement with Camden and the preferred Contractor (Wates).
- G.67 Overheating and purge ventilation is discussed and the relationship of the importance of both stated as being the direct result of resident engagement.
- G.68 Arup demonstrate compliance in their dimensional treatment of the window heights, including exceeding the required guarding level, even when standing on the sill.
- G.69 Overheating spreadsheets are again included, showing ability (for certain options) against current and future environmental conditions.
- G.70 Item 4.0 'Purge Ventilation' explains that requirements will only be met if the windows are opened to an angle greater than 30 degrees. Arup state that this can be achieved by the residents having possession of the special tool to disconnect the restrictor, leaving the possibility of opening to 90 degrees. This is repeated under section 5.3 'Residents Safety'.
- G.71 The proposal to lower the sill is explained as being related to the need to provide a + 1100 mm guarding height above the lower sill level.



Appendix H Issue 3: Supplemental Information

- H.1 Subsequent to the second issue of this report, dated 17th December 2019, further supplemental information was sent to BRE by Camden (Table 3).
- H.2 The following commentary addresses each of the documents in chronological order from latest to earliest.

Email Issue: Camden to BRE 17th February 2020

- H.3 Camden wrote to BRE on the 17th February 2020 attaching the documents listed in table 3 above.
- H.4 In addition to describing the contents of the attachments, Camden also suggested format revisions to issue 2 of this report, including the moving of the body of the information assessments to appendices. This has been completed.
- H.5 A fundamental statement is included within the email issued on this date that:
- "I can also confirm that Wates, Arup, Arcadis and Camden have discussed the risk assessments and Wates are sourcing a self-engaging restrictor with tool as child proof feature".*
- H.6 Further details are not provided within the attachments, but we assume that this statement has been issued in response to items 12.3 & 12.4 of our issue 2 version of the report. (Section 12 'Conclusions and Recommendations')
- H.7 BRE would recommend that all parties formally re-issue their risk assessments once the final version of the restrictor is selected.
- H.8 The information issued to BRE on the 17th February consisted of two separate emails. The later document (timed at 16:49) contains summary tables issued by Sally Kikaya, Project Officer. These tables refer to 1) the total number of responses to surveys conducted by Camden & TRA and 2) a chronology of dates and responses ranging from May 2018-November 2019. This latter table is potentially the most useful as it places the results that were available to the design team at various stages of the design. With the exception of the 1st floor residents' survey (October 2019) the proportion of respondents to total residents represented approximately a quarter to a third.

Issue 2: BRE Report Overview (comments by Sally Kikava of Camden) 6th January 2020

- H.9 This document contains two comments on the original document produced by Astrid Kjellberg-Obst on the 6th January 2020 (see below). The first of these is semantic in nature and not relevant to our assessment.
- H.10 The second comment is relevant as it appears to suggest that further work is required by Arup to cover 7 No. flat types. We are unaware of a response to this comment.

Issue 2: BRE Report Comments by Camden (AKO & SK) January 2020

- H.11 Issue 2 of the BRE report was commented on by Camden during January 2020, primarily Astrid Kjellberg-Obst and Sally Kikava although other individuals appear to have also provided notes. Comments on the report have been attached using formal comments and sticky notes within the pdf programme.
- H.12 The comments included appear to be mainly intended as discussion points between Camden staff and have not been addressed in our assessment. Relevant comments however are as follows.



3.17. For clarity, our understanding is that Camden considered the existing window design, which was then ruled out based on the risk assessment for each window opening type.

4.9 In regard to the survey information collation and publishing, Camden have now supplied all data.

4.12 As above.

4.17 As above.

6.16 It has been clarified that this document was provided for BRE use only.

7.17 c) Camden are stating here that when in tilt mode the bottom hung windows will only open to a maximum 50° angle. Camden have clarified to BRE (31st March 2020) that the maximum will actually be 45° and that the 90° figure is an error in the source document.

9.23 Camden state here that cleaning of the outside of the windows will only be possible for residents on the inward opening panes.

9.56 Camden have stated that the risk assessment was carried out by Arup, but this is not our understanding. Camden have subsequently clarified to us (31st March 2020) that both Camden and Arup jointly developed the risk assessment.

10.2 We have corrected the flat number visited from 113 to 85.

10.5 Camden confirm that external cleaning will be by professional cleaners twice a year and that this will be carried out using the rails on the top of the building.

10.7 Camden commented that the two flat numbers have been mixed.

10.21 Camden have now confirmed that all glass panels will be clear and a solution developed (such as a film or other device) to help those residents suffering from the effects of vertigo.

10.25 Camden have responded to our comment regarding possible use of a chair (or similar) to clean the top of a fully opened-in window as 'not expected'.

11.4.1 Camden have stated that residents will not be responsible for cleaning their windows externally.

Issue 2: BRE Report Comments (AKO and Arup) (December 2019 – January 2020)

H.13 The PDF file for these comments is named with dates 31/12/19 and 15/01/20, which we assume were the dates responded to by Camden and Arup respectively. The Camden comments are essentially identical to those in the previous document (Issue 2: BRE Report Comments by Camden (AKO & SK) with new Arup comments overlaid.

H.14 There is a comment on the introduction stating that repeated comments from the issue 1 audit will not be repeated (see below).

H.15 Similar to the commented document above (Issue 2: BRE Report Comments by Camden (AKO & SK)) there are a number of comments which appear to be inter-company queries and



conversations. This will not be responded to by us. Comments relevant to our assessment as follows.

2.4 Camden (camao077) comment that the height of the proposed window sills (original height) was a concern raised by the Main Contractor, not residents.

8.5 Arup state that the risk assessment advised will be carried out by the Main Contractor.

8.7 Arup refer the reader to 'Principle Designer Handover Information' with regard to risk assessments for the stays. We suggest this is checked to ensure the information is available.

9.46 Arup confirm that their comments have not been incorporated into the Frankham Risk Assessments.

9.5.3 As above.

11.2.10 BRE will not be producing risk assessments for this project.

11.2.17 There are no further BRE comments to add to this clause.

11.5.1 Arup state that a second sash is not being considered. It is of concern that the following statement has been made:

"Weathertightness was never calculated and the number of openings should not affect the whether (sic) tightness of a tried and tested system."

"We assume that this is an error. It would be unusual for a window system employed to such a large degree as that at Chalcot Estates not to have been calculated and tested."

12.4 Arup state that the residents should not be cleaning external areas of fixed glass from inside. Clearly, this is a fundamental risk (should the residents undertake it) and we would recommend that the point is made from consultation to service, giving the same degree of attention as the releasing of the stays.

BRE Overview Document Camden (17th December 2019)

H.16 Camden have issued two versions of an overview of our report (P116025-1000 issue 2) dated 17th December 2019. The first is the original produced by Astrid Kjellberg-Obst and the second the original with comments by Sally Kikaya (see above).

H.17 The original document appears to have been produced for internal circulation and summarises Camden's interpretation of the BRE report. The commentary is necessarily a precis of individual sections and as a consequence the context is absent from the original description. This is not intended as a criticism of the process, but only to highlight that we have not examined the commentary for meanings which were not originally intended.

H.18 Nevertheless, some relevant material exists. The following is not exhaustive:

2.2 Camden state that revised risk assessments are required, with Camden's landlord experience being factored in.

2.4 The free area available when the newly installed window is installed is critical to both ventilation and safety calculations/ risk assessments.

2.5 The proposed restrictor (not yet chosen at the time of writing issue 3 of this report) requires to be included in a revised risk assessment.



It is correct for Camden to point out the issues that typically affect warranties for new windows.

4.3-4.5 The contradiction in Frankham's risk assessments is clearly stated including factoring in of furniture distribution.

4.6 There is confusion as to who will hold the restrictor key (Landlord or resident).

Glass breakage assessment needs revising in the risk assessments.

6 Camden make the comment that the resident does not need to clean the outside of the windows except where the sash opens inwards, in which case 'spot cleaning' can be carried out. The question remains as to how residents would be encouraged not to remove spots at high level with use of a chair etc. BRE suggest that this is incorporated into any further risk assessments.

H.19 Sally Kikaya made two comments on the original document. The first describes a description error in the original document. The second is a more fundamental statement about the on-going concern that Arup assessment(s) didn't take into account the different flat types (7 No.) on the Estate. On the 29th April 2020, Arup responded to this comment by stating: "All of Arup's calculations and reports have analyzed each flat type and provided room by room overheating and purge calculations".

H.20 We have assumed that this apparent discrepancy has been addressed and corrected during Camden's internal discussions.

Issue 1: BRE Report Comments (Arup, Camden, Arcadis) approximate date October 2019

H.21 This document is based on BRE's issue 1 report, but was received after publication of issue 2. We have restricted our commentary therefore to the relevant points arising from this document which may still be considered current in our assessment.

H.22 There is also confusion in the comments made generally regarding the status of items (such as restrictor operation) which has changed since publication of revision 1.

H.23 Please note that no statements within any issue of this report should be construed as a design proposal by BRE. This includes any references to products and/ or operation of the building.

H.24 Comments appear to have been made during October 2019 and again include inter-departmental or inter-team conversations which we have not responded to below. We have also not responded to comments such as 'not correct' where no further detail is added to explain why.

2.3 BRE will not be commenting on what they consider to be the 'best' solution.

BRE are operating to a brief and description provided by Camden. The description of existing cladding build-up and potential technical/ safety issues was not something we were asked to specifically comment on.

2.5 The scope of BRE's work is described in our signed proposal.

BRE have carried out a review of Arups comments on the Frankham Risk Assessments.

Section 3: BRE were presented with the document under section 3 and assessed it. The comment will be retained within this revision.



3.57 Arup state within their comments that they have not selected Schüco as a system and that this will be at the discretion of the design and build contractor. The various sections used throughout Arup's reports are Schüco sections, hence the comment. However, we accept this is at the Contractor's discretion.

4.4 Arup make the comment that Blashford Tower has a different layout to the other blocks, which we accept.

4.6 Arup appear to be saying that they did not have influence in the formation of window types discussed with residents during the survey period, which we assume to be incorrect.

4.12 Arup state that a detailed review of survey results is unnecessary. It is true however that the survey results formed a critical part of the window option development.

4.24 The safety comment exists and is not taken out of context – we believe this comment was made by Camden and then answered by Arup in a sticky note response.

4.27 Arup state that restricting the key ownership to the Landlord is not their position, however the original statement arises from their document (Report version 11th May 2018 page 39).

5 BRE have reviewed the Arup comments on this document.

5.1 Arup state that the Frankham report does not cover all types as stated, which will need to be addressed in the on-going risk assessments.

6 BRE are now aware that the document was prepared for BRE only. We will not be omitting our comments on this document from the report.

6.10 BRE will not be providing commentary as to the apparent contradiction between Wates/ Arup and Camden. The restrictor issue is discussed elsewhere in the latest version of this report (issue 3).

7 BRE will only comment on the content of the risk assessment published at the time.

7.1 Arup again state that BRE should review the Arup comments on this document, see above.

7.9 BRE make reference to the restrictor operation and self-engagement elsewhere in this report (revision 3).

7.12 BRE will not be providing further commentary on this section.

7.14 BRE will not be recommending a restrictor and note that the Arup comment refers to a restrictor not having been chosen. This section will not be amended as it is fundamental to the understanding of this version of the Frankham assessment.

7.16 The Frankham assessment, correctly or otherwise, states 90°.

7.17 BRE will not be making recommendations or proposals with regard to the operation of the windows. This section refers specifically to Frankham's insistence that the windows are only fully opened by maintenance personnel.

7.21 Conclusions and recommendations are not incorporated for this risk assessment except where stated in the body of our assessment of it.

8.2 Our understanding from the site visit was that rails do exist on the top of the towers. We assume from Arup's comments therefore that these are inadequate for the purposes of



supporting cradles and that new rails are to be provided. The provision of rails or not is not part of our brief for assessment.

8.5 The comment from 'Bellem' states that contrary to this item, a BMU system is proposed and that occupiers would not be responsible for cleaning their own windows. This is addressed in our new (revision 3) report.

8.6 This section similarly needs revising, see above.

The Bellem comment here is incorrect. The Frankham assessment does discuss the risk of a fully opened window.

8.23 Arup again confirm that their current thinking is consistent with Camden but not Wates. Arup, at the time of making the comment, understand that Wates are not agreeable to occupiers holding the key to enable full opening of the window. Camden have now indicated that this has changed.

9.1.1 Camden comments regarding discussion of other factors are included within the body of the report and not provided here.

9.1.3 The comment that Arup were not involved in the collating and interpretation of the survey results will be removed from this version of the report (issue 3).

9.1.4 The comment regarding risk assessments being provided to residents will be removed from this latest issue (issue 3) of this report.

9.21 We will remove references to pre-selection of Schüco from the issue of the latest report (Issue 3).

9.2.2 Referring to the commentary by Bellem, this clause was amended within revision 2.

9.4 We acknowledge that specifications for the windows have been issued but this does not change the content of this clause by BRE.

9.5 The section was revised in issue 2.

9.7.1 Weathertightness is an issue that is relevant when discussing openings in window units. We understand however that the proposal to provide small openings to supplement ventilation has now been cancelled, except to the kitchens.

10.3 BRE have provided commentary throughout the report with regard to the restrictor operation. BRE will not be proposing products or operation ideas.

10.4 This has been revised in issue 3 of our report.

10.7 As above.

Executive Decision Chalcots Window Design (10th April 2019)

H.25 This document was submitted to the Director of Property Management at the London Borough of Camden on the 10th April 2019 and asks for approval to replace the windows on the Chalcots Estates. Part of the submitted supporting documents was the Windows Engagement Survey described below.

H.26 The introduction rehearses the technical and social need for replacement windows as discussed elsewhere within this report, including the window detachment failures of the existing systems.



- H.27 A brief description of how options 1 & 3 for the windows was chosen. (Top hung tilt outwards and bottom/ side hung tilt and turn inwards).
- H.28 The overheating, ventilation and safety concerns are described, including the proposal to lower the sills.
- H.29 Of relevance to this report (issue 3), there is a clear statement within the application to the residents having control over the full opening of the window with a special tool. BRE have not been aware of this document previously. The Resident Safety section clearly demonstrates that use of a special tool to fully open the window was a fundamental part of the design proposal for option 3 as early as April 2019.
- H.30 The differences between Blashford window sizes and the other blocks is fully explained.
- H.31 The document states that the design team consider option 3 with the lowered sill height best satisfies the critical issues.
- H.32 The resident survey and engagement results are published, based on the information outlined in the email sent to BRE on the 17th February 2020, which in turn are based on the Windows Engagement Survey Breakdown (see below).

Windows Engagement Survey Breakdown (undated)

- H.33 This document is attached to the email sent to BRE on the 17th February 2020 by Camden. It contains collated feedback from the various surveys and engagements carried out with the Chalcots residents.
- H.34 No dates are attached to the breakdown, but the tabled data identify the quantity of responses as well as values against Criteria Priority.
- H.35 It is not clear at what point this sheet was used in the decision making process on technical issues. There is an explanatory text in the 17th February 2020 email which places a chronology on the engagement surveys etc., but these span (for instance) either side of the Executive Application made above. It is not possible therefore from this document alone to establish how much of the resident feedback was available to the project team before the application was made.
- H.36 In these circumstances it is unlikely that this document would provide any additional data for assessment by BRE of the decisions on technical issues.

Windows Window Design Feedback / Survey Overview (last entry - November 2019)

- H.37 The windows feedback study summarises data from the engagement activities carried out by Camden, spanning a period between May 2018 to November 2019. There are 5 activities in total.
- H.38 The survey subjects refer to various social and technical criteria. The survey outcomes are expressed as percentages of responses. The number of responses are generally in the region of a quarter to a third of the total residents on Chalcots Estates.
- H.39 There is further information at the bottom of the table which comments on the successful outcome of resident engagement at the window samples provided in the basement of Burnham Block.
- H.40 The tables associated with this document are pasted into the email received by BRE from Camden on 17th February 2020.

Arup Report: Chalcots Estate Recladding, Window systems options 18th April 2018



- H.41 This document has been sent to us under cover of the Camden email dated 17th February 2020. The report has an issue date of 18th April 2018.
- H.42 The contents of this report are progressed and developed in the subsequent version dated 14th May 2018 Arup ref: 259493/00 rev A, which was commented on in revision 2 of this BRE report.
- H.43 Consequently, no assessment of the 18th April 2018 report has been undertaken.

Arup Report: Window System Options 03/19 Update/ 4 Towers rev C (25th March 2019)

- H.44 This particular version of the Arup information has not previously been sent to BRE. We note that revisions A, B and C were issued in quick succession during March of 2019.
- H.45 The introduction explains that this revision of the document is an update of previous versions and concentrates on overheating, purge venting and residents' safety.
- H.46 The report concentrates on options 1 & 3.
- H.47 Section 2.0 describes the guidance standards used in the calculation of overheating (CIBSE) and ADF appendix B for purge ventilation. It also makes reference to the standard of installation of the new parts to not be of a lesser standard than the original.
- H.48 Section 2.1 repeats the majority of content of previously issued 'Window System Options' documents issued between February and September 2019. In this version (March 2019) the discussion regarding guarding heights and control heights is clearly explained and how these have affected the proposed design.
- H.49 We will rely on previous comments issued by BRE in issues 1 & 2 regarding the calculations and analysis of overheating and purge ventilation.
- H.50 Section 5.1 rehearses the previously issued proposal to lower the sill levels as a reaction to Residents' Safety.
- H.51 Section 5.2 is identical to section 4.1 of the previously issued report by Arup on this subject (Chalcots Estates Recladding/ Window System Options/ Update/ 259493/00/F) issued 18th September 2018 and previously commented on by BRE.
- H.52 The fundamental change between the two documents in the clause above is in relation to the 'Tilt and Turn' version of the window under section 5.3 of the new report and section 4.2 of the previous version.
- H.53 In section 5.3, the third operation mode 'Turn Fully Open' Arup specifically state that the residents as well as Camden will be able to open the sash by using a special tool to release the restrictor. The wider explanation states that the residents are not under an obligation to do this if they do not feel comfortable doing so. The opportunity to fully open the windows is linked to the customer feedback that suggests opening the window during hot weather is desirable.
- H.54 The type of window restrictor is also discussed in this section but we understand that this is under review as a self-engaging version is being sought (refer to comments at the beginning of this 'Issue 3 Supplemental Information').
- H.55 Subsequent to the above sections, the balance of the included information repeats the matrices of previous 'Window Option' documents which are commented on elsewhere in revision 3 of this BRE report.



H.56 Under section 8.0 'Conclusions' there is a statement that "Key/ special tool will be managed by LBC based on safety and risk assessments. LBC will engage with residents on the approach". We assume that this refers to the on-site training of residents in the use of the key and not on retention of the key by Camden, based on section 5.3 discussed above.

Appendix I Issue 1: Site Visit 11th October 2019

- I.1 Graham Lee of BRE attended Burnham block on the 11th October 2019 for the purpose of inspecting the sample windows installed in the basement and review internal finishes in two show flats. Astrid Kjellberg-Obst and John Brett of Camden were also in attendance and access was provided by Niall Tierney, Wates site manager.
- I.2 The team firstly visited flat 85 of the Burnham Block tower to familiarise BRE with the general layout of the flats. No remedial or preparatory work had been carried out. Windows and internal finishes were as existing throughout the block.



[1577] Window to living room, flat 85, Burnham block

- I.3 Camden explained that the top-hung windows were of the type that had previously detached. As a consequence, all windows to all blocks had been fitted externally with stainless steel cables to ensure any detachment would not result in units falling to the ground.
- I.4 Unlike the other rooms in the flat, the living room benefited from an additional window, however Camden stated that this was only the case for flats with external flank walls.



[1578] Second window to living room (flats with flanking walls only)

- I.5 Prior to issue 3 of this report, Camden confirmed that the current thinking for cleaning of these windows externally was that a professional company would be used twice yearly for this task, using a rooftop bmu. Camden have also confirmed that full opening of the sash for spot-cleaning purposes of the external glass of the sash only whilst in the open position could be effected.
- I.6 Occupiers therefore, were to retain all keys and tools to enable the new windows to be fully opened. This protocol is discussed elsewhere in this BRE report, particularly in relation to the Frankham risk assessments.
- I.7 Subsequent to the visit to flat 85, the team visited flat 113 which contained partially complete internal finishes which have been used to demonstrate to residents the likely fitted arrangements including sill heights and sill board depths. The flat was not fitted with the proposed window units, but left the current frames in place.
- I.8 The new arrangements in the living room reduced the sill height of the main window to approximately 290 mm from finished floor level, meaning that the existing radiator, commonly placed below the main window, would have to be moved. Camden showed BRE options for the new radiator positions and type being considered by the residents.
- I.9 The new details for the main window effectively provide a sill board of approximately 430 mm depth, capable of being used for sitting.
- I.10 Wates explained that the height of the replacement windows required the sill board to be moved closer to the floor than currently installed. In order to enable this, the internal blockwork currently forming the wall under the existing windows will be demolished to the required level.
- I.11 Wates also confirmed that the internal blockwork wall was not tied into the primary structure and that no slab upstand was present underneath the existing blocks, allowing them to be removed without structural consequence.

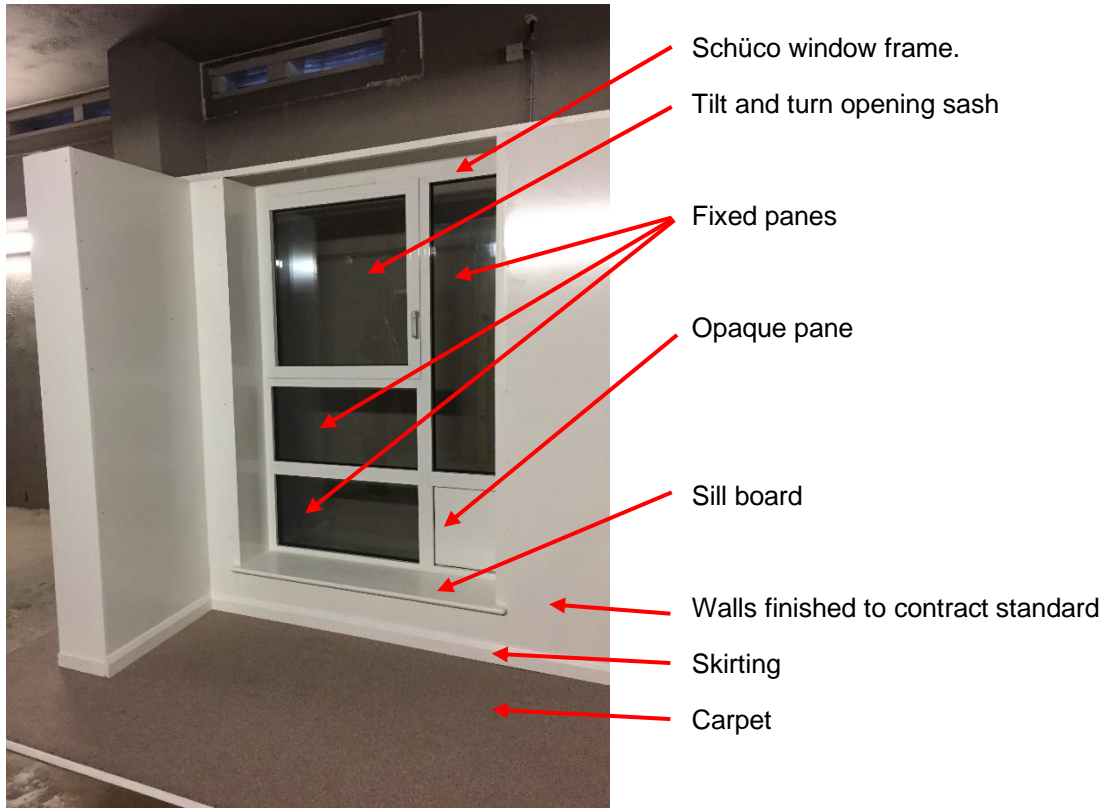


- I.12 Although empty at the time of the inspection, Wates confirmed that the residual cavity underneath the new window board was to be filled with insulation for the purposes of minimising heat loss.
- I.13 The cavity was seen to have been fitted with a fire stop material at floor level, representing the approach to be adopted as part of the overall solution, meaning that a compartment was to be created at floor level. Although not seen on the large living room window, Wates confirmed that fire stopping to the window frame perimeter, including jambs and head, would be installed in accordance with Building Regulations.
- I.14 The partially constructed sill board of the large window allowed examination of the fixing arrangements which appeared to show no accommodation for live load on the newly created bench seats. As components subject to sitting and most probably standing, there was no allowance for the sill board, plasterboard or metal framing sections to move differentially from each other.
- I.15 All currently installed upvc profiles (sill boards, reveals etc.) were confirmed as due for replacement with timber alternatives for all window of all flats throughout the estate.
- I.16 The smaller window of the living room was also partially finished for the purpose of inspection. This allowed the construction of the sill board, fire stopping and reveal construction to be examined.
- I.17 The construction followed the same principles as the large window.



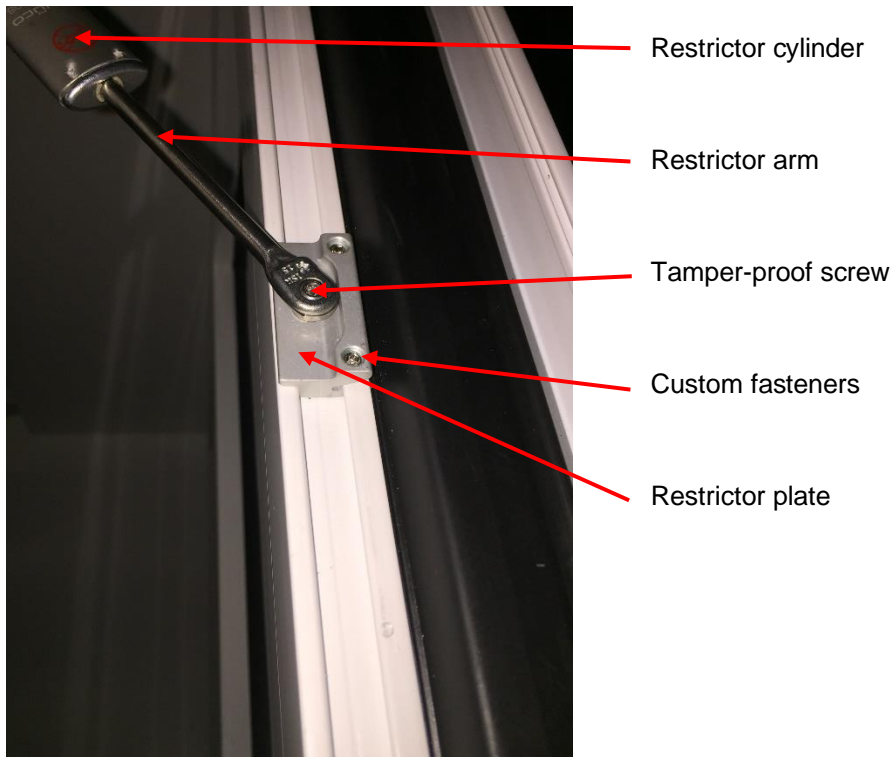
[1581] Flat 113, living room, small window.

- I.18 Subsequent to the visits to the flats, the team moved to the basement to examine constructed sample windows.
- I.19 The first sample to be examined was a large living room window. The sample was presented as a fully finished window set within the refurbished finishes, including painted walls, skirting and carpet.



[1583] Sample large window in the basement of Burnham block.

- I.20 The external face of the window system, whilst complete, was not set in an arrangement which replicated the external façade, lacking, among other things, cladding materials and membranes. Drainage caps were present and were seen to be correctly created when viewed via the opening sash.
- I.21 An opaque panel had been incorporated into one of the lower fixed panes as an example of obscurity, intended to help with occupants suffering vertigo. Camden explained (31st March 2020) that for planning reasons, this option will not proceed, but rather a film or other device will be used to provide comfort for those residents suffering from vertigo.
- I.22 The opening sash is a tilt and turn unit. When tilted (bottom hung) the window falls in and stops at a distance approximately 390 mm from the head of the window frame. The free distance created is approximately 60 mm.
- I.23 In the 'turn' mode, the window is physically prevented from fully opening by a patented restrictor. The frame to sash dimension is approximately 390 mm at its widest point with an approximate dimension of 300 mm clear. In order to fully open the sash, the restrictor must be disabled with a special key/ tool, which we understand is to be supplied to the occupier. Please refer to the Frankham risk assessment sections within this BRE document for discussion on this subject.



[1588] Restrictor arrangement

- I.24 BRE dimensionally surveyed the window and then carried out a simple test by repeatedly pulling the sash away from the frame with the restrictor attached (turn mode). Whilst doing this, the restrictor plate (see above) exhibited considerable movement.
- I.25 We were not able to disengage the sash from the restrictor to examine the processes involved in cleaning the top left hand corner of the window when fully opened-in. The dimensions suggest that a chair or small step stool may be used by an occupier in order to reach this location.
- I.26 The small window sample was then examined and found to have been constructed in the same way as the large window sample, meaning that the internal finishes were complete (except for the ceiling) however the external finishes were incomplete.
- I.27 The small window is fitted as a 'tilt' only sash.



[IM1] External face of small window



[IM2] Internal face of small window

- I.28 During the inspection of the small window sample, Camden stated that the tilt-only facility will not provide the correct amount of free air for purge ventilation and that discussions were being undertaken to develop an appropriate solution, including allowing the lower sash to open.



Appendix J Centre for Window and Cladding Technology: Specifiers Checklist

- 1) The following checklist is taken from 'Standard for systemised building envelopes: part 0' published by the Centre for Window and Cladding Technology. It is an extract from the document and included for discussion purposes with the project designers. It is a small part of a larger compendium, which we recommend is referred to during the design phases.

- 2) CWCT contact details:

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E-mail: cwct@cwct.co.uk

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Post:

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The Studio
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BA2 5LY



Part 0 - Specifiers' checklist and certification

Clause	Content	Action required	Applicability
1.4.1.2	Construction principle	State whether the system should be a secondary defence system.	Curtain walling
1.5.1	Testing	Decision on Specialist Consultant.	All
1.5.1	Testing	Decision on need for testing.	All
1.5.3	Testing	Decision on need for independent witness.	All
1.5.5	Testing	Decide whether previous test results may be used.	All
2.2.1	Wind loads	Select method of calculation or specify values.	All
2.2.7	Wind loads	Can the existing structure carry the loads?	Recladding
2.3.5	Loads	Can the existing structure carry the loads?	Recladding
2.3.2.1	Loads	State dead loads from fixtures etc.	All
2.3.3	Loads	State live loads due to maintenance and building occupancy, snow and ice, wind load on fixtures.	All
2.3.4.1	Impact loads	State any safety impact loads and zones to which they apply.	All
2.3.4.2	Impact loads	State any serviceability impact loads and zones to which they apply.	All
2.5.4	Panel attachment	State any higher factors of safety required for fixings and bonded joints.	All
2.6.1	Building movements	State anticipated building movements.	All
2.7.2	Service temperatures	State any exceptional service temperatures.	All
3.3.2.2	Air permeability	State the required class of performance for air infiltration.	All
3.3.2.3	Air permeability	State acceptable air exfiltration rates.	All
3.3.3.3	Air permeability	State any requirement for repeat air permeability tests.	All
3.4.2.1	Water penetration resistance	State if any components of the building envelope are not to be wetted.	All
3.4.2.2	Water penetration resistance	State the required class of performance for water penetration resistance	All
3.4.3.2	Water penetration	Agree which dynamic water penetration test should be used, if any.	Walls
3.5.2.1	Deflections	State any specific deflection limits relating to fixtures, internal finishes and interfaces.	All
3.5.4.2	Deflections	State whether additional stiffness is allowable.	All



Standard for systemised building envelopes

3.7.3	Wind resistance	State whether fatigue testing is required.	Rainscreen
4.2.1	Opening lights	State the air, water and wind performance criteria for windows.	Walls
4.2.4	Opening lights	State which, if any, windows are required to be secure and to what level of performance.	Walls
4.2.5	Opening lights	State any requirement to provide restricting catches and allowable openings.	Walls
4.2.6	Opening lights	State what ventilation openings are required for opening lights.	Walls
4.2.7	Opening lights	State which, if any, windows are to be cleaned from inside.	Walls
4.3.1	Doors	State the air, water and wind performance criteria for doors.	Walls
4.3.2	Doors	State which entrance doors are designated for use by the disabled.	Walls
4.3.3	Doors	State any requirements for testing doors for strength.	Walls
4.3.5	Doors	State which, if any, doors are required to be secure and to what level of performance.	Walls
4.5.1	Louvres	State performance class of louvres and any requirements for testing.	All
4.5.1	Louvres	State who is responsible for the design of louvres.	All
4.7.1	Additional components	State any additional components that should be included in the test specimen.	All
4.7.2	Brise soleil	State any additional loads on brise soleil.	Walls
4.7.3	Canopies	State any additional loads on canopies.	Walls
4.7.4	External fixtures	State any provision to be made for the attachment of external fixtures.	All
4.8.1	Access	State the maintenance and repair strategy for the building envelope.	All
4.8.1	Access	State the maintenance and repair strategy for the external fixtures and adjacent construction.	All
4.8.2	Access	State if any structural anchors and anchor devices are to be provided.	All
5.2.2	U-values	State the required average U-value of each envelope zone.	All
5.2.2	U-values	State the required average U-value of the main components if required.	All



Part 0 - Specifiers' checklist and certification

5.2.3.1	U-values	Assign responsibility for interface design and calculation.	All
5.2.3.2	U-values	Agree the method of assessment of assembly U-values.	All
5.3.2	Condensation	State if any spaces have high relative humidity.	All
5.3.2	Condensation	State any exceptional internal or external temperatures.	All
5.4.2	Solar gain	State the acceptable total solar energy transmission.	All
5.4.3	Daylight	State the acceptable visible light transmission.	All
5.5.2	Sound transmission	State any requirement to limit sound transmission from outside the building.	All
5.5.3.1	Sound transmission	State any requirement to limit sound transmission between floors of a building.	Walls
5.5.3.2	Sound transmission	State any requirement to limit sound transmission between rooms of a building.	Walls
7.2.2	Durability	State the design life of the building envelope.	All
7.2.3	Durability	State any particular degradation agents or mechanisms to be considered.	All
7.2.5	Durability	State the design life of particular secondary components if required.	All
7.3.4.1	Lightning protection	State which, if any, components are to form part of the lightning protection system.	All
7.4.2	Accuracy	State the tolerance of primary structure.	All
7.4.3	Accuracy	State the tolerance of envelope zone.	All
7.4.4	Accuracy	State other critical dimensions and locations.	All
7.6.1	Materials	State what materials certification and test reports are required.	All
8.4.1	Testing Authority	Agree the Testing Authority.	All
8.4.2	Testing laboratory	Agree the testing laboratory.	All
8.5.5.1	Test specimens	Provide drawings and other details of test specimens.	All
8.5.6	Testing	Specify any additional test requirements.	All
8.6	Testing	Agree method of identifying areas of concentrated air leakage.	All
8.9	Testing	State any requirements for performing site tests on the test specimen.	All
8.13	Testing	State which, if any, discretionary tests are required with details.	All



Appendix K BS 8213-4 Windows and Doors

- 1) British Standard 8213-4: 2016 'Windows and doors – Part 4: Code of practice for the survey and installation of windows and external doorsets' contains recommendations that are applicable to the window installation at Chalcots Estates.
- 2) The document should be considered in its entirety by the project designers. For ease of reference and discussion purposes, the standards checklists are shown below.
- 3) BS 8312-4 can be purchased from the BSI shop

Email: cservices@bsigroup.com
Tel: +44 345 086 9001

BSI Customer Services
389 Chiswick High Road
London
W4 4AL
UK
Map: Office location

**BRITISH STANDARD****BS 8213-4:2016**

Annex C
(informative)
C.1 **Typical checklists**
Surveyor's checklist

A typical surveyor's checklist is shown in Figure C.1.

Figure C.1 **Typical surveyor's checklist**

	Y/N
Have risk assessment(s) been completed (see BS 8213-4:2015, 5.1)?	
Is the condition of the aperture satisfactory and without evidence of damp or cracks?	
Is the aperture square and even to within 5 mm height and width and 10 mm diagonals?	
Will any loads be carried by the building and not the window or doorset?	
Has the size and method of fixing any sill been determined?	
Will the proposed style function without being fouled by plaster, etc.?	
Will any trickle vents fitted function without being fouled by plaster, etc.?	
Will hinges function without being fouled by plaster, etc.?	
Are curtain tracks and nets clear of the proposed design?	
Is the size and configuration within the manufacturer's limits?	
Will the products exposure category be suitable for the location?	
Will the installation conform to Building Regulations?	
Is the method of drainage appropriate for the installation and product?	
Has the purchaser confirmed the position and handing of opening lights?	
Has any additional hardware been specified?	
Is the access for installation safe?	
Has the fixing method been determined?	
Has the extent of making good been agreed with the purchaser?	

NOTE: It can be of benefit to make a photographic record of the existing installation in case of dispute over Building Regulations compliance at a later date.

BS 8213-4:2016**BRITISH STANDARD****C.2 Final inspection checklist**

A typical final inspection checklist is shown in Figure C.2.

Figure C.2 **Typical final inspection checklist**

	Y/N
Visual appearance	Is the frame installed plumb and square?
	Are the beads fitted correctly and evenly?
	Are exposed faces – including beads – free from damage?
	Is the frame clean with all protective tape removed?
	Has any damage to aperture been correctly made good?
	Have all trims been fitted correctly?
Glazing	Has all site debris been removed?
	Is all glazing as specified on contract?
	Are all sealed units free from scratches and signs of failure?
	Are obscure and coated glasses oriented properly?
	Are sealed unit spacer bars covered by frame and beads?
	Is the glazing held properly by beads/gaskets, etc.?
Operation	Is safety glass used where necessary?
	Do all openers open close and lock as intended?
	Are seals on frames without gaps?
	Are cams free from binding against strikers?
	Is all operating gear lubricated as necessary?
Sight lines	Is all hardware attached with correct numbers of fixings?
	Are all sight lines visually correct?
	Are adjacent opening lights aligned as appropriate?
Sealing	Are all decorative features, e.g. leading, correctly aligned?
	Are all joints smooth and correctly formed?
	Is the sealant continuous around the frame?
Drainage	Is the frame face free from excess sealant?
	Are all drainage channels free from obstruction?
Miscellaneous	Are sill end caps fitted if required?