

## REPORT ON THE EXTERNAL WALLS

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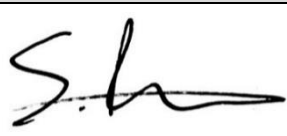
Vulcan Works  
2 Malta Street  
Manchester  
M4 7BH



for

Residential Management Group  
RMG House  
Essex Road  
Hoddesdon  
EN11 0DR

Contract No: SB/10349  
Dated: 16 October 2020

| Prepared by                                                   | Signature                                                                         | Date            |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------|
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| Issue | Description | Date       | Originator | Approved |
|-------|-------------|------------|------------|----------|
| 1     | First Issue | 16/10/2020 | SB         | GB       |
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**THOMASONS**

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## **1.0 Introduction**

- 1.1 In accordance with the Ministry of Housing, Communities and Local Government (MHCLG) Advice Notes and duties under the Regulatory Reform (Fire Safety) Order 2005 (FSO), Thomasons and Design Fire Consultants (DFC) were appointed to identify the external wall construction details and report on whether an adequate standard is achieved for compliance with the FSO and whether any remediation and/or interim measures might be required.
- 1.2 This report has been produced in conjunction with DFC, whose External Wall Assessment is included in Appendix C, which should be considered the main authority to this report as a whole.
- 1.3 No as-built information was available for review, therefore information gathered is generally based on site investigation findings.
- 1.4 Details of the site investigation findings are shown in Appendix A and investigation locations, based on permissible safe access, are referenced within Appendix B.
- 1.5 DFC use Approved Document B (ADB) of the Building Regulations as the most relevant industry recognised guidance document to establish whether the external walls achieve an adequate standard of fire safety and therefore sufficient for compliance with the FSO. DFC also advise on whether any remediation and/or interim fire safety measures might be required.
- 1.6 Approved Document B (ADB) states that materials used in the external wall construction should not provide a medium for fire spread.
- 1.7 A sample of each wall type was exposed on site at limited locations to establish the construction composition. Where the wall types were found to comprise of a cavity, evidence of cavity barrier protection to compartment floor and wall junctions and around existing openings was sought.
- 1.8 Risks arising from balcony attachments have been reviewed with respect to MHCLG Advice Note 21.
- 1.9 Exclusions
- 1.9.1 The internal compartmentation, or any other internal element of Vulcan Works did not form part of Thomasons' scope.

## **2.0 The Building**

- 2.1 Vulcan Works, Manchester comprises of two connected parts – a modern medium rise extension to a longstanding historic mill which has been converted to residential units. The longstanding mill conversion is constructed of original solid brick and is anticipated to contain minimal (or no) cavities within the external wall. There are no visible modern attachments present to the mill, therefore the focus of this report is to the modern extension “the building” only.
- 2.2 On plan the building is rectangular in shape and access is via Pollard Street and Malta Street.
- 2.3 The building is 5 storeys tall comprising of residential units only.
- 2.4 There is car parking provision to the rear of the development which is accessed via a controlled entrance to Malta Street.
- 2.5 The height of the topmost storey is less than 18m (measured approx. 16.5m from lowest ground level to top of uppermost storey floor height). It is our understanding that the building has not been fitted with sprinklers.
- 2.6 The external elevations are clad in a mixture of timber, render, cement panel and copper panel.
- 2.7 The windows comprise of timber double glazed units.

### 3.0 Site Investigation

3.1 Full details of the Site Investigation findings can be found in **Appendix A** – Site Investigation Details.

3.2 The site investigation focused on the timber, render, cement panel and copper panel cladding types, with samples taken as per the locations noted to **Appendix B** – Site Investigation Location Details, generally revealing the following wall type build-ups (recorded outside to inside):

#### 3.3 Wall Type 1 – Timber (Located to several elevations spanning multiple storeys)

- Timber panels (approx.16mm) **Combustible**
- Timber battens / void (50mm) **Combustible**
- Render (approx. 6mm)
- Expanded polystyrene insulation (EPS) (90mm) **Combustible**
- Cement particle board (timber stranded) (12mm) **Combustible**

Mineral wool horizontal cavity barriers were typically observed, within the depth of the EPS insulation, at junctions with party floors, in lieu of the expanding polystyrene insulation, however, did not span the full depth of the external wall construction. No as-built information was available for review; however, it is not anticipated that this construction type spans vertical party wall junctions. The inspections noted a lack of adequate protection around openings.

#### 3.4 Wall Type 2 – Render (Located to all elevations throughout)

It was apparent that the render system as described below formed the primary external wall cladding to the building, with further cladding material, forming attachments, added to various locations around the building (Wall Types 1, 3 & 4).

- Render (approx. 6mm)
- Expanded polystyrene insulation (EPS) (90mm) **Combustible**
- Cement particle board (timber stranded) (12mm) **Combustible**

Mineral wool horizontal cavity barriers were typically observed at junctions with party floors, in lieu of the expanding polystyrene insulation. No as-built information was available for review; however, it is anticipated that this construction type spans vertical party wall junctions. In the absence of basic design information, the exact party wall locations are not known and therefore not inspected.

A lack of adequate protection around openings is assumed based upon inspections from other wall types.

3.5 Wall Type 3 – Cement Panel (Located to several elevations, some at lower level only, others full height spanning multiple storeys)

- Cement panel board (approx. 16mm) with void behind (assumed approx. 12mm)
- Render (approx. 6mm)
- Expanded polystyrene insulation (EPS) (90mm) **Combustible**
- Cement particle board (timber stranded) (12mm) **Combustible**

Due to the fragile nature and fixing arrangement of the cement panels, only a limited non-destructive inspection was possible from ground level, which identified the cement panel over-cladding the Wall Type 2 –Render construction. Information for the substrate is supported from other inspection locations.

A lack of adequate protection around openings is assumed based upon inspections from other wall types.

3.6 Wall Type 4 – Copper Panel (Located to side and rear elevations spanning multiple storeys)

- Copper panels (approx. 1-2mm)
- Plywood backing board (12mm) **Combustible**
- Timber battens / void (25mm) **Combustible**
- Render (approx. 6mm)
- Expanded polystyrene insulation (EPS) (90mm) **Combustible**
- Cement particle board (12mm) **Combustible**

The inspection of this construction type was not intrusive past identification of the EPS layer. Information for the substrate is supported from other inspection locations. No as-built information was available for review; however, it is anticipated that this construction type may span vertical party wall junctions. In the absence of basic design information, the exact party wall locations are not known and therefore not inspected.

No cavity barriers were observed in the void created by the timber batten voids between the render and copper panels.

A lack of adequate protection around openings is assumed based upon inspections from other wall types.

### 3.7 Balconies / Attachments

There are two types of balconies / attachments to the building external wall systems:

#### 3.7.1 Vertically stacked private balconies, recessed within Wall Type 2, constructed of:

- Steel framework with timber decking
- Glass balustrade steel supports

#### 3.7.2 Vertically stacked common external walkways (single access/egress route) along Wall Type 2 to the rear aspect, constructed of:

- Steel framework with perforated steel deck
- Glass balustrade with steel supports

## 4.0 Conclusions

4.1 Refer to Appendix C - External Wall Assessment by Design Fire Consultants for full unabbreviated commentary.

4.2 There are four external wall types and two balcony attachments investigated:

1. Timber (Wall Type 1) – Timber panelling attached to Wall Type 2.
2. Render (Wall Type 2 – also located to all other wall types) – Render finish with expanded polystyrene (EPS) insulation.
3. Cement Panel (Wall Type 3) – Cement panel board attached to Wall Type 2.
4. Copper Panel (Wall Type 4) – Copper finish sat on plywood backing board attached to Wall Type 2.
5. Balconies / Attachments – Recessed balconies and external single access/egress walkway.

4.3 Following review and assessment of the site investigation information, DFC have considered the compliance of each wall type construction in accordance with Approved Document B (ADB), which is summarised as below:

|                                            | Construction Type            |                |                              |                              |
|--------------------------------------------|------------------------------|----------------|------------------------------|------------------------------|
|                                            | 1:<br>(Timber)               | 2:<br>(Render) | 3:<br>(Cement panel)         | 4:<br>(Copper Panel)         |
| <b>Protection of Compartment Floors</b>    | Not adequate                 | Not adequate   | Not adequate                 | Not adequate                 |
| <b>Protection of Party Walls</b>           | Not adequate (if applicable) | Unknown        | Not adequate (if applicable) | Not adequate (if applicable) |
| <b>Protection of Openings</b>              | Not adequate                 | Unknown        | Unknown                      | Unknown                      |
| <b>Resistance to Fire Spread over Wall</b> | Not adequate                 | Adequate       | Adequate                     | Adequate                     |
| <b>Fire Spread between Buildings</b>       | Unknown                      | Unknown        | Unknown                      | Unknown                      |

#### 4.4 Timber (Wall Type 1)

Whilst cavity barriers might have been installed in the EPS system at junctions with compartment floors, they may not be effective, due to their relationship with other aspects of the construction. A timber stranded (combustible) sheathing board is located to the rear of the EPS and a timber batten void to the front with the timber cladding. This arrangement provides a continuous, combustible, medium for fire spread around the fire barrier both to the front and rear of the fire barrier.

Therefore, the construction does not comply with ADB because adequate fire barriers have not been provided at junctions with compartment floors.

#### 4.5 Render (Wall Type 2)

Whilst cavity barriers might have been installed in the EPS system at junctions with compartment floors, they may not be effective, due to their relationship with other aspects of the construction. A timber stranded (combustible) sheathing board is located to the rear of the EPS. This arrangement provides a continuous, combustible, medium for fire spread around the fire barrier to the rear of the fire barrier.

Therefore, the construction does not comply with ADB because adequate fire barriers have not been provided at junctions with compartment floors.

Junctions with compartment walls and protection around openings is unknown, however, a lack of protection around openings is assumed based on inspection of other wall types.

#### 4.6 Cement Panel (Wall Type 3)

Whilst cavity barriers might have been installed in the EPS system at junctions with compartment floors, they may not be effective, due to their relationship with other aspects of the construction. A timber stranded (combustible) sheathing board is located to the rear of the EPS. This arrangement provides a continuous, combustible, medium for fire spread around the fire barrier to the rear of the fire barrier.

Furthermore, the cement panel appears to be attached to the EPS construction. The protective topcoat is not supported by the fire barriers or mechanically fixed to the substrate and as such may become detached in a fire, providing a route for fire spread over the fire barriers.

Therefore, the construction does not comply with ADB because adequate fire barriers have not been provided at junctions with compartment floors and it is considered likely the as-built construction would not achieve BR 135:2013 classification.

A lack of protection around openings is unknown and assumed based on inspection of other wall types.

#### 4.7 Copper Panel (Wall Type 4)

Whilst cavity barriers might have been installed in the EPS system at junctions with compartment floors, they may not be effective due to their relationship with other aspects of the construction. A timber stranded (combustible) sheathing board is located to the rear of the EPS and a timber batten void with plywood backing to the front with the timber cladding. This arrangement provides a continuous, combustible, medium for fire spread around the fire barrier both to the front and rear of the fire barrier.

Therefore, the construction does not comply with ADB because adequate fire barriers have not been provided at junctions with compartment floors.

A lack of protection around openings is unknown and assumed based on inspection of other wall types.

#### 4.8 Balconies / Attachments

##### *Recessed Balconies*

The recessed balconies are vertically stacked and comprise of a metal and glass balustrade. The balcony structure is enclosed with timber cladding which can be a medium for fire spread, particularly as balconies are often used for storage.

DFC have assessed the balcony type in isolation and consider the rate of fire spread to be likely no greater than that associated with ADB compliant construction. Based on their assessment, the recessed balcony construction complies with ADB, when considered in isolation.

##### *Common External Walkways*

The common external walkways are stacked over all storeys to the rear aspect of the building to Wall Type 2 (Render). The external walkways comprise of non-combustible materials – steel

structural frame and steel mesh floor with glass balustrade and metal framing. The walkways provide a means of escape; therefore, require protection from fire and smoke. The open grid nature of the flooring and the absence of any fire protection (amongst other deficiencies) indicate that the walkways are not ADB compliant.

## 5.0 Recommendations

5.1 The assessment of risk associated with ADB non-compliances resulted in the remediation options shown below. The clearest way to meet the functional requirements of Part B (Fire Safety) of the Building Regulations is to undertake the works shown for ADB compliance. It may be possible to consider alternative subjective minimum works following further investigation and/or a holistic assessment of fire safety features of the building.

### 5.2 Long Term Remedial Works

ADB compliant recommendations are identified as below:

|                                            | Construction Type                                                    |                |                      |                      |
|--------------------------------------------|----------------------------------------------------------------------|----------------|----------------------|----------------------|
|                                            | 1:<br>(Timber)                                                       | 2:<br>(Render) | 3:<br>(Cement panel) | 4:<br>(Copper Panel) |
| <b>Protection of Compartment Floors</b>    | Install full thickness fire barriers                                 |                |                      |                      |
| <b>Protection of Party Walls</b>           | Install full thickness fire barriers                                 |                |                      |                      |
| <b>Protection of Openings</b>              | Install full thickness fire barriers                                 |                |                      |                      |
| <b>Resistance to Fire Spread over Wall</b> | Limit the height of timber cladding to 18m                           | N/A            | N/A                  | N/A                  |
| <b>Fire Spread between Buildings</b>       | Confirm <i>internal component</i> fire resistance, upgrade as needed |                |                      |                      |

#### 5.2.1 Wall Type 1 - Timber

- Provide full thickness cavity barriers within the external wall cavity, at the junctions with fire resisting walls and floors, at the heads, sides and edges of cavities and around openings;
- Ensure no timber cladding is installed above 18m.

In practise, it may be feasible to undertake remediation with minimal disturbance to the external finishes. Works to the render substrate are also required as set out below.

### 5.2.2 Wall Type 2 – Render

- Provide full thickness cavity barriers within the external wall cavity, at the junctions with fire resisting walls and floors, at the heads, sides and edges of cavities and around openings;

Due to the expected disturbance associated with remediation to the render coat finish, in practise, this is likely to require complete replacement of the exposed render finishing coat where not otherwise hidden behind other cladding materials (Wall Types 1, 3 & 4).

### 5.2.3 Wall Type 3 – Cement Panel

- Provide full thickness cavity barriers within the external wall cavity, at the junctions with fire resisting walls and floors, at the heads, sides and edges of cavities and around openings;

In practise, it may be feasible to undertake remediation with minimal disturbance to the external finishes. Works to the render substrate are also required as set out above.

### 5.2.4 Wall Type 4 – Copper Panel

- Provide full thickness cavity barriers within the external wall cavity, at the junctions with fire resisting walls and floors, at the heads, sides and edges of cavities and around openings;

In practise, it may be feasible to undertake remediation with minimal disturbance to the external finishes. Works to the render substrate are also required as set out above.

### 5.2.5 General

The building internal construction does not form part of the scope of this assessment; however, DFC recommend further investigation of the internal linings (plasterboard) to determine the current level of fire resistance and upgrade where necessary.

### 5.2.6 Balconies / Attachments

- Inset balconies – No remediation required; however, DFC recommend replacing the timber decks/structural cladding with a non-combustible alternative as part of a general maintenance plan.

- External walkways – DFC consider the risk to occupants sufficiently high that remediation is required. As a minimum, the soffit cladding (30REI) should be installed to the underside of the walkway.

### 5.3 Alternative Subjective Minimum Remedial Works

Alternative subjective minimum works following further investigation and/or a holistic assessment of fire safety features of the building are shown below:

|                                            | Construction Type                                                                                                               |                |                      |                      |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------|----------------------|
|                                            | 1:<br>(Timber)                                                                                                                  | 2:<br>(Render) | 3:<br>(Cement panel) | 4:<br>(Copper Panel) |
| <b>Protection of Compartment Floors</b>    | AR1 or AR2                                                                                                                      | AR1 or AR2     | AR1 or AR2           | AR1 or AR2           |
| <b>Protection of Party Walls</b>           | AR1 or AR2                                                                                                                      | AR1 or AR2     | AR1 or AR2           | AR1 or AR2           |
| <b>Protection of Openings</b>              | N/A                                                                                                                             | AR1 or AR2     | N/A                  | N/A                  |
| <b>Resistance to Fire Spread over Wall</b> | N/A *                                                                                                                           | N/A            | N/A                  | N/A                  |
| <b>Fire Spread between Buildings</b>       | Install residential sprinkler system, supported by further information regarding the <i>internal component</i> fire resistance. |                |                      |                      |

Notes:

AR1 Provide sprinklers in flats and provide cavity barriers at all junctions and edges of the over cladding systems, where relevant.

AR2 Provide detection and alarm system coverage of all rooms with an external wall and provide cavity barriers at all junctions and edges of the over cladding systems, where relevant.

\* If the stair provides stepped access to a roof that achieves 60REI, this may be reviewed by risk assessment, subject to meeting ADB recommendations elsewhere and GMFRS consultation.

5.3.1 If any of the above options are to be considered (as opposed to remediation in compliance with ADB), the following steps are required:

- Confirmation of the internal component build-up;
- Confirmation of the fire barrier provision at compartment wall junctions (locations tbc);

- Confirmation of the method used to close cavity edges, around penetrations and openings;
- The sheathing board should be tested to determine its reaction to fire;
- The detection and alarm system(s) in apartments should be confirmed.

## 5.4 Interim Measures

- 5.4.1 Whether interim measures are required must be considered as part of the suitable and sufficient assessment of risk (the FRA) for the building as required by the FSO.

In this instance, DFC considers that the risk of fire spread via the external wall constructions is sufficiently high that interim measures are required as soon as they can reasonably practicably implemented until the hazard has been removed or remediation has been implemented.

The interim measures should include the general fire precautions listed in MHCLG advice (see Appendix D of DFC's report) and should also include:

- Automatic smoke detection in all rooms used for sleeping with external wall of Wall Types 1, 3 & 4 as minimum.
- Prohibit the introduction of ignition sources or combustible materials to all balconies.

### *External Walkways*

With particular consideration of the external walkway, the risk to occupants is sufficiently high that interim measures are required as soon as they can be practicably implemented until the hazard has been removed or remediation has been implemented. Interim measures should include the general fire precautions listed in MHCLG advice (See DFC report Appendix D).

## 5.5 Immediate Next Steps

- 5.5.1
- Implement the Interim Measures stated above as soon as reasonably practicably able to do so.
  - Consultation with the fire and rescue service to discuss and agree the findings of this report.
  - Ensure that a suitable and sufficient assessment of risk has been carried out within the last 12 months and actions have been completed and the assessment is up to date with any changes, or immediately instruct such an assessment. Ensure the findings of this report are incorporated.

- Consultation with residents and other relevant stakeholders to discuss the findings of this report and agree the next steps.
- Carry out further investigations and/or holistic building assessment to determine whether alternative subjective minimum scope of remedial works are feasible for this building.
- Undertake cost assessment as part of a Feasibility Study to determine the most appropriate scope of remedial works.

Vulcan Works, Manchester

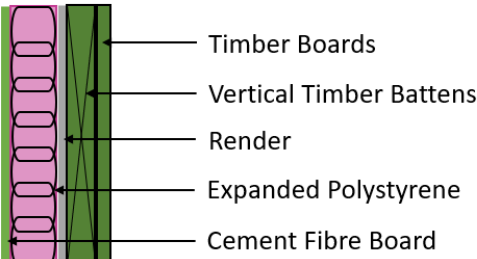
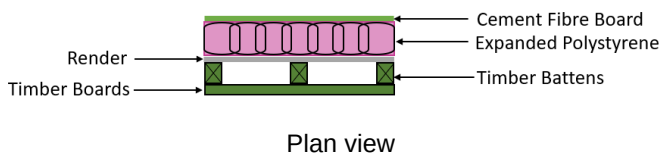
## **Appendix A**

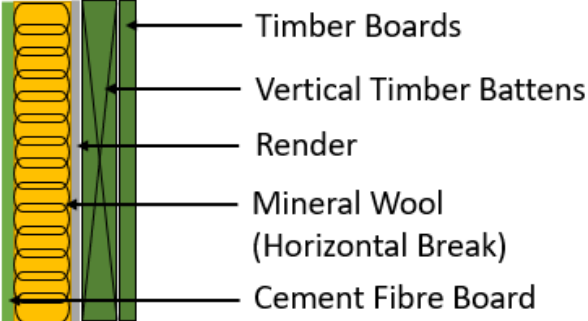
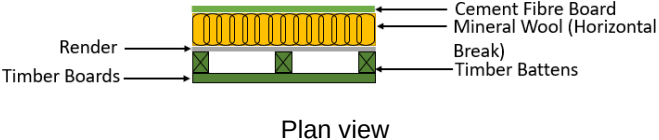
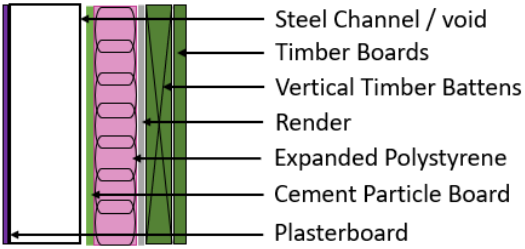
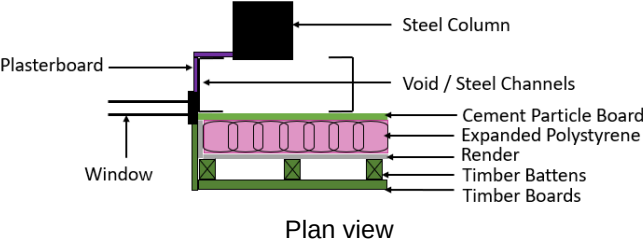
Site Investigation Details

## WALL TYPE 1 – Timber

| Component (Outside to Inner) | Depth (mm) | Combustible |
|------------------------------|------------|-------------|
| Timber                       | 16         | Yes         |
| Timber Battens / void        | 50         | Yes         |
| Render                       | 6          | No          |
| Expanded Polystyrene         | 90         | Yes         |
| Cement Particle Board        | 12         | Unknown     |

| Sample Locations | Elevation | Floor Level |
|------------------|-----------|-------------|
| A                | South     | 2           |
| D                | East      | 2           |
| H                | North     | 3           |
| I                | East      | 2           |
| J                | East      | 4           |

| Approx. Wall Detail                                                                                                                                                                                         |                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A, D                                                                                                                                                                                                        | A, D                                                                                                                                                                                                                 |
|  <p>Timber Boards</p> <p>Vertical Timber Battens</p> <p>Render</p> <p>Expanded Polystyrene</p> <p>Cement Fibre Board</p> |  <p>Plan view</p> <p>Cement Fibre Board</p> <p>Expanded Polystyrene</p> <p>Timber Battens</p> <p>Render</p> <p>Timber Boards</p> |

|                                                                                                     |                                                                                                      |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| H                                                                                                   | H                                                                                                    |
|                    |  <p>Plan view</p>  |
| I, J                                                                                                | I, J                                                                                                 |
|  <p>Plan view</p> |  <p>Plan view</p> |

| Sample | Cavity | Horizontal Cavity Barrier | Vertical Cavity Barrier | Protection Around Openings |
|--------|--------|---------------------------|-------------------------|----------------------------|
| A      | Yes    | No                        | N/A at this position    | No (Vent)                  |
| D      | Yes    | N/A at this position      | N/A at this position    | N/A at this position       |
| H      | Yes    | No                        | N/A at this position    | N/A at this position       |
| I, J   | Yes    | N/A at this position      | N/A at this position    | Yes                        |

#### Additional Comments

Timber sat on top of render construction

Evidence of protected steel noted

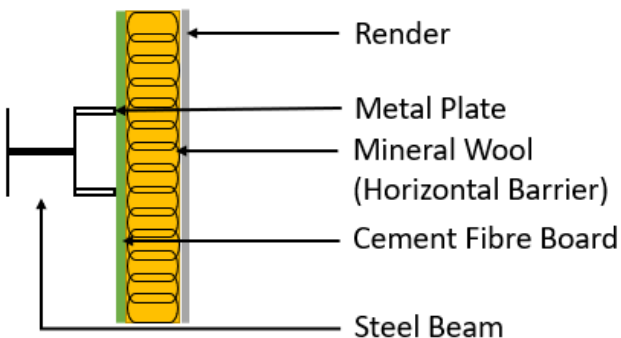
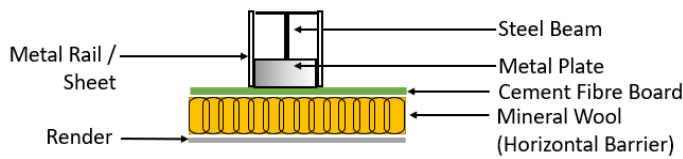
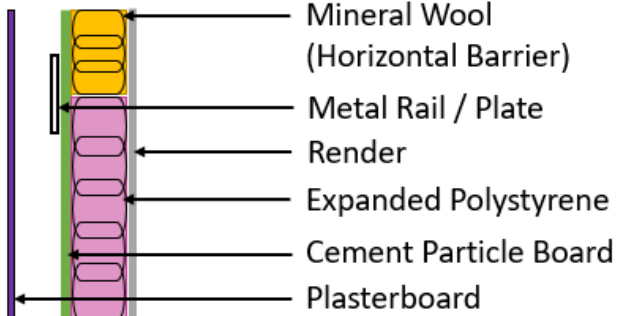
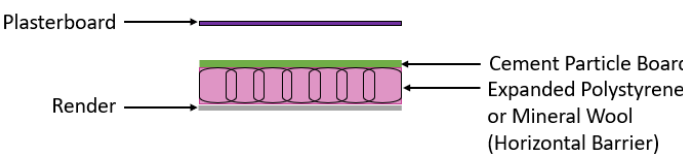
| Photos   |                                                                                     |          |                                                                                      |
|----------|-------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------|
|          |    |          |    |
| Sample A |                                                                                     | Sample A |                                                                                      |
|          |   |          |   |
| Sample D |                                                                                     | Sample D |                                                                                      |
|          |  |          |  |
| Sample D |                                                                                     | Sample H |                                                                                      |

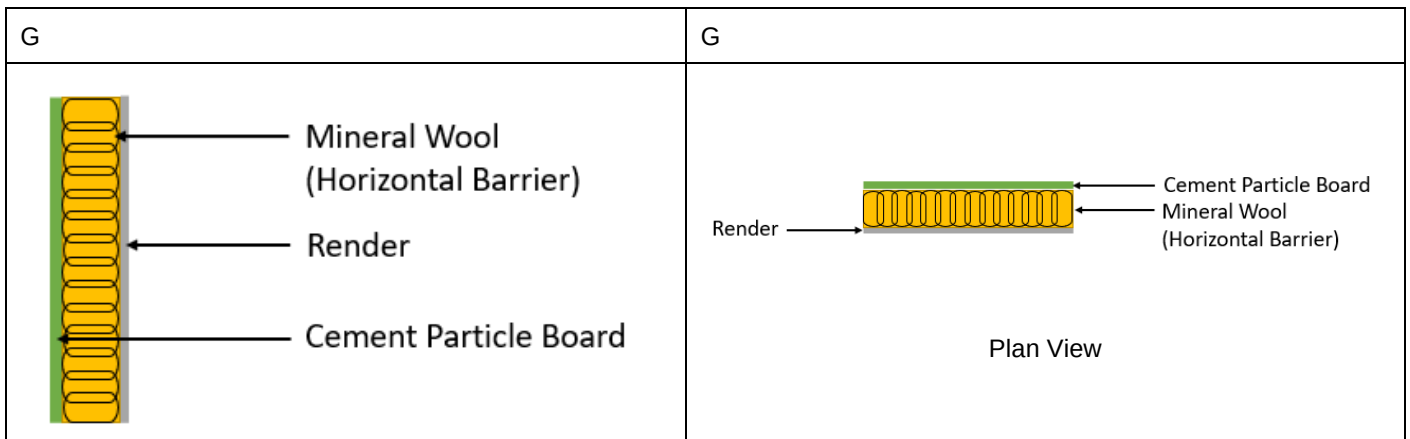
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|          |    |  |          |    |  |
| Sample H |                                                                                     |  | Sample H |                                                                                      |  |
|          |   |  |          |   |  |
| Sample I |                                                                                     |  | Sample I |                                                                                      |  |
|          |  |  |          |  |  |
| Sample J |                                                                                     |  | Sample J |                                                                                      |  |

## WALL TYPE 2 – RENDER

| Component (Outside to Inner) | Depth (mm) | Combustible |
|------------------------------|------------|-------------|
| Render                       | 6          | No          |
| Expanded Polystyrene         | 90         | Yes         |
| Cement Particle Board        | 12         | Unknown     |

| Sample Locations | Elevation | Floor Level |
|------------------|-----------|-------------|
| B                | South     | 3           |
| F                | North     | 2           |
| G                | North     | 3           |

| Approx. Wall Detail                                                                                                                                                                                                                               |                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| B                                                                                                                                                                                                                                                 | B                                                                                                                                                                                                                                     |
|  <p>Render</p> <p>Metal Plate</p> <p>Mineral Wool (Horizontal Barrier)</p> <p>Cement Fibre Board</p> <p>Steel Beam</p>                                          |  <p>Steel Beam</p> <p>Metal Plate</p> <p>Cement Fibre Board</p> <p>Mineral Wool (Horizontal Barrier)</p> <p>Render</p> <p>Plan View</p>           |
| F                                                                                                                                                                                                                                                 | F                                                                                                                                                                                                                                     |
|  <p>Mineral Wool (Horizontal Barrier)</p> <p>Metal Rail / Plate</p> <p>Render</p> <p>Expanded Polystyrene</p> <p>Cement Particle Board</p> <p>Plasterboard</p> |  <p>Plasterboard</p> <p>Render</p> <p>Cement Particle Board</p> <p>Expanded Polystyrene or Mineral Wool (Horizontal Barrier)</p> <p>Plan View</p> |



| Sample | Cavity | Horizontal Cavity Barrier | Vertical Cavity Barrier | Protection Around Openings |
|--------|--------|---------------------------|-------------------------|----------------------------|
| B      | No     | Mineral Wool              | N/A at this location    | N/A at this location       |
| F      | No     | Mineral Wool              | N/A at this location    | N/A at this location       |
| G      | No     | Mineral Wool              | N/A at this location    | N/A at this location       |

#### Additional Comments

No void in render buildup but void behind

Steel is painted

#### Photos



Sample B



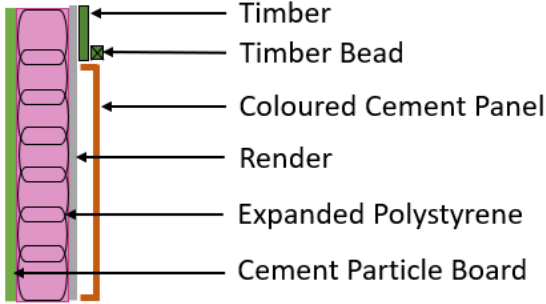
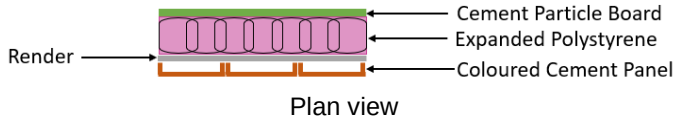
Sample B

|          |                                                                                    |  |          |                                                                                     |  |
|----------|------------------------------------------------------------------------------------|--|----------|-------------------------------------------------------------------------------------|--|
|          |   |  |          |   |  |
| Sample F |                                                                                    |  | Sample F |                                                                                     |  |
|          |  |  |          |  |  |
| Sample G |                                                                                    |  | Sample G |                                                                                     |  |

## WALL TYPE 3 – CEMENT BOARD

| Component (Outside to Inner) | Depth (mm) | Combustible |
|------------------------------|------------|-------------|
| Cement Panel                 | 16         | Unknown     |
| Render                       | 6          | No          |
| Expanded Polystyrene         | 90         | Yes         |
| Cement Particle Board        | 12         | Unknown     |

| Sample Locations | Elevation | Floor Level |
|------------------|-----------|-------------|
| C                | East      | Ground      |

| Approx. Wall Detail                                                                 |                                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| C                                                                                   | C                                                                                                     |
|  |  <p>Plan view</p> |

| Sample | Cavity | Horizontal Cavity Barrier | Vertical Cavity Barrier | Protection Around Openings |
|--------|--------|---------------------------|-------------------------|----------------------------|
| C      | Yes    | N/A at this position      | N/A at this position    | N/A at this position       |

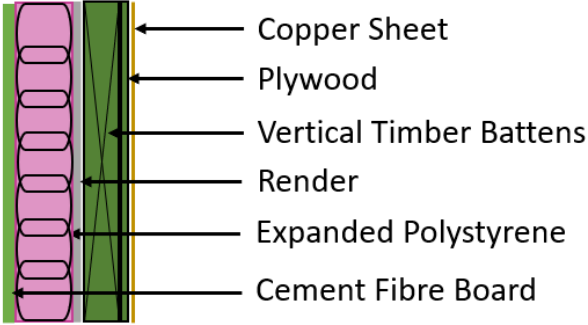
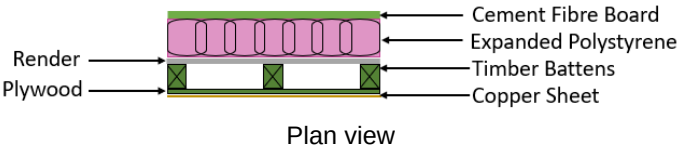
| Additional Comments                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------|
| <p>Panels sat on top of render construction.</p> <p>Panels are at ground floor only</p> <p>Void to panel recess</p> |

| Photos                                                                             |                                                                                    |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|   |  |
| Sample A                                                                           | Sample A                                                                           |
|  |                                                                                    |
| Sample A                                                                           |                                                                                    |

## WALL TYPE 4 – COPPER CLADDING PANELS

| Component (Outside to Inner) | Depth (mm) | Combustible |
|------------------------------|------------|-------------|
| Copper cladding panel        | 1-2        | No          |
| Plywood                      | 12         | Yes         |
| Timber Battens               | 25         | Yes         |
| Render                       | 6          | No          |
| Expanded Polystyrene         | 90         | Yes         |
| Cement Particle Board        | 12         | Unknown     |

| Sample Locations | Elevation | Floor Level |
|------------------|-----------|-------------|
| E                | East      | 3           |

| Approx. Wall Detail                                                                 |                                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| E                                                                                   | E                                                                                                     |
|  |  <p>Plan view</p> |

| Sample | Cavity | Horizontal Cavity Barrier | Vertical Cavity Barrier | Protection Around Openings |
|--------|--------|---------------------------|-------------------------|----------------------------|
| E      | Yes    | N/A at this position      | N/A at this position    | N/A at this position       |

### Additional Comments

Middle of wall position

### Photos



Sample E



Sample E

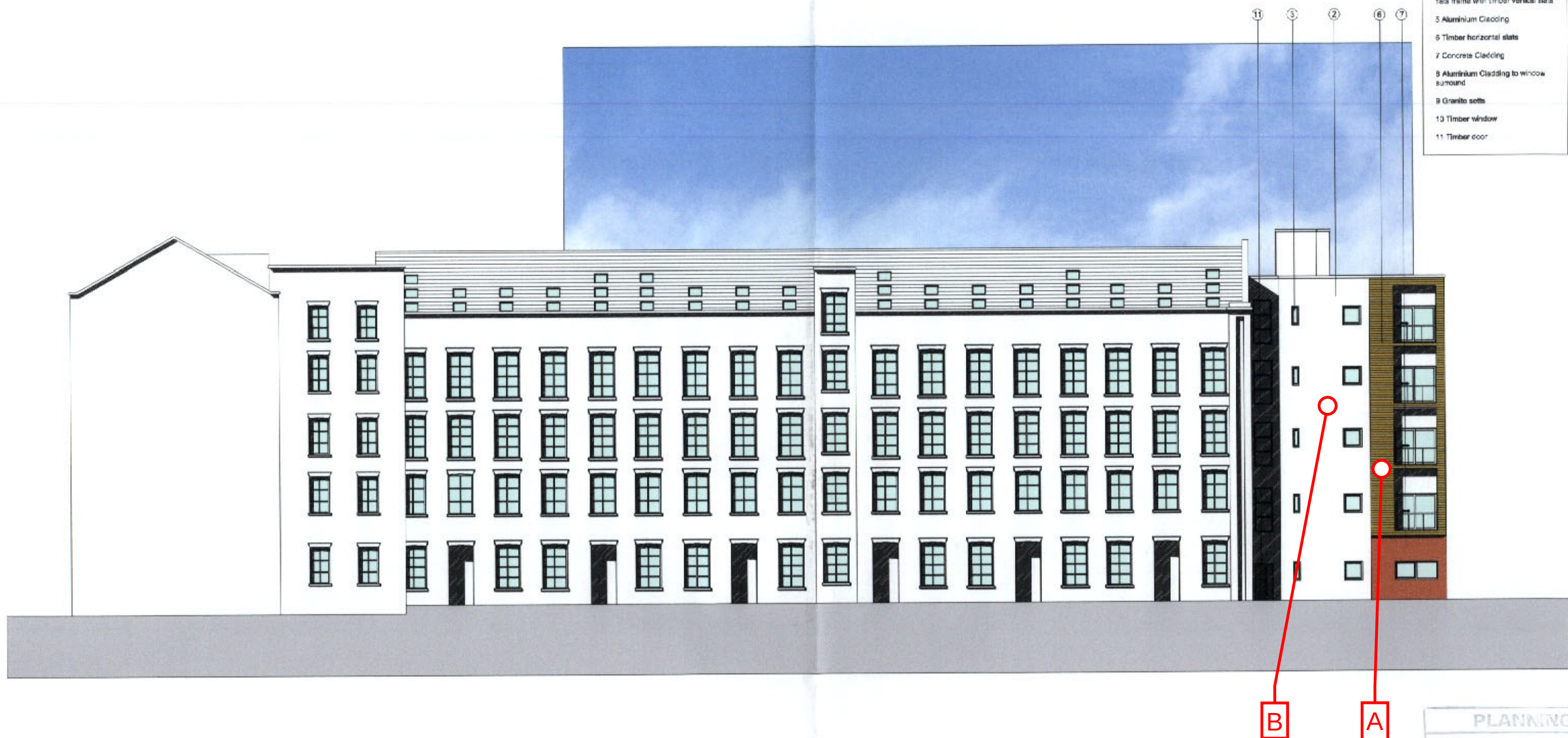


Sample E

## **Appendix B**

### Site Investigation Location Details

- Proposed Materials and Finishes
- 1 Copper Cladding
  - 2 Sto Flex Render, off white colour
  - 3 Timber window frames
  - 4 Timber handrails on powder coated steel frame with timber vertical slats
  - 5 Aluminium Cladding
  - 6 Timber horizontal slats
  - 7 Concrete Cladding
  - 8 Aluminium Cladding to window surround
  - 9 Granite sills
  - 10 Timber window
  - 11 Timber door



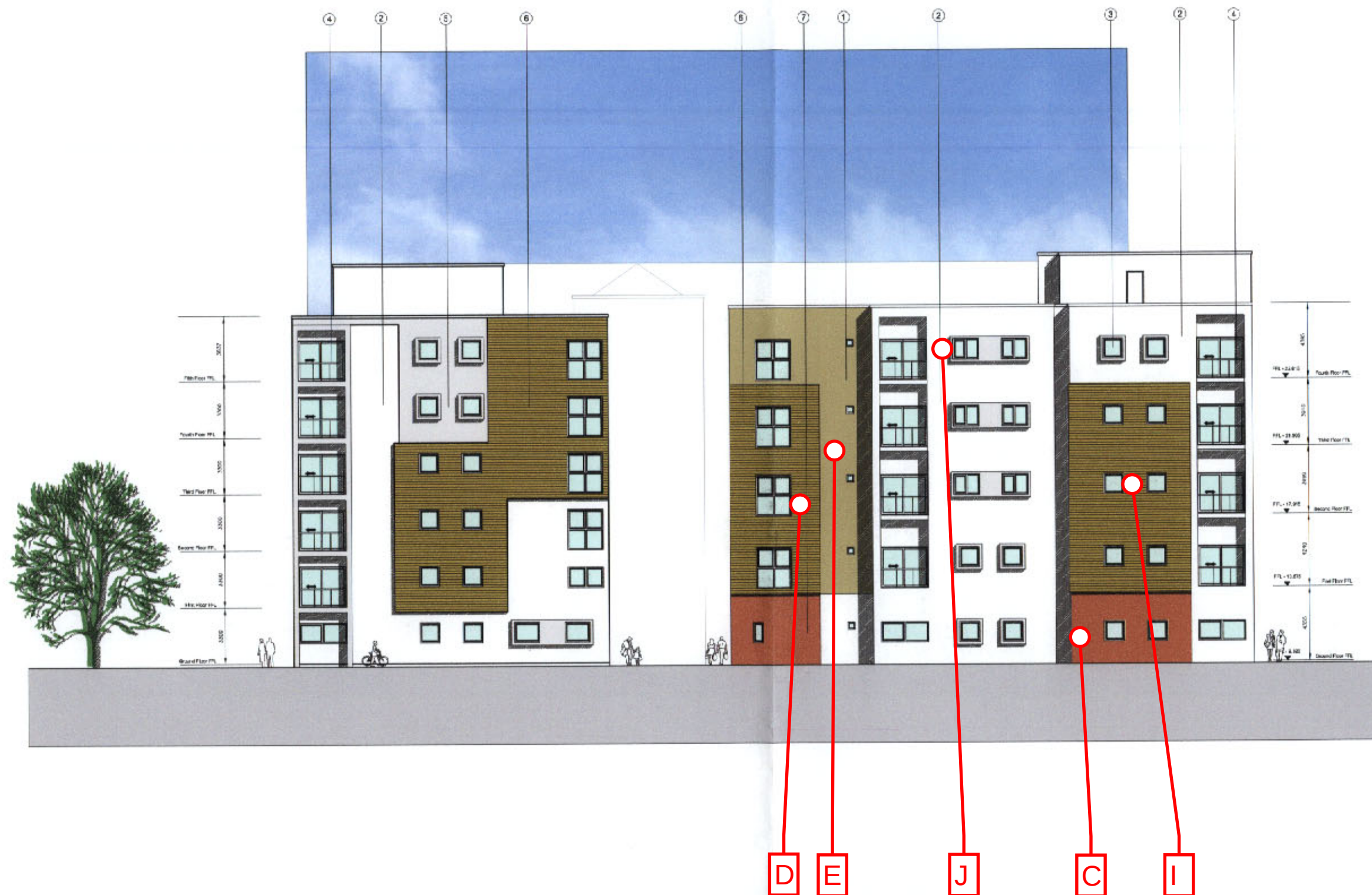
South Elevation

| PLANNING |             |
|----------|-------------|
| ACKD     |             |
| REPLIED  |             |
| REC'D    | 22 MAY 2007 |
|          |             |
|          |             |
|          |             |



- Proposed Materials and Finishes
- 1 Copper Cladding
  - 2 Sto Flex Render, off white colour
  - 3 Timber window frames
  - 4 Timber handrails on powder coated flats frame with timber vertical slats
  - 5 Aluminium Cladding
  - 6 Timber horizontal slats
  - 7 Concrete Cladding
  - 8 Aluminium Cladding to window surround
  - 9 Granite setts
  - 10 Timber window
  - 11 Timber door

| PLANNING          |  |
|-------------------|--|
| ACK'D             |  |
| REPLIED           |  |
| REC'D 22 MAY 2007 |  |
|                   |  |
|                   |  |
|                   |  |



East Elevation



| PLANNING |             |      |
|----------|-------------|------|
| ACK'D    |             |      |
| REPLIED  |             |      |
| RECD     | 22 MAY 2007 |      |
| L1       | NO          | DATE |
| L1       |             |      |
| L1       |             |      |

- Proposed Materials and Finishes
- 1 Copper Cladding
  - 2 Sto Flex Render, off white colour
  - 3 Timber window frames
  - 4 Timber handrails on powder coated steel frame with timber vertical slats
  - 5 Aluminium Cladding
  - 6 Timber horizontal slats
  - 7 Concrete Cladding
  - 8 Aluminium Cladding to window surround
  - 9 Granite setts
  - 10 Timber window
  - 11 Timber door



North Elevation





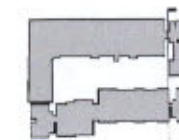
**West Elevation**





- Proposed Materials and Finishes
- 1 Copper Cladding
  - 2 Sto Flex Render, off white colour
  - 3 Timber window frames
  - 4 Timber handrails on powder coated steel frame with timber vertical slats
  - 5 Aluminium Cladding
  - 6 Timber horizontal slats
  - 7 Concrete Cladding
  - 8 Aluminium Cladding to window surround
  - 9 Granite setts
  - 10 Timber window
  - 11 Timber door

West Courtyard Elevation



UPPER EASTSIDE  
VULCAN WORKS  
north east courtyard elevation  
PL35C  
october 2004  
1:250

## **Appendix C**

External Wall Assessment by Design Fire Consultants



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## **Vulcan Works, Manchester**

External Wall Construction

Fire Engineering Assessment

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Revision 00

30 September 2020

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## Summary

### Background and Brief

Vulcan Works is a 5-storey residential building in Manchester. The external wall construction was required to comply with Part B of Schedule 1 to the Building Regulations (Part B) and the responsible persons are required to comply with the duties placed on them by the Regulatory Reform (Fire Safety) Order 2005 (FSO).

RMG has appointed Thomasons (who has in turn appointed Design Fire Consultants Ltd (DFC)) to identify the external wall construction details and to provide an opinion as to whether an adequate standard is achieved for compliance with the FSO and to inform whether any remediation and/or interim measures might be required.

The scope of the Thomasons / DFC assessment is limited to risk of fire spread via the external walls of the building. It does not consider other fire precautions (e.g. means of warning, means of escape, inhibition of fire spread within the building and access and facilities for the fire service). The findings of this report should be incorporated into the fire risk assessment for the building.

### ADB Compliance

DFC has used the 2004 edition of Approved Document B (ADB) as the basis of the assessment of adequacy because it was the relevant ADB at the time of construction and defines the benchmark expectation for compliance with Part B, the FSO and MHCLG advice.

For external wall constructions, ADB makes recommendations in respect of measures required to protect junctions with internal compartment floors and party walls between flats, to resist fire spread over the walls of buildings and to resist fire spread between buildings.

The following tables summarise DFC's assessment of the external wall constructions (as identified by Thomasons) against ADB recommendations.

|                                            | Construction Type            |                |                              |                              |
|--------------------------------------------|------------------------------|----------------|------------------------------|------------------------------|
|                                            | 1:<br>(Timber)               | 2:<br>(Render) | 3:<br>(Cement panel)         | 4:<br>(Copper Panel)         |
| <b>Protection of Compartment Floors</b>    | Not adequate                 | Not adequate   | Not adequate                 | Not adequate                 |
| <b>Protection of Party Walls</b>           | Not adequate (if applicable) | Unknown        | Not adequate (if applicable) | Not adequate (if applicable) |
| <b>Protection of Openings</b>              | Not adequate                 | Unknown        | Unknown                      | Unknown                      |
| <b>Resistance to Fire Spread over Wall</b> | Not adequate                 | Adequate       | Adequate                     | Adequate                     |
| <b>Fire Spread between Buildings</b>       | Unknown                      | Unknown        | Unknown                      | Unknown                      |

All external wall construction includes *combustible materials*. There is a primary wall type (Construction Type 2) and three further wall types, which consist of the primary wall type and additional over cladding:

- Construction Type 2 (Render); includes Expanded Polystyrene (EPS) combustible insulation and a combustible sheathing board.
- Construction Type 1 (Timber); as per Construction Type 2 with timber cladding on timber battens attached.
- Construction Type 3 (Cement Panel); as per Construction Type 2 with cement panels attached.
- Construction Type 4 (Copper Panel); as per Construction Type 2 with plywood backed copper cladding on timber battens attached.

There are balcony and external walkway attachments to Construction Type 2 at the east and west elevations respectively.

### Government Building Safety Remediation Fund

In May 2020, MHCLG announced funding for remediation of non-ACM cladding systems.

Given that the building does not have a *storey height* of at least 18m, the construction types assessed are not eligible for funding.

### Remediation

Compliance with ADB is not mandatory, compliance with ADB ensures compliance with benchmark expectation at the time of construction and is a defensible, objective means of ensuring compliance with Part B and MHCLG advice.

The external wall constructions do not comply with ADB and the following table identifies the remediation measures that are required to ensure compliance with ADB.

|                                        | Construction Type                                                    |                |                      |                      |
|----------------------------------------|----------------------------------------------------------------------|----------------|----------------------|----------------------|
|                                        | 1:<br>(Timber)                                                       | 2:<br>(Render) | 3:<br>(Cement panel) | 4:<br>(Copper Panel) |
| Protection of<br>Compartment<br>Floors | Install full thickness fire barriers                                 |                |                      |                      |
| Protection of<br>Party Walls           | Install full thickness fire barriers                                 |                |                      |                      |
| Protection of<br>Openings              | Install full thickness fire barriers                                 |                |                      |                      |
| Resistance to Fire<br>Spread over Wall | Limit the height<br>of timber<br>cladding to 18m                     | N/A            | N/A                  | N/A                  |
| Fire Spread<br>between Buildings       | Confirm <i>internal component</i> fire resistance, upgrade as needed |                |                      |                      |

### Alternative Remediation

ADB provides generic advice for more common building situations. Depending on the specifics of a building and its holistic physical and general fire precautions, it is possible that an adequate standard can be achieved without directly compliance with ADB.

In this instance, DFC considers that an adequate standard could be achieved as summarised in the following tables.

|                                            | Construction Type                                                                                                               |                |                      |                      |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------|----------------------|
|                                            | 1:<br>(Timber)                                                                                                                  | 2:<br>(Render) | 3:<br>(Cement panel) | 4:<br>(Copper Panel) |
| <b>Protection of Compartment Floors</b>    | AR1 or AR2                                                                                                                      | AR1 or AR2     | AR1 or AR2           | AR1 or AR2           |
| <b>Protection of Party Walls</b>           | AR1 or AR2                                                                                                                      | AR1 or AR2     | AR1 or AR2           | AR1 or AR2           |
| <b>Protection of Openings</b>              | N/A                                                                                                                             | AR1 or AR2     | N/A                  | N/A                  |
| <b>Resistance to Fire Spread over Wall</b> | N/A *                                                                                                                           | N/A            | N/A                  | N/A                  |
| <b>Fire Spread between Buildings</b>       | Install residential sprinkler system, supported by further information regarding the <i>internal component</i> fire resistance. |                |                      |                      |

#### Notes:

- AR1 Provide sprinklers in flats and provide cavity barriers at all junctions and edges of the over cladding systems, where relevant.
- AR2 Provide detection and alarm system coverage of all rooms with an external wall and provide cavity barriers at all junctions and edges of the over cladding systems, where relevant.
- \* If the stair provides stepped access to a roof that achieves 60REI, this may be reviewed by risk assessment, subject to meeting ADB recommendations elsewhere and GMFRS consultation.

If any of the above options are to be considered (as opposed to remediation in compliance with ADB), the following steps are required:

- Confirmation of the *internal component* build-up, including plasterboard type, thickness and overlaps, SFS framework including spacing, and fixing and taping provisions.
- Confirmation of *fire barrier* provision at compartment wall junctions, including the separating wall between the stair and other spaces, and details of that provision.
- Confirmation of the method used to close cavity edges, including around penetrations and openings.
- The sheathing board should be tested to determine its reaction to fire.
- The detection and alarm system(s) in apartments should be confirmed.

### Interim Measures

The interim measures that are required must be considered as part of the suitable and sufficient assessment of risk (the FRA) for the building as required by the FSO.

In this instance, DFC considers that the risk of fire spread via the external wall constructions is sufficiently high that:

- Interim measures are required until the hazard has been removed or remediation has been implemented.
- The interim measures should include the general fire precautions listed in MHCLG advice (see D.6.1) and should also include;
  - Automatic smoke detection in all rooms used for sleeping with an external wall of Construction Types 1, 3 & 4 as a minimum.
  - Prohibit the introduction of ignition sources or combustible materials to all balconies.

With particular consideration of the external walkway, the risk to occupants is sufficiently high that:

- Interim measures are required as soon as they can reasonably practicably implemented until the hazard has been removed or remediation has been implemented.
- The interim measures should include the general fire precautions listed in MHCLG advice (see Appendix D) and should also include a method of protecting occupants on an external walkway from fire and products of combustion.

### Immediate Next Steps

1. Implement interim measures as soon as reasonably practicably able to do so.
2. Ensure that a suitable and sufficient assessment of risk is in place and actioned. Incorporate the findings of this report into the FRA. The FRA should include consideration of the items discussed in Sections 7 & 9.3.
3. Consultation with the fire and rescue service to discuss and agree the findings of this report and any interim measures.
4. Consultation with relevant stakeholders to discuss the findings of this report and agree next steps.
5. Engage with residents to communicate the findings of the risk assessment and this report and to inform them of actions they should be taking (see Appendix D.6.1).
6. Undertake investigation to confirm compartmentation junction with Construction Type 2 adequately protects the escape stair.
7. Provide protection to the external walkway. This should consist of fire resistance (*30REI*) to the underside of the walkway, as a minimum.

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# 1 Introduction

## 1.1 Background and Brief

Vulcan Works is a 5-storey residential building at Pollard Street & Malta Street in Manchester. The external wall construction was required to comply with Part B of Schedule 1 to the Building Regulations 2000<sup>1</sup> (Part B) and the responsible persons are required to comply with the duties placed on them by the Regulatory Reform (Fire Safety) Order 2005<sup>2</sup> (FSO).

In accordance with the Ministry of Housing, Communities and Local Government's (MHCLG) advice (see Appendix D) and as part of their duties under the FSO, RMG has appointed Thomasons to identify the external wall construction details and Thomasons has appointed Design Fire Consultants Ltd (DFC) and to provide an opinion as to whether an adequate standard of safety is achieved.

## 1.2 Scope of Appointment

The scope of the Thomasons / DFC assessment is limited to risk of fire spread via the external walls of the building. It does not consider other fire precautions (e.g. means of warning, means of escape, inhibition of fire spread within the building and access and facilities for the fire service).

The findings of this report should be incorporated into the suitable and sufficient assessment of risk (the FRA) that is required for compliance with the FSO. Specifically, the risk assessor should determine, as a function of the overall risk of fire spread, whether interim measures are required.

## 1.3 Basis of DFC Assessment

Thomasons has reviewed available drawings and documentation and conducted site inspections to identify and document the build-up of the external wall constructions. DFC has assessed the external wall constructions (as documented in the Thomasons Inspection Report<sup>3</sup>) for compliance with Part B.

DFC has used Approved Document B<sup>4</sup> (ADB) as the basis of the assessment of adequacy because it was the relevant ADB at the time of construction and defines the benchmark expectation (see Appendix B) for compliance with Part B, the FSO and MHCLG advice.

Additionally, DFC has taken account of MHCLG clarifications (explicit and implicit) on interpretation of ADB and its scope. Therefore, DFC's assessment against ADB provides a basis of assessing adequate safety for compliance with MHCLG advice.

DFC has adopted the assessment methodology defined in Appendix C, which also describes how DFC has applied MHCLG advice and interpreted the principles and scope of ADB guidance. The relevant clauses of ADB, and DFC's interpretation of ADB guidance are quoted in Appendix E for external wall constructions generally and in Appendix F & Appendix G for private and common balconies respectively.

## 1.4 Definitions and Terminology

This report uses technical definitions and terminology. These are *italicised* within the report and defined or described in Appendix A.

---

<sup>1</sup> Statutory Instruments, '2000 No. 2531 Building and Buildings, England and Wales, The Building Regulations 2000', (as amended).

<sup>2</sup> Statutory Instruments, '2005 No. 1541 Regulatory Reform, England and Wales, The Regulatory Reform (Fire Safety) Order 2005', 2005.

<sup>3</sup> Thomasons, 'LM/10349 Vulcan Works, Manchester - Appendix A', July 2020.

<sup>4</sup> Department of Transport Local Government Regions, 'The Building Regulations 2000, Approved Document B – Fire safety, 2000 edition consolidated with 2000 and 2002 amendments', HMSO.

## 1.5 Limitations

The Thomasons inspections are necessarily limited in scope (see Appendix C.2.1). Therefore, DFC's review is based on information available and our opinion is subjective and includes uncertainty. Additionally, DFC's assessment is limited to the requirements for health and safety and does not consider other factors such as brand standards, insurer requirements, etc.

Thomasons has assessed that the refurbished mill external walls of brick do not require investigation. Therefore, the construction types assessed herein are to the modern construction extension only.

## 1.6 Building Description

DFC has made our assessment on the basis of the building and external wall constructions as defined in the Thomasons Inspection Report.

The building is primarily formed by a mill conversion to apartments with Ground Floor commercial units, with a modern construction extension to the east, consisting of apartments only.

Selected building features (as defined in ADB where relevant) are listed below:

- Purpose group: 1(a) Flat, with commercial units (Purpose group 4) at Ground Floor of the converted mill portion.
- Number of flats: ~15 in modern construction extension; ~200 total.
- Evacuation strategy: defend-in-place (aka stay-put).
- Number of *storeys*: 5 *storeys* (Ground Floor plus 4 above ground *storeys*).
- Height of topmost *storey*: 16.5m (measured at the modern construction extension).
- *Building height* (approximated): 23.5m (at flat roof of stair in modern construction extension), 21m (to average roof height of converted mill pitched roof).
- Boundary Distances:
  - North Elevation: 6.1m (approx.) to centre line of Pollard Street.
  - East Elevation: 6.8m (approx.) to centre line of Malta Street.
  - South Elevation: 3.3m (approx.) to on site centre point between modern construction extension and adjacent 'Vulcan Mill Phase 2' building.
  - West Elevation: Facing open space of site or external wall of adjoined converted mill.
- Perimeter access: Provided to north (Pollard Street), east (Malta Street) and south and west (via on-site parking access).

The received information does not include internal layouts. Therefore, the number of flats in the modern extension are estimated. It is understood that the extension has a single stair connected to, and also providing one of multiple escape stairs from, the converted mill.

There are four construction types reported. Based on the Thomasons investigation, all construction types can be considered to have a consistent substrate and insulation build-up with differing external cladding element. In brief, Construction Types 1, 3 & 4 consist of Construction Type 2 with varying additional cladding added to the outside of the Construction Type 2 render finish.

## 2 Construction Type 1 (Timber) Assessment

### 2.1 As-Built Construction

#### 2.1.1 Description

The construction comprises (from inside to outside): a *structural framing system (SFS)* comprising a plasterboard internal lining and cement particle board sheathing board, expanded polystyrene, render, timber battens / void and timber cladding.

Variances across the five inspection locations of the construction type were identified as follows:

- Inspection Locations A & D – Inspection did not include the substrate behind the sheathing board. Location A, at a floor junction, did not penetrate the render system to identify any mineral wool fire break as observed at Locations H & F, for example;
- Inspection Location H (at floor junction) – Inspection did not include the substrate behind the sheathing board. Opening height of circa 150mm did not extend to expected EPS above or below to match Locations D & I as apparent at Location F, for example;
- Inspection Locations I & J – Inspection included the substrate as described for the construction type. From location I, it is understood that the building structure is inbound of the *internal component* but that one flange of the steel column is exposed to the SFS void.

There are no direct attachments to Construction Type 1, however it is utilised next to balconies attached to Construction Type 2. Where this occurs, the balconies are recessed such that the balcony balustrade is flush with the timber cladding/battens of Construction Type 1.

#### 2.1.2 Products

Table 1 lists the *primary products* used in the construction.

Table 1: Construction Type 1 build-up

|                              | <b>Product</b>                                    | <b>Depth</b> | <b>Reaction to Fire</b>                |
|------------------------------|---------------------------------------------------|--------------|----------------------------------------|
| <b>Substrate</b>             | Plasterboard                                      | Unknown      | <i>Limited combustibility</i> [Note 1] |
|                              | Metal <i>SFS</i> System and steel structure       | Various      | <i>Non-combustible</i> [Note 2]        |
|                              | Cement particle sheathing board (timber stranded) | 12mm         | <i>Combustible</i> [Note 3]            |
| <b>Cavity and Insulation</b> | Expanded Polystyrene (EPS)                        | 90mm         | <i>Combustible</i> [Note 4]            |
|                              | Render                                            | 6mm          | <i>Limited combustibility</i> [Note 1] |
|                              | Timber battens / void                             | 50mm         | <i>Combustible</i> [Note 3]            |
| <b>Cladding</b>              | Timber                                            | 16mm         | <i>Combustible</i> [Note 3]            |

Notes:

- 1 See Table A7 of ADB.
- 2 See Table A6 of ADB.
- 3 Assumed based on constituent parts, including timber.
- 4 See Appendix F of ADB.

The timber cladding and battens are located over render system matching Construction Type 2. Therefore, in part, these elements can be considered attachments to render cladding.

Table 2 lists the *secondary products* used in the construction.

Table 2: Construction Type 1 secondary products

|                                                          | <b>Product</b>                                | <b>Reaction to Fire</b>                |
|----------------------------------------------------------|-----------------------------------------------|----------------------------------------|
| <b>Fire Break</b>                                        | Mineral wool in lieu of EPS at floor junction | <i>Limited combustibility</i> [Note 1] |
| <b>Window Frames and Glass</b>                           | Timber                                        | <i>Combustible</i> [Note 2]            |
| <b>Seals, Gaskets, Fixings, Sealants and Backer Rods</b> | Window seals and gaskets (assumed)            | <i>Combustible</i> [Note 2]            |
| <b>Ventilation ducts</b>                                 | Flexible duct [Note 3]                        | <i>Combustible</i> [Note 2]            |
| <b>Electrical Installations</b>                          | Parking gate sensors                          | <i>Combustible</i> [Note 2]            |

Notes:

- 1 See Table A7 of ADB.
- 2 Assumed on basis of likely constituent *components*.
- 3 Flexible duct identified in void created by timber void. No intrusive survey undertaken at this penetration.

### 2.1.3 Junctions

Junction details as identified by Thomasons are shown indicatively in the Thomasons Inspection Report.

This construction type spans junctions with compartment floors but not compartment walls.

### Floors

The inspections suggest that not all of the plasterboard inner lining and *SFS* is built between the concrete slabs/steel structure. Therefore, no definitive evidence of fire-stopping to the sheathing board has been observed. Acceptance of such arrangement relies on the *internal component* fire resistance, see Section 2.1.5.

Where the internal component is constructed between the floor slabs, the sheathing board and cladding are continuous over junctions. Where the sheathing boards span the floor slab, no evidence of fire-stopping between the floor slab and the sheathing board was observed. This may be acceptable based on the *internal component* fire resistance, see Section 2.1.5; or absence of void and use of non-combustible sheathing board or suitable breaks in a combustible sheathing board, neither of which has been observed.

A mineral wool break in the EPS system has been observed at all locations where the render has been penetrated at floor junctions; i.e. Locations B, F, G & H. This has been included as a fire barrier in EPS system that meet BR 135 criteria, see Section 2.2.2.

No *fire barriers* were observed in the void created by the timber batten voids between the render and timber cladding.

## Walls

There are no party walls (between flats) that form a junction with Construction Type 1. Elevations suggest that there is also no junction with the fire resisting separation enclosing the escape stair.

### 2.1.4 Cavity Edges and Openings

In this construction type, cavity voids exist in the substrate and between the timber battens connecting the timber cladding to the render; i.e. no voids were observed between the sheathing board and render.

The heads of cavities appear to be parapet walls at the top level of the building or timber, where this construction type does not extend to the roof. A timber closer is not a suitable *fire barrier* at the edge of a void. The parapet construction and capping has not been inspected.

The base of SFS cavities are expected to interface with the ground level construction, and as such would be protected by construction that achieves appropriate fire resistance, however this has not been inspected. The base of the timber batten voids, where protruding other construction, is closed by timber. The junction with other protruding cladding, Construction Types 3 & 4 were not inspected.

Vent openings are not protected in the timber batten void. It is not known how other cavity edges are protected at vent openings.

It is not known how cavity edges at window openings are protected. It is noted that the windows are timber and may provide the 38mm thickness recommended by ADB. Battens may have been similarly utilised in the timber batten void.

### 2.1.5 Fire Resistance of *Internal Components*

No investigation of the internal linings has been made. Although plasterboard has been identified, no thickness or manufacturer confirmation is provided. Therefore, the fire resistance of the *internal component* cannot be confirmed by reference to manufacturer information.

The *SFS* side of the plasterboard is brown in colour and therefore likely to be a standard plasterboard, e.g. Gyproc WallBoard and not Gyproc FireLine (enhanced performance in fire), which is distinguished by a pink backing. In addition, the sheathing board is *combustible*. On this basis, the *internal component* is not expected to achieve *60E* fire resistance from inside or *30EI* in both directions, see Section 8.3.

## 2.2 Assessment Against ADB

### 2.2.1 Part B3: Internal Fire Spread (Structure)

All floors are required to be *60REI* compartment floors and party walls between flats are required to be *60EI* compartment walls.

Whilst *fire barriers* might have been installed in the EPS system at junctions with compartment floors, they may not be effective. There is a timber stranded sheathing board at the rear of the EPS and a timber batten void with timber cladding attached to the EPS system render. This arrangement provides a continuous, *combustible*, medium for fire spread around the *fire barrier* both to the front and rear of the fire barrier.

Therefore, the construction does not comply with ADB because adequate *fire barriers* have not been provided at junctions with compartment floors.

It is noted that the fire resistance of *internal components* and protection to openings is not known.

## 2.2.2 Part B4: Spread of Fire over Walls

### Flame Spread

The cladding surface complies with ADB to the east and west elevations because the external cladding is of timber >9mm thick and located on an elevation <18m in height.

The cladding surface does not comply with ADB to the north and south elevations because the external timber cladding is applied at a height >18m. Any surface used above 18m should achieve *Class 0* or *Class B-s3, d2* as a minimum.

### Combustibility

At the time of construction, compliance with ADB required compliance with BR 135: 1988. BR 135: 1988 made the following recommendations for constructions similar to EPS External wall construction (i.e. thin protective topcoats with glass fabric reinforcement over thermoplastic insulants):

- Fire barriers should be fitted at every *storey* from the second floor upwards.
- The barrier should also support the protective finish.

The as-built construction does not comply with these recommendations because:

- There is a timber cladding supported by timber battens attached to the EPS construction.
- A combustible sheathing board is continuous past the fire barriers creating a break in the polystyrene, which therefore do not provide a continuous barrier to fire spread via the combustible insulation; and
- The protective topcoat is not supported by the fire barriers or mechanically fixed to the substrate and as such could become detached in fire, providing a route for fire spread over the fire barriers.

Furthermore, further examination of BR 135: 1988 shows that the testing was done for masonry substrates and as such the guidance cannot be relied upon for SFS substrates.

It is highly likely that the as-built system would not achieve BR 135: 2013 classification.

Therefore, the construction does not comply with ADB.

## 2.2.3 Part B4: Spread of Fire between Buildings

The fire resistance of the *internal components* has not been confirmed. In conjunction with incomplete fire barriers at floor junctions, the basis of fire spread between buildings may need to be based on the building dimensions rather than compartment dimensions.

Based on an external wall fire resistance of < 60E & 15EI, see Section 2.1.5, the external walls should be assessed as unprotected. Based on inadequate fire barriers at compartment junctions, the potential for compartmentation to be compromised should be assessed.

An assessment in accordance with BR187 suggests that there is insufficient boundary separation distance for a full building fire. Should suitable fire stopping be provided at junctions, the assessment could be based on compartment dimensions, which would provide acceptable conditions to the north and east elevations.

A more detailed assessment should be undertaken by the client for the south elevation. In addition, a fire involving multiple *storeys* of the modern construction extension presents an increased risk of fire spread to the adjoined converted mill portions of the building, which should be assessed by the client.

### 3 Construction Type 2 (Render) Assessment

#### 3.1 As-Built Construction

##### 3.1.1 Description

The construction comprises (from inside to outside): a *structural framing system (SFS)* comprising a plasterboard internal lining and cement particle board sheathing board, expanded polystyrene and render.

All inspections of this construction type were at the junction with floors. Therefore, the information observed for the substrate is supported from other inspection locations; Locations I & J. Variances across the three inspection locations of the construction type were identified as follows:

- Inspection Locations B – At this location, the substrate accessed was a void to a steel column enclosed by metal plates;
- Inspection Location F – At this location, the substrate access allowed observation of a void to plasterboard but no defined SFS system;
- Inspection Locations G – At this location, primary structure was observed behind the sheathing board. Sufficient access was provided to identify the transition from the mineral wool fire break to the EPS above.

This is the most extensive construction type to the modern construction extension, and it includes several attachments as outlined below. It is also noted that all other construction types constitute this construction type with alternative over-cladding.

##### 3.1.2 Products

Table 3 lists the *primary products* used in the construction.

Table 3: Construction Type 2 build-up

|                               | <b>Product</b>                                    | <b>Depth</b> | <b>Reaction to Fire</b>                |
|-------------------------------|---------------------------------------------------|--------------|----------------------------------------|
| <b>Substrate</b>              | Plasterboard                                      | Unknown      | <i>Limited combustibility</i> [Note 1] |
|                               | Metal <i>SFS</i> System and steel structure       | Various      | <i>Non-combustible</i> [Note 2]        |
|                               | Cement particle sheathing board (timber stranded) | 12mm         | <i>Combustible</i> [Note 3]            |
| <b>Insulation (No Cavity)</b> | Expanded Polystyrene (EPS)                        | 90mm         | <i>Combustible</i> [Note 4]            |
| <b>Cladding</b>               | Render                                            | 6mm          | <i>Limited combustibility</i> [Note 1] |

Notes:

- 1 See Table A7 of ADB.
- 2 See Table A6 of ADB.
- 3 Assumed based on constituent parts, including timber.
- 4 See Appendix F of ADB.

Table 4 lists the *secondary products* used in the construction.

Table 4: Construction Type 2 secondary products

|                                                          | <b>Product</b>                                | <b>Reaction to Fire</b>                |
|----------------------------------------------------------|-----------------------------------------------|----------------------------------------|
| <b>Fire Break</b>                                        | Mineral wool in lieu of EPS at floor junction | <i>Limited combustibility</i> [Note 1] |
| <b>Window Frames and Glass</b>                           | Timber                                        | <i>Combustible</i> [Note 2]            |
| <b>Seals, Gaskets, Fixings, Sealants and Backer Rods</b> | Window seals and gaskets (assumed)            | <i>Combustible</i> [Note 2]            |
| <b>Ventilation ducts</b>                                 | Unknown                                       | Unknown [Note 3]                       |
| <b>Electrical Installations</b>                          | Exterior lighting                             | <i>Combustible</i> [Note 2]            |

Notes:

- 1 See Table A7 of ADB.
- 2 Assumed on basis of likely constituent *components*.
- 3 Flexible duct identified as part of Construction Type 1.

Construction Type 2, has external walkways and balconies (see Section 6) attached to the wall construction. Table 5 describes the relevant attachments.

Table 5: Construction Type 2 attachments

|                                                        | <b>Product</b>                         | <b>Reaction to Fire</b>         |
|--------------------------------------------------------|----------------------------------------|---------------------------------|
| <b>Beams and Joists (external walkways)</b>            | Steel beams                            | <i>Non-combustible</i> [Note 1] |
|                                                        | Steel joists                           | <i>Non-combustible</i> [Note 1] |
| <b>Floor / decking (external walkways)</b>             | Steel mesh                             | <i>Non-combustible</i> [Note 1] |
| <b>Balustrades (balconies &amp; external walkways)</b> | Glass balustrades with metal frames    | <i>Non-combustible</i> [Note 2] |
| <b>Beams and Joists (balconies)</b>                    | Timber cladding (structure is unknown) | <i>Combustible</i> [Note 3]     |
| <b>Floor / decking (balconies)</b>                     | Unknown                                | Unknown [Note 4]                |

Notes:

- 1 See Table A6 of ADB.
- 2 See Commission Decision 96/603/EC, 19 Oct 1996.
- 3 Assumed on basis of likely constituent *components*.
- 4 Assumed as timber to match other cladding of balcony structure.

### 3.1.3 Junctions

Junction details as identified by Thomasons are shown indicatively in the Thomasons Inspection Report.

This construction type spans junctions with compartment floors and compartment walls. It is understood that compartment walls (between apartments) do not have junctions perpendicular to an external wall. Rather, these walls meet the external wall(s) where they change direction by 90° as part of recesses in the elevation. Given the absence of a clear location for fire barrier requirements, these have not been inspected. In the absence of inspection, the provisions at these locations are unknown.

## Floors

The inspections suggest that not all of the plasterboard inner lining and SFS is built between the concrete slabs/steel structure. Therefore, no definitive evidence of fire-stopping to the sheathing board has been observed. Acceptance of such arrangement relies on the *internal component* fire resistance, see Section 2.1.5.

Where the internal component is constructed between the floor slabs, the sheathing board and cladding are continuous over junctions. Where the sheathing boards span the floor slab, no evidence of fire-stopping between the floor slab and the sheathing board was observed. This may be acceptable based on the *internal component* fire resistance, see Section 2.1.5; or absence of void and use of non-combustible sheathing board or suitable breaks in a combustible sheathing board, neither of which has been observed.

A mineral wool break in the EPS system has been observed at all locations where the render has been penetrated at floor junctions; i.e. Locations B, F, G & H. This has been included as a fire barrier in EPS system that meet BR 135 criteria, see Section 3.2.2.

## Walls

There are no compartment walls that form a junction with Construction Type 2 at the inspected locations. However, elevations suggest that this construction type will have junction with compartment walls and a junction with the fire resisting separation enclosing the escape stair.

### 3.1.4 Cavity Edges and Openings

In this construction type, cavity voids exist in the substrate only; i.e. no voids observed between the sheathing board and render.

The heads of cavities appear to be parapet walls at the top level of the building. The parapet construction and capping has not been inspected.

The base of SFS cavities are expected to interface with the ground level construction, and as such would be protected by construction that achieves appropriate fire resistance, however this has not been inspected.

It is not known how cavity edges along vent paths through the external wall are protected.

It is not known how cavity edges at window openings are protected. However, it is noted that the windows are timber and may provide the 38mm thickness recommended by ADB.

### 3.1.5 Fire Resistance of *Internal Components*

No investigation of the internal linings has been made. Although plasterboard has been identified, no thickness or manufacturer confirmation is provided. Therefore, the fire resistance of the *internal component* cannot be confirmed by reference to manufacturer information.

The SFS side of the plasterboard is brown in colour and therefore likely to be a standard plasterboard, e.g. Gyproc WallBoard and not Gyproc FireLine (enhanced performance in fire), which is distinguished by a pink backing. In addition, the sheathing board is *combustible*. On this basis, the *internal component* is not expected to achieve 60E fire resistance from inside or 30EI in both directions, see Section 8.3.

## 3.2 Assessment Against ADB

### 3.2.1 Part B3: Internal Fire Spread (Structure)

All floors are required to be *60REI* compartment floors and both party walls between flats and all separating walls enclosing the escape stair are required to be *60EI* compartment walls.

Whilst *fire barriers* might have been installed in the EPS system at junctions with compartment floors, they may not be effective as there is a timber stranded sheathing board at the rear of the EPS. This arrangement provides a continuous, *combustible*, medium for fire spread around the *fire barrier* to the rear of the fire barrier.

Therefore, the construction does not comply with ADB because adequate *fire barriers* have not been provided at junctions with compartment floors.

It is noted that the junctions with compartment walls, the fire resistance of *internal components* and protection to openings is not known.

### 3.2.2 Part B4: Spread of Fire over Walls

#### Flame Spread

The cladding surface complies with ADB because the external cladding is render, which achieves the required classification of *Class 0* or *Class B-s3, d2* as a minimum.

#### Combustibility

At the time of construction, compliance with ADB required compliance with BR 135: 1988. BR 135: 1988 made the following recommendations for constructions similar to EPS External wall construction (i.e. thin protective topcoats with glass fabric reinforcement over thermoplastic insulants):

- Fire barriers should be fitted at every *storey* from the second floor upwards.
- The barrier should also support the protective finish.

The as-built construction does not comply with these recommendations because:

- A combustible sheathing board is continuous past the fire barriers creating a break in the polystyrene, which therefore do not provide a continuous barrier to fire spread via the combustible insulation; and
- The protective topcoat is not supported by the fire barriers or mechanically fixed to the substrate and as such could become detached in fire, providing a route for fire spread over the fire barriers.

Furthermore, further examination of BR 135: 1988 shows that the testing was done for masonry substrates and as such the guidance cannot be relied upon for SFS substrates.

Therefore, the construction does not comply with ADB.

### 3.2.3 Part B4: Spread of Fire between Buildings

The fire resistance of the *internal components* and the presence of compartment wall junction fire barriers has not been confirmed. In conjunction with incomplete fire barriers at floor junctions, the basis of fire spread between buildings may need to be based on the building dimensions rather than compartment dimensions.

Based on an external wall fire resistance of  $< 60E$  &  $15EI$ , see Section 2.1.5, the external walls should be assessed as unprotected. Based on inadequate fire barriers at compartment junctions, the potential for compartmentation to be compromised should be assessed.

An assessment in accordance with BR187 suggests that there is insufficient boundary separation distance for a full building fire. Should suitable fire stopping be provided at junctions, the assessment could be based on compartment dimensions, which would provide acceptable conditions to the north and east elevations.

A more detailed assessment should be undertaken by the client for the south elevation. In addition, a fire involving multiple *storeys* of the modern construction extension presents an increased risk of fire spread to the adjoined converted mill portions of the building, which should be assessed by the client.

## 4 Construction Type 3 (Cement Panel) Assessment

### 4.1 As-Built Construction

#### 4.1.1 Description

The construction comprises (from inside to outside): a *structural framing system (SFS)* comprising a plasterboard internal lining (assumed) and cement particle board sheathing board, expanded polystyrene, render, and cement panel outer cladding with void behind.

The inspection of this construction type was not intrusive past identification of the EPS layer. Therefore, the information observed for the substrate is supported from other inspection locations; Locations I & J.

#### 4.1.2 Products

Table 6 lists the *primary products* used in the construction.

Table 6: Construction Type 3 build-up

|                              | <b>Product</b>                                    | <b>Depth</b> | <b>Reaction to Fire</b>                |
|------------------------------|---------------------------------------------------|--------------|----------------------------------------|
| <b>Substrate</b>             | Plasterboard                                      | Unknown      | <i>Limited combustibility</i> [Note 1] |
|                              | Metal <i>SFS</i> System and steel structure       | Various      | <i>Non-combustible</i> [Note 2]        |
|                              | Cement particle sheathing board (timber stranded) | 12mm         | <i>Combustible</i> [Note 3]            |
| <b>Cavity and Insulation</b> | Expanded Polystyrene (EPS)                        | 90mm         | <i>Combustible</i> [Note 4]            |
|                              | Render                                            | 6mm          | <i>Limited combustibility</i> [Note 1] |
|                              | Void                                              | Unknown      | N/A                                    |
| <b>Cladding</b>              | Cement panel                                      | 16mm         | <i>Class 0</i> [Note 5]                |

Notes:

- 1 See Table A7 of ADB.
- 2 See Table A6 of ADB.
- 3 Assumed based on constitute parts, including timber.
- 4 See Appendix F of ADB.
- 5 See Table A8 of ADB.

The cement panels are located over a render system matching Construction Type 2. Therefore, in part, these elements can be considered attachments to the render cladding.

Table 7 lists the *secondary products* used in the construction.

Table 7: Construction Type 3 secondary products

|                                                          | <b>Product</b>                                  | <b>Reaction to Fire</b>                |
|----------------------------------------------------------|-------------------------------------------------|----------------------------------------|
| <b>Fire Break</b>                                        | Mineral wool in lieu of EPS at floor junction * | <i>Limited combustibility</i> [Note 1] |
| <b>Window Frames and Glass</b>                           | Timber                                          | <i>Combustible</i> [Note 2]            |
| <b>Seals, Gaskets, Fixings, Sealants and Backer Rods</b> | Window seals and gaskets (assumed)              | <i>Combustible</i> [Note 2]            |

Notes:

1 See Table A7 of ADB.

2 Assumed on basis of likely constituent *components*.

\* Assumed from Construction Types 1 &amp; 2 information.

### 4.1.3 Junctions

Junction details as identified by Thomasons are shown indicatively in the Thomasons Inspection Report.

This construction type spans junctions with compartment floors on the north elevation, but not compartment walls. Where used on other elevations, east and south, it is located at Ground Floor only and does not span compartment wall junctions.

### Floors

The inspections suggest that not all of the plasterboard inner lining and *SFS* is built between the concrete slabs/steel structure. Therefore, no definitive evidence of fire-stopping to the sheathing board has been observed. Acceptance of such arrangement relies on the *internal component* fire resistance, see Section 2.1.5.

Where the *internal component* is constructed between the floor slabs, the sheathing board and cladding are continuous over junctions. Where the sheathing boards span the floor slab, no evidence of fire-stopping between the floor slab and the sheathing board was observed. This may be acceptable based on the *internal component* fire resistance, see Section 2.1.5; or absence of void and use of non-combustible sheathing board or suitable breaks in a combustible sheathing board, neither of which has been observed.

A mineral wool break in the EPS system has been observed at all locations where the render has been penetrated at floor junctions; i.e. Locations B, F, G & H. This has been included as a fire barrier in EPS systems that meet BR 135 criteria, see Section 4.2.2.

The void between the render and cement panel was not investigated. Therefore, it is not known if *fire barriers* are provided at floor junctions.

### Walls

There are no party walls (between flats) that form a junction with Construction Type 3. Elevations suggest that there is also no junction with the fire resisting separation enclosing the escape stair.

### 4.1.4 Cavity Edges and Openings

In this construction type, cavity voids exist in the substrate and between the render and cement panel; i.e. no voids observed between the sheathing board and render.

The heads of cavities appear to be parapet walls at the top level of the building (north elevation) or at the interface with Construction Type 1 (east and south elevations), where this construction type does not extend to the roof. The separation between Construction Types 1 & 3 is unknown. The parapet construction and capping has not been inspected.

The base of all cavities are expected to interface with the ground level construction, and as such would be protected by construction that achieves appropriate fire resistance, however this has not been inspected.

It is not known how cavity edges at window openings are protected. However, it is noted that the windows are timber and may provide the 38mm thickness recommended by ADB.

#### 4.1.5 Fire Resistance of *Internal Components*

No investigation of the internal linings has been made. Although plasterboard has been identified, no thickness or manufacturer confirmation is provided. Therefore, the fire resistance of the *internal component* cannot be confirmed by reference to manufacturer information.

The *SFS* side of the plasterboard is brown in colour and therefore likely to be a standard plasterboard, e.g. Gyproc WallBoard and not Gyproc FireLine (enhanced performance in fire), which is distinguished by a pink backing. In addition, the sheathing board is *combustible*. On this basis, the *internal component* is not expected to achieve *60E* fire resistance from inside or *30EI* in both directions, see Section 8.3.

## 4.2 Assessment Against ADB

### 4.2.1 Part B3: Internal Fire Spread (Structure)

All floors are required to be *60REI* compartment floors and party walls between flats are required to be *60EI* compartment walls.

Whilst *fire barriers* might have been installed in the EPS system at junctions with compartment floors, they may not be effective. There is a timber stranded sheathing board at the rear of the EPS and a cement panel void attached to the EPS system render. This arrangement provides a continuous, *combustible*, medium for fire spread around the *fire barrier* to the rear, and potentially to the front, of the fire barrier.

Therefore, the construction does not comply with ADB because adequate *fire barriers* have not been provided at junctions with compartment floors.

It is noted that the fire resistance of *internal components* and protection to openings is not known.

### 4.2.2 Part B4: Spread of Fire over Walls

#### Flame Spread

The cladding surface complies with ADB because the cement panel achieves the required classification of *Class 0*.

#### Combustibility

At the time of construction, compliance with ADB required compliance with BR 135: 1988. BR 135: 1988 made the following recommendations for constructions similar to EPS *External wall construction* (i.e. thin protective topcoats with glass fabric reinforcement over thermoplastic insulants):

- Fire barriers should be fitted at every *storey* from the second floor upwards.
- The barrier should also support the protective finish.

The as-built construction does not comply with these recommendations because:

- There is a cement panel attached to the EPS construction.
- A combustible sheathing board is continuous past the fire barriers creating a break in the polystyrene, which therefore do not provide a continuous barrier to fire spread via the combustible insulation; and
- The protective topcoat is not supported by the fire barriers or mechanically fixed to the substrate and as such would become detached in fire, providing a route for fire spread over the fire barriers.

Furthermore, further examination of BR 135: 1988 shows that the testing was done for masonry substrates and as such the guidance cannot be relied upon for SFS substrates.

It is almost certain that the as-built system would not achieve BR 135: 2013 classification.

Therefore, the construction does not comply with ADB.

#### 4.2.3 Part B4: Spread of Fire between Buildings

The fire resistance of the *internal components* has not been confirmed. In conjunction with incomplete fire barriers at floor junctions, the basis of fire spread between buildings may need to be based on the building dimensions rather than compartment dimensions.

Based on an external wall fire resistance of  $< 60E$  &  $15EI$ , see Section 2.1.5, the external walls should be assessed as unprotected. Based on inadequate fire barriers at compartment junctions, the potential for compartmentation to be compromised should be assessed.

An assessment in accordance with BR187 suggests that there is insufficient boundary separation distance for a full building fire. Should suitable fire stopping be provided at junctions, the assessment could be based on compartment dimensions, which would provide acceptable conditions to the north and east elevations.

A more detailed assessment should be undertaken by the client for the south elevation. In addition, a fire involving multiple *storeys* of the modern construction extension presents an increased risk of fire spread to the adjoined converted mill portions of the building, which should be assessed by the client.

## 5 Construction Type 4 (Copper Panels) Assessment

### 5.1 As-Built Construction

#### 5.1.1 Description

The construction comprises (from inside to outside): a *structural framing system (SFS)* comprising a plasterboard internal lining (assumed) and cement particle board sheathing board, expanded polystyrene, render, and copper panel outer cladding with void behind.

The inspection of this construction type was not intrusive past identification of the EPS layer. Therefore, the information observed for the substrate is supported from other inspection locations; Locations I & J.

#### 5.1.2 Products

Table 8 lists the *primary products* used in the construction.

Table 8: Construction Type 4 build-up

|                              | <b>Product</b>                                    | <b>Depth</b> | <b>Reaction to Fire</b>                |
|------------------------------|---------------------------------------------------|--------------|----------------------------------------|
| <b>Substrate</b>             | Plasterboard                                      | Unknown      | <i>Limited combustibility</i> [Note 1] |
|                              | Metal <i>SFS</i> System and steel structure       | Various      | <i>Non-combustible</i> [Note 2]        |
|                              | Cement particle sheathing board (timber stranded) | 12mm         | <i>Combustible</i> [Note 3]            |
| <b>Cavity and Insulation</b> | Expanded Polystyrene (EPS)                        | 90mm         | <i>Combustible</i> [Note 4]            |
|                              | Render                                            | 6mm          | <i>Limited combustibility</i> [Note 1] |
|                              | Timber battens / void                             | 25mm         | <i>Combustible</i> [Note 3]            |
|                              | Plywood                                           | 12mm         | <i>Combustible</i> [Note 3]            |
| <b>Cladding</b>              | Copper panel                                      | 1-2mm        | <i>Non-combustible</i> [Note 2]        |

Notes:

- 1 See Table A7 of ADB.
- 2 See Table A6 of ADB.
- 3 Assumed based on constituent parts, including timber.
- 4 See Appendix F of ADB.

The copper panels are located over a render system matching Construction Type 2. Therefore, in part, these elements can be considered attachments to render cladding.

Table 9 lists the *secondary products* used in the construction.

Table 9: Construction Type 4 secondary products

|                                                          | <b>Product</b>                                  | <b>Reaction to Fire</b>                |
|----------------------------------------------------------|-------------------------------------------------|----------------------------------------|
| <b>Fire Break</b>                                        | Mineral wool in lieu of EPS at floor junction * | <i>Limited combustibility</i> [Note 1] |
| <b>Window Frames and Glass</b>                           | Timber                                          | <i>Combustible</i> [Note 2]            |
| <b>Seals, Gaskets, Fixings, Sealants and Backer Rods</b> | Window seals and gaskets (assumed)              | <i>Combustible</i> [Note 2]            |
| <b>Ventilation ducts</b>                                 | Unknown                                         | Unknown [Note 3]                       |

Notes:

- 1 See Table A7 of ADB.
- 2 Assumed on basis of likely constituent *components*.
- 3 Flexible duct identified as part of Construction Type 1.
- \* Assumed from Construction Types 1 & 2 information.

### 5.1.3 Junctions

Junction details as identified by Thomasons are shown indicatively in the Thomasons Inspection Report.

This construction type spans junctions with compartment floors and may span compartment walls also. It is understood that compartment walls (between apartments) do not have junctions perpendicular to an external wall. Rather, these walls meet the external wall(s) where they change direction by 90° as part of recesses in the elevation. Given the absence of a clear location for fire barrier requirements, these have not been inspected. In the absence of inspection, the provisions at these locations are unknown.

### Floors

The inspections suggest that not all of the plasterboard inner lining and *SFS* is built between the concrete slabs/steel structure. Therefore, no definitive evidence of fire-stopping to the sheathing board has been observed. Acceptance of such arrangement relies on the *internal component* fire resistance, see Section 2.1.5.

Where the internal component is constructed between the floor slabs, the sheathing board and cladding are continuous over junctions. Where the sheathing boards span the floor slab, no evidence of fire-stopping between the floor slab and the sheathing board was observed. This may be acceptable based on the *internal component* fire resistance, see Section 2.1.5; or absence of void and use of non-combustible sheathing board or suitable breaks in a combustible sheathing board, neither of which has been observed.

A mineral wool break in the EPS system has been observed at all locations where the render has been penetrated at floor junctions; i.e. Locations B, F, G & H. This has been included as a fire barrier in EPS system that meet BR 135 criteria, see Section 4.2.2.

No *fire barriers* were observed in the void created by the timber batten voids between the render and copper panels.

### Walls

The exact location of party walls (between flats) is unknown. Therefore, any that form a junction with Construction Type 4 has not been confirmed.

#### 5.1.4 Cavity Edges and Openings

In this construction type, cavity voids exist to the substrate and between the render and plywood backing of the copper panel.

The heads of cavities appear to be parapet walls at the top level of the building. The parapet construction and capping has not been inspected.

The base of all cavities that extend to ground are expected to interface with the ground level construction, and as such would be protected by construction that achieves appropriate fire resistance, however this has not been inspected.

The separation between Construction Type 4 and its interfaces with other Construction Types 1 & 2 is not known.

It is not known how cavity edges at window openings are protected. However, it is noted that the windows are timber and may provide the 38mm thickness recommended by ADB.

#### 5.1.5 Fire Resistance of *Internal Components*

No investigation of the internal linings has been made. Although plasterboard has been identified, no thickness or manufacturer confirmation is provided. Therefore, the fire resistance of the *internal component* cannot be confirmed by reference to manufacturer information.

The *SFS* side of the plasterboard is brown in colour and therefore likely to be a standard plasterboard, e.g. Gyproc WallBoard and not Gyproc FireLine (enhanced performance in fire), which is distinguished by a pink backing. In addition, the sheathing board is *combustible*. On this basis, the *internal component* is not expected to achieve *60E* fire resistance from inside or *30EI* in both directions, see Section 8.3.

### 5.2 Assessment Against ADB

#### 5.2.1 Part B3: Internal Fire Spread (Structure)

All floors are required to be *60REI* compartment floors and party walls between flats are required to be *60EI* compartment walls.

Whilst *fire barriers* might have been installed in the EPS system at junctions with compartment floors, they may not be effective. There is a timber stranded sheathing board at the rear of the EPS and a timber batten void with plywood backed cladding attached to the EPS system render. This arrangement provides a continuous, *combustible*, medium for fire spread around the *fire barrier* both to the front and rear of the fire barrier.

Therefore, the construction does not comply with ADB because adequate *fire barriers* have not been provided at junctions with compartment floors.

It is noted that the fire resistance of *internal components* and protection to openings is not known.

#### 5.2.2 Part B4: Spread of Fire over Walls

##### Flame Spread

The cladding surface complies with ADB because the external copper cladding achieves the required classification of *Class 0*.

## Combustibility

At the time of construction, compliance with ADB required compliance with BR 135: 1988. BR 135: 1988 made the following recommendations for constructions similar to EPS *External wall construction* (i.e. thin protective topcoats with glass fabric reinforcement over thermoplastic insulants):

- Fire barriers should be fitted at every *storey* from the second floor upwards.
- The barrier should also support the protective finish.

The as-built construction does not comply with these recommendations because:

- There is a plywood backed panel system supported by timber battens attached to the EPS construction.
- A combustible sheathing board is continuous past the fire barriers creating a break in the polystyrene, which therefore do not provide a continuous barrier to fire spread via the combustible insulation; and
- The protective topcoat is not supported by the fire barriers or mechanically fixed to the substrate and as such would become detached in fire, providing a route for fire spread over the fire barriers.

Furthermore, further examination of BR 135: 1988 shows that the testing was done for masonry substrates and as such the guidance cannot be relied upon for SFS substrates.

It is highly likely that the as-built system would not achieve BR 135: 2013 classification.

Therefore, the construction does not comply with ADB.

### 5.2.3 Part B4: Spread of Fire between Buildings

The fire resistance of the *internal components* has not been confirmed. In conjunction with incomplete fire barriers at floor junctions, the basis of fire spread between buildings may need to be based on the building dimensions rather than compartment dimensions.

Based on an external wall fire resistance of  $< 60E$  &  $15EI$ , see Section 2.1.5, the external walls should be assessed as unprotected. Based on inadequate fire barriers at compartment junctions, the potential for compartmentation to be compromised should be assessed.

An assessment in accordance with BR187 suggests that there is insufficient boundary separation distance for a full building fire. Should suitable fire stopping be provided at junctions, the assessment could be based on compartment dimensions, which would provide acceptable conditions to the north and east elevations.

A more detailed assessment should be undertaken by the client for the south elevation. In addition, a fire involving multiple *storeys* of the modern construction extension presents an increased risk of fire spread to the adjoined converted mill portions of the building, which should be assessed by the client.

## 6 Attachments

There are two primary attachments to the external wall systems at Vulcan Works, these are:

- Vertically stacked private balconies recessed in Construction Type 2 on the east elevation; and,
- Vertically stacked common external walkways (single access/egress route) along Construction Type 2 on the west elevation.

In the absence of internal layouts, the use of rooms with openings to the attachments is not known.

Whilst there is ambiguity as to whether balconies should be considered as part of the *external wall construction* (in respect of compliance with ADB), they can provide a medium for fire spread that could be a risk to health and safety. Therefore, the risk of spread of fire via the balconies has been considered by DFC herein.

In addition to being a potential medium for fire spread, the external walkways are escape routes. Therefore, they require protection from fire which may result in external walls specification different to other locations.

### 6.1 Private Balconies

#### 6.1.1 As-Built Construction

The private balconies are stacked at two locations on the east elevation at Construction Type 2. A total of 8 apartments have these balconies, i.e. 2 x 4 apartments stacked from the First through to the Fourth *storey*. The balconies have a width and depth of approximately 2.7m and 1m respectively.

The balustrades are glass with metal frames, which in isolation are not a medium for fire spread. The structural frame of the private balconies is unknown as the timber cladding was not removed as part of the investigations. The timber cladding is a medium for fire spread.

In addition to the timber cladding, if the balconies are used for storage then, ignition on one balcony introduces the possibility that fire would spread to the next balcony above. This could be quickened due to the connectivity of any *combustible* external cladding systems.

Therefore, the rate of spread of fire via the balconies could be greater than that associated with ADB compliant construction where the balconies are associated with *combustible* cladding systems.

The timber balcony does not provide alternative means of escape; therefore, the timber balcony does not directly pose an increased fire risk for means of escape.

#### 6.1.2 Part B3: Internal Fire Spread

##### 6.1.2.1 Junctions and Cavities

The balconies do not form junctions with internal walls / floors and do not create a cavity.

Therefore, the construction complies with ADB.

#### 6.1.3 Part B4: Spread of Fire over Walls

Timber typically achieves *Class 2* (depending on the timber) and it can be treated to achieve *Class 0*. Regardless of any treatment it would not be of *limited combustibility* or achieve *Class A2*.

Thick timber is harder to ignite than thin timber. Similarly, the combustion characteristics of thick timber are such that the energy produced by combustion is not enough to sustain continued combustion. The rate of timber combustion is also influenced by the orientation of the timber (fire spread in horizontally lain timber is opposed to the direction of the flame, whereas in vertical timber it is concurrent).

The balcony cladding, over balcony structure, is located to the balconies at Second through Fourth storey. The cladding is laid both horizontally and vertically, with the height of range of approximately 0.5-0.75m (0.75m at Second Floor and 0.5m at Third and Fourth Floors). Therefore, each balcony timber cladding is separated by approximately 3.5m vertically from each other and at least 1m above the door opening below. However, the balconies are stacked vertically above each other, with EPS (Construction Type 2) connecting the balconies vertically and the *internal components* fire resistance is unknown.

Therefore, if one balcony were ignited, it is possible that fire would spread to the next balcony, albeit this may be progressive rather than rapid while the render remains in place. Vertical spread of fire via the balconies would likely be to multiple balconies at a time as opposed to a single balcony should the external wall become involved, which would promulgate fire spread vertically.

For context, the likelihood and rate of spread of fire via the balconies is not likely to be greater than spread of fire over timber cladding, and timber cladding up to a height of 18m above ground can be acceptable within ADB. Therefore, the rate of spread of fire via the balconies in isolation is likely to be no greater than that associated with ADB compliant construction.

Based on the above, the balcony construction complies with ADB, when considered in isolation.

## 6.2 Common External Walkways

### 6.2.1 As-Built Construction

The external walkways are stacked over all storeys at the south elevation along Construction Type 2. A total of 8 apartments, 2 per storey, are accessed via these walkways. The walkways have a width and depth of approximately 9m and 1.2m respectively.

The external walkways are constructed from *non-combustible materials* – steel structural frame and steel mesh floor, glass balustrade with metal framing.

The walkways provide means of escape; therefore, they require protection from fire.

### 6.2.2 Part B3: Internal Fire Spread

#### 6.2.2.1 Junctions and Cavities

The walkways do not form junctions with internal walls / floors and do not create a cavity.

Therefore, the construction complies with ADB.

#### 6.2.2.2 Fire Resistance of *Internal Components*

Reference should be made to the fire resistance of *internal components* of Construction Type 2, see Section 3.1.5.

In addition, there are openings along the walkways that have no confirmed fire resistance. Therefore, with reference to Appendix G, the walkway floor should be imperforate and provide fire resistance (30REI as a minimum). As the floor is mesh steel, this has not been provided.

### 6.2.3 Part B4: Spread of Fire over Walls

The walkways are formed of *non-combustible materials*. Therefore, they do not provide a medium for fire spread.

Therefore, the construction complies with ADB. However, the presence of combustible construction, Construction Type 2, adjacent to an escape route with unprotected openings should be considered as part of the building fire risk assessment.

## 7 Building Risk Assessment

### 7.1 Elevations

The following are brief descriptions of each elevation:

- North: This elevation consists of three construction types, i.e. Construction Types 1, 2 & 3. There are no attachments to this elevation.
- East: This elevation includes all four construction types, Construction Types 1, 2, 3 & 4. This elevation also includes private balcony attachments to Construction Type 2.
- South: This elevation consists of three construction types, i.e. Construction Types 1, 2 & 3. There are no attachments to this elevation.
- West: This elevation consists of three construction types, i.e. Construction Types 1, 2 & 4. This elevation also includes common external walkway attachments to Construction Type 2.

Based on the Thomasons investigation, all construction types are considered to have a consistent substrate and insulation build-up with differing external cladding element. In brief, Construction Types 1, 3 & 4 consist of Construction Type 2 but have varying additional cladding added to the outside of the render finish.

### 7.2 Hazard

#### 7.2.1 Construction Type 2 (Render)

##### Potential Medium for Fire Spread

The combustible Expanded Polystyrene (EPS) insulation provides a means of fire spread between flats immediately above, below and to the sides of each other.

Construction Type 2 provides a potential medium for fire spread across compartment floors as suitable fire barriers have not been installed. There is a combustible sheathing board to the back of the EPS fire barrier and the render to that barrier is not mechanically fixed. Therefore, should a fire spread into the external wall, there may be insufficient means to restrict fire spread in the structure and fabric of the building.

Construction Type 2 may also have inadequate protection at junctions for party walls. Additional information is required to identify location and details of party wall junctions for this wall type.

##### Burning Characteristics

Construction Type 2 provides a medium for both vertical fire spread, vertically downward fire spread and horizontal fire spread. Expanded polystyrene at temperatures above 140°C will begin to soften, contract and finally melt, creating a cavity in the external wall. There is a risk that this polystyrene could melt, drip and ignite combustible *components* on the floors below and this could be a mechanism for downwards fire spread within the cavity.

#### 7.2.2 Construction Types 1, 3 & 4

##### Potential Medium for Fire Spread

Each of these construction types are a variance of Construction Type 2 and the assessment presented in Section 7.2.1 applies in addition to the below.

- Construction Type 1 (Timber);
  - The timber cladding surface is a medium for fire spread, albeit acceptable to ADB when considered in isolation.
  - The timber battens and associated void provide a medium for fire spread across compartment floors as suitable *fire barriers* have not been installed.
  - The addition of the timber cladding to the render, outlined in Construction Type 2, may increase the potential for the render to detach and the combustible EPS to be exposed to a fire.
- Construction Type 3 (Cement panel);
  - The cement panel void provides a path for fire spread across compartment floors as suitable *fire barriers* have not been installed.
  - In addition, the fixings of the cladding to the render, outlined in Construction Type 2, may increase the potential for the render to detach and the combustible EPS to be exposed to a fire.
- Construction Type 4 (Copper panel);
  - The timber battens, associated void and plywood backing to the copper panels provide a medium for fire spread across compartment floors as suitable *fire barriers* have not been installed.
  - The addition of the timber cladding framework to the render, outlined in Construction Type 2, may increase the potential for the render to detach and the combustible EPS to be exposed to a fire.

### Burning Characteristics

Each of these construction types are a variance of Construction Type 2 and the characteristics outlined in Section 7.2.1 applies in addition to the below.

- Construction Type 1 (Timber); Should fire enter the timber cladding void, ignited timber may develop an elongated flame leading to increased speed of vertical fire spread. Burning brands may also detach and fall to the horizontal timber framework below. As the timber is relatively thick, the speed of fire spread may be slow at the initial stages but the fuel will sustain a longer burning period.
- Construction Type 3 (Cement panel); The void created by the panels would provide conditions for flame elongation of any fire that enters the void.
- Construction Type 4 (Copper panel); Should fire enter the timber framework void, ignited timber may develop an elongated flame leading to increased speed of vertical fire spread. Burning brands may also detach and fall to the horizontal timber framework below. The plywood board is likely to allow for faster fire development in comparison to the timber cladding in Construction Type 1.

### 7.2.3 Attachments

With regards their potential as a medium for fire spread, these construction types are considered to comply with ADB and therefore, they do not pose an increased risk of fire spread when considered in isolation. Therefore, remediation is not required.

Notwithstanding, DFC recommends that consideration be given to replacing the timber on the private balconies as part of a general maintenance plan. The external walkways are considered further in Section 7.3.

## 7.3 Likelihood of Causing Harm

### 7.3.1 Likelihood of Ignition

Potential ignition sources include fires breaking out of flats via windows or fires starting on balconies (where there are balconies). It is noted that there are electrical systems in the external wall (lighting and security sensors). In addition, there is a public bin and two padmount transformers next to the north elevation, and a parking space in close proximity to the west elevation.

There are no measures to reduce the likelihood of ignition via these sources; therefore, the likelihood of ignition is no less than that associated with an ADB compliant construction.

### 7.3.2 Likelihood of Spread

As discussed in Section 7.2, unless shown otherwise, it must be assumed that fire could spread more rapidly between flats at junctions with floors and walls and that fire could spread more rapidly and extensively over the *external wall construction* than for an ADB compliant construction.

Reference is made in particular to the EPS insulation provided in all construction types. In addition, the use of a combustible sheathing board and addition of combustible cladding / cladding framework and associated voids outside of the EPS render covering for Construction Types 1, 3 & 4 are noteworthy.

### 7.3.3 Likelihood of Harm

The likelihood of causing harm is a function of extent (total number of flats and rooms that might be at risk), rate (number of flats that might be at risk simultaneously), and severity (heat and duration of risk) of fire spread.

The total number of flats at risk increases the number of people at risk and the likelihood of failure of other systems. Compliance with ADB does not prevent fire spread between flats (fire can spread from window to window), but it does make the likelihood of spread to multiple flats via the wall construction itself sufficiently low. It has to be assumed (see Section 7.2) that fire could spread to multiple floors due to incomplete fire stopping at junctions and around openings & penetrations.

There is potential for fire to spread extensively through the EPS system used in all construction types. As such, it is possible that fire could spread across multiple flats and floors. This is greater than would be expected for an ADB compliant construction.

Additionally, the extent of fire spread is such that fire could spread into any single flat at multiple entry points (i.e. there could be more than one seat of fire within a flat). This increases the hazard to which occupants of that flat might be exposed. It is possible that this increased risk is partially mitigated by a protected entrance hall layout, if they are used in the apartments.

The external walkway is a single escape route from eight apartments. The fire resistance of the *external wall construction* adjacent the walkway is not known, there are openings in the adjacent wall with no determined fire resistance and the walkway floor is not fire resisting. Furthermore, the walkway floor and balustrade are not imperforate. Therefore, escape along this route may be compromised by a building fire and the external wall construction increases the likelihood of harm.

Finally, it is noted that the method of protecting the escape stair from smoke ingress from a fire in the north-most apartments is not known. Therefore, a potential that the smoke control system for the common corridors could be compromised if smoke were to enter multiple corridors simultaneously needs to be assessed as part of the building fire risk assessment.

Therefore, the likelihood of causing harm is greater than associated with an ADB compliant design.

## **7.4 Fire Service Access and Incident Command**

### **7.4.1 Entry into the Building**

The modern construction extension is accessed via a single stair. It is understood that the stair can be accessed via both the north and south elevations. Therefore, the entry points are sufficiently remote from each other that fire spread over the construction would not compromise fire service access into the stair.

Access to several apartments is via the external walkway, which does not have a fire resisting floor. Therefore, if a fire spread to multiple flats, firefighter access to the upper *storeys* could be compromised.

### **7.4.2 Facilities**

It is noted that the building has good external access to elevations. However, due to building height, firefighting response is expected to be via the internal access routes.

If firefighting operations were to take place on multiple floors where fire had spread to flats on those floors, it is possible that the smoke venting systems in the common corridors would be overwhelmed.

### **7.4.3 Incident Command**

Fire spread to multiple flats increases resource demands and complexity of fire service operations.

## **7.5 Risk**

Whilst at the time of writing it is not possible to quantify, there is an increased likelihood of harm to residents due to fire spread via the construction and the associated risk might require mitigation.

There is also an increased risk of fire service operations being compromised due to an increased likelihood of fire spread to multiple flats and the external walkways.

## 8 Remediation Requirements

### 8.1 Definition of Options

See Appendix C.2.5 for a discussion on principles and merits of the remediation options presented below.

### 8.2 Government Building Safety Remediation Fund

In May 2020, MHCLG issued the prospectus for the Building Safety Fund for the remediation of non-ACM cladding systems<sup>5</sup>. The following are eligible for funding where the building has a *storey height* of at least 18m (allowing for a tolerance of 30cm):

- Any cladding of *Class C-s1, d0* or worse.
- Systems comprising insulation of *Class B-s1, d0* or worse and cladding that is *Class B-s1, d0* to *Class B-s3, d2* that have not achieved BR 135 classification.
- Systems comprising insulation, or filler, of *Class B-s1, d0* or worse that have not achieved BR 135 classification.

Given that the building does not have a *storey height* of at least 18m, the construction types assessed are not eligible for funding.

### 8.3 ADB Compliance

Compliance with ADB would require the provision of *fire barriers* at all junctions between the external walls and internal compartmentation, floors and walls, and at all penetrations & openings through the external walls.

For clarity, *fire barrier* requirements are as follows:

- Install mechanically fixed full thickness *fire barriers* in line with compartment floors and compartment walls in the EPS system.
- Provide mechanically fixed *fire barriers* between the compartment floors & compartment walls to, and aligning with, the EPS fire barrier unless the *internal component* fire resistance is confirmed, see further information below. In all scenarios, a break in any combustible sheathing board is required.
- Provide mechanically fixed *fire barriers* between the render and any further cladding system, i.e. Construction Types 1, 3 & 4; in line with compartment floors and compartment walls; and aligning with the EPS fire barrier. The fire barrier should extend through the plywood backing to reach the copper panel in Construction Type 4.
- The above fire barriers require 60EI, reduced to 30E/15EI if the internal component fire resistance is confirmed, see further information below.
- Provide full depth fire barriers around all openings in all construction types. These fire barriers require 30E/15EI or ADB alternatives (e.g. 12mm gypsum boards).

Alternatively, for Construction Type 2, it might be possible to show though testing in accordance with BS 8414 that the construction meets the BR 135 performance criteria without or with reduced need for

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<sup>5</sup> Ministry of Housing, Communities & Local Government, 'Building Safety Fund for the remediation of non-ACM Cladding Systems (England only) – Registration prospectus', May 2020 ([https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/887452/BSF\\_Non-ACM\\_Cladding\\_Prospectus.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/887452/BSF_Non-ACM_Cladding_Prospectus.pdf))

remediation. It is noted that the substrate / *internal component* may require alteration to meet the performance criteria, e.g. the combustible sheathing board may negatively impact the test results.

In order to rely on the *internal component*, further information would be required to confirm the fire resistance, with one of the following required to allow a reduction in *fire barrier* performance as listed above:

- The *internal component* must achieve 60E from inside to out; or,
- The *internal component* must achieve 30EI in each direction.

It is noted that DFC assessment of the *internal components* fire resistance from available information suggests that fire resistance is unlikely to be demonstrated from the cavity side, outside to in, and 60 minutes is unlikely to be achieved from inside to out.

To comply with ADB, the external walkway requires fire resistance and smoke retarding elements as outlined in Appendix G.3.1.5.

Any new *products* introduced into the *external wall construction* as part of remediation would have to comply with Regulation 7(2) of the Building Regulations and achieve *Class A1* or *Class A2-s1, d0*.

## 8.4 Alternative Options

### 8.4.1 Options

It is possible that *external wall constructions* achieve adequate safety without necessarily complying with ADB.

In this instance, it is possible that adequate resistance to fire spread can be considered to be achieved by the following in combination with *fire barrier* provision to over cladding systems:

- The installation of a residential sprinkler system to the modern construction extension;
- Automatic detection and alarm system coverage of all rooms with an external wall.

Should an automatic sprinkler system be installed, this may support additional alternative options to ADB compliance subject to detailed fire engineering assessment.

With reference to Section 8.3, the installation of a sprinkler system could be utilised in combination with the existing *internal component* information to define a fire resisting performance. This may be utilised through fire engineering assessment to remove the need to replace the sheathing board or inspect the *internal component* construction further. However, in order for the EPS system to meet BR 135, the *internal component* and the sheathing board may need to be changed anyway.

Provision of a sprinkler system will reduce the risk of external fire spread to other buildings, as noted in Sections 2.2.3, 3.2.3, 4.2.3 & 5.2.3. Sprinklers will also reduce the risk to the external walkway, as discussed in Section 6.2, but may not negate other remediation to these walkways.

The provision additional detection and alarm coverage in apartments would reduce risk but require further holistic risk assessment and associated controlling authority consultation and agreement. This option would not resolve requirements for the external walkway.

Regarding the external walkway, it is possible that adequate fire resistance can be provided by the adjacent external walls in lieu of the external walkway floor. This would include replacement of non-fire resisting windows with fire resisting construction.

Any new *products* introduced into the *external wall construction* as part of remediation would have to comply with Regulation 7(2) of the Building Regulations and achieve *Class A1* or *Class A2-s1, d0*.

#### 8.4.2 Further Investigations and Testing

In some instances, additional inspections and/or fire testing are required because the option relies on the fire resistance of elements of construction or *combustibility of products* that are not currently known.

The following additional investigations and/or fire testing are required:

- Confirmation of *fire barrier* provision at compartment wall junctions, including the separating wall between the stair and other spaces, and details of that provision.
- Confirmation of the method used to close cavity edges, including around penetrations and openings.
- The fire resistance of the substrate should be determined. Therefore, the internal plasterboard type and thickness should be confirmed.
- The sheathing board should be tested to determine its reaction to fire, see Appendix A.6.
- The detection and alarm system(s) in apartments should be confirmed.
- The fire resistance of the doors and windows of the adjacent external walls would also need to be confirmed where alternative protection to external walkways is considered.

## 9 Interim Measures

### 9.1 Suitable and Sufficient Assessment of Risk

Whether any interim measures are required depends on the specifics of the building, the people at risk and the general fire precautions within the building. The scope of this assessment is limited to the *external wall construction*. Therefore, any interim measures must be determined and defined by the suitable and sufficient assessment of risk (the FRA) for the building as a whole (and cannot be determined as part of this assessment).

Notwithstanding, DFC recommends the following as a result of our assessment of the *external wall constructions*.

### 9.2 Immediate Action

DFC recommends that the following should be implemented as soon as reasonably practicable:

- Implement interim measures to protect the external walkway as soon as reasonably practicably able to do so.
- Prohibit the introduction of ignition sources or *combustible materials* to all balconies.
- Prohibit vehicle parking and the storage of waste within 5m of the perimeter of the building.
- Ensure that a suitable and sufficient assessment of risk has been carried out within the last 12 months and actions have been completed and the assessment is up to date with any changes, or immediately instruct such an assessment (see Appendix D.6.1).
- Incorporate the findings of this report into the FRA to determine any interim measures that are required. The FRA should include consideration of the items discussed in Section 9.3.
- Consultation with the fire and rescue service to discuss and agree the findings of this report and any interim measures.
- Consultation with relevant stakeholders to discuss the findings of this report and agree next steps.
- Engage with residents to communicate the findings of the risk assessment and this report and to inform them of actions they should be taking (see Appendix D.6.1).

### 9.3 FRA Considerations

#### 9.3.1 General Measures

The following general actions should be considered:

- Survey residents in respect of their ability to evacuate the building without assistance and ensure adequate measures are in place to provide assistance as required.
- Remove, reduce and prevent external ignition sources that could result in risk (e.g. cars, *materials* on balconies, waste materials, etc.).
- Assess the adequacy of any smoke ventilation provisions included to protect the single escape stair.
- Review the potential for fire spread to other buildings. In particular, the building to the south elevation as it is in close proximity across shared site access road.

### 9.3.2 Evacuation Strategy; Assessment of Appropriateness of Stay-put

MHCLG recommends factors that should be considered when assessing whether a stay-put strategy remains appropriate. Appendix D.6.2 of this report lists those factors and DFC's interpretation of their relevance.

#### General Fire Precautions in the Building

The general fire precautions are not known and should be confirmed through a suitable and sufficient assessment of risk.

#### Height of the Building

The height of the building influences the hazard posed by fire spread over its external walls (because the rate of vertical fire spread and heat released increases exponentially with respect to the height over which burning takes place) and whether fire spread can be inhibited by the fire service from outside.

ADB makes more stringent recommendations with respect to the combustibility of *external wall constructions* for buildings with *storey* more than 18m above ground. Vulcan Works does not have a *storey* over 18m.

Unless otherwise confirmed by the fire service, DFC considers that the fire service would be able to effectively inhibit fire spread from outside the building because vehicle access is good to all elevations. Therefore, the rate and extent of fire spread may be mitigated by fire service intervention from outside however it should not be relied on to reduce the risk of fire spread.

#### Provision of Sprinklers

It is not known if the building is protected by sprinklers or any other form of automatic fire suppression.

#### Number of Escape Stairways

The modern construction extension has a single stair core serving 15 flats. The general fire precautions and suitability of stair protection are not known and should be confirmed through a suitable and sufficient assessment of risk.

#### Number of Flats

The building occupancy number and capability of occupants is not known and should be considered through a suitable and sufficient assessment of risk.

The number of flats influences the number of people at risk from fire spread, the number of people that might be required to evacuate simultaneously and the resource and complexity of fire service incident management.

The modern construction extension has 15 flats. Based on an average of approximately 4 people per flat (for context purposes), this equates to around 60 people, including Ground Floor occupants. If the stairs have a clear width of at least 1100mm, using ADB Tables 6 and 7, the stair capacity would be suitable for simultaneous evacuation. This is likely to remain the case even if fire service were using the stair to access the building.

The number of occupants potentially at risk from fire spread is greater than that associated with an ADB compliant design. However, simultaneous evacuation could result in more than 60 people being evacuated, which in turn potentially puts them at risk and creates fire service and management difficulties. Therefore, whilst it must be ensured that those at risk can be evacuated should they need to evacuate, a simultaneous evacuation may not be appropriate.

## 9.4 Interim Measures to Ensure Safe Evacuation (Holistic Assessment)

### 9.4.1 NFCC Compliance

Where *external wall constructions* do not adequately resist spread of fire, MHCLG recommends compliance with NFCC guidance on implementing a simultaneous evacuation strategy. These include two primary components as summarised below.

#### Waking Watch

Where a waking watch is necessary, DFC recommends that proposals should be obtained from suitably qualified personnel for review by the fire risk assessor and GMFRS.

As a benchmark, the objective of the waking watch should be that:

- The perimeter of the modern construction extension should be visually inspected from the perimeter of the building every 15 to 30 minutes. The inspection should include an internal inspection of each fire alarm panel.
- If a fire is confirmed, the fire service should be notified immediately, and the waking watch should initiate an evacuation of the block in question. This is likely to require knocking on doors or sounding an air horn at each level of the building. This process should take no more than 10 minutes.

#### Fire Alarm

NFCC guidance recommends that (if not installed already), a fire alarm should be installed to detect fires that could result in fire spread over the external walls and to raise the alarm in all flats.

As a minimum:

- Heat detectors should be provided in all rooms on the perimeter of the building that are associated with 'defective' *external wall construction*.
- Fire alarm sounders should be provided such that the alarm can be adequately heard in all rooms within all flats (this is likely to require at least one sounder in every flat).
- The system should be configured such that activation of any heat detectors results in alarm of every flat.

Once the fire alarm system is installed and commissioned, it might be possible to reduce the waking watch requirements.

### 9.4.2 Building Specific Mitigation

NFCC guidance is generic, and as such, depending on the specifics of the situation and the overall risk of fire spread to occupants, adequate safety might be ensured by alternative interim measures. Whether this is the case should be determined as part of the FRA.

If alternative mitigation measures are to be considered, DFC recommends the following:

#### Risks Requiring Mitigation

The following risks need to be mitigated:

- Risk of rapid and extensive fire spread over the render construction.
- Risk of rapid and extensive fire spread within the cavity of the cladding construction where *fire barriers* have not been installed.

- Fire and smoke spread into the stair core via the *external wall constructions*.
- Fire spread via balconies on the east elevation.
- Fire spread that can impact use of the external walkways.

### Mitigation Options

The following building specific mitigation options might be possible as alternatives to complying with NFCC guidance:

- Subject to protection of the external walkway escape route, install interlinked smoke detection within any room which has an external wall opening, specifically any room that is used for sleeping (to ensure residents have suitable warning to enable evacuation in the event of a fire).

The appropriate interim measure to protect the external walkway is not immediately obvious. It is likely that a waking watch will not fully mitigate the risk presented, as it directly impacts the escape route, and an alternative such as a thermal imaging camera detector linked to alarms in each apartment evacuating via external walkway is more appropriate.

Regardless of any detection and alarm provision, a degree of fire resisting protection to those using the external walkway is recommended. This may be to the walkway or to the adjacent external walls.

### Fire Alarm Systems

Where fire alarm systems are being proposed as mitigation, the following should be considered when designing and costing the systems:

- The systems are for mitigation only. Therefore, they do not have to comply with all BS 5839 requirements.
- Separate systems are not required for each form of mitigation (e.g. the same system could be installed for the render mitigation as for other mitigations).
- The systems are temporary and could be decommissioned once remediation is in place. Therefore, the system could be wireless, or any cabling could be surface mounted.
- Where appropriate, consideration should be given to extending any existing systems as opposed to installation of a separate system.
- Where self-contained systems are installed, it might be possible for these to be wireless or stand-alone and battery operated. Where the latter, consideration should be given to regular communication with residents and offers to test and replace batteries.

## 9.5 Fire and Rescue Service Consultation

The risk assessment conducted above is necessarily subjective and uncertain. Therefore, the findings of the assessment should be discussed and agreed with the fire rescue service before relying on any of the conclusions of the assessment.

## 10 Conclusions

### 10.1 External Wall Constructions

All *external wall construction* includes combustible *materials*. There is a primary wall type (Construction Type 2) and three further wall types, which consist of the primary wall type and additional over cladding:

- Construction Type 2 (Render); includes Expanded Polystyrene (EPS) combustible insulation and a combustible sheathing board.
- Construction Type 1 (Timber); as per Construction Type 2 with timber cladding on timber battens attached.
- Construction Type 3 (Cement Panel); as per Construction Type 2 with cement panels attached.
- Construction Type 4 (Copper Panel); as per Construction Type 2 with plywood backed copper cladding on timber battens attached.

There are balcony and external walkway attachments to Construction Type 2 at the east and west elevations respectively.

### 10.2 Assessment

Construction Types 1 to 4 and the building attachments have been reviewed for compliance with ADB, and where non-compliances are identified the associated risk to health and safety of occupants has been assessed. Where necessary, remediation options have been identified and interim measures proposed.

#### 10.2.1 Construction Type 2 (Render)

##### Compliance with ADB

Junctions with compartment floors do not comply with ADB because the combustible sheathing board is continuous behind the EPS fire break detail (*fire barrier* at the junction with the compartment floor), the render over the *fire barrier* is not mechanically fixed and the *internal component* is not masonry construction.

The details at the junction with compartment walls have not been investigated. However, if the floor junction fire break is repeated in this orientation, the same variances from ADB apply.

There is insufficient fire tests data available on the fire performance of the *external wall construction* to determine whether it adequately resists fire spread.

##### Risk Assessment

Whilst at the time of writing it is not possible to quantify, there is an increased likelihood of harm to residents due to fire spread via the polystyrene and the associated risk requires mitigation.

##### Government Building Safety Remediation Fund

The construction is not eligible for funding because the top *storey* of the building has a height less than 18m.

## Remediation Requirements for Compliance with ADB

Compliance with ADB would require:

- Installing full thickness *fire barriers* in line with compartment floors, compartment walls and around openings.

## Alternative Remediation Options

It is possible that external wall constructions achieve adequate safety without necessarily complying with ADB. It is possible that adequate resistance to fire spread can be achieved by one or more of the following:

- The installation of a residential sprinkler system to relevant parts of the building.
- Automatic detection and alarm system coverage of all rooms with an external wall.

The following additional intrusive surveys and/or fire testing would be required to determine whether any of the above alternative remediation options would achieve an adequate standard:

- Confirmation of *fire barrier* provision at compartment wall junctions, including the separating wall between the stair and other spaces, and details of that provision.
- Confirmation of the method used to close cavity edges, including around penetrations and openings.
- The fire resistance of the substrate should be determined. Therefore, the internal plasterboard type and thickness should be confirmed.
- The sheathing board should be tested to determine its reaction to fire, see Appendix A.6.
- The detection and alarm system(s) in apartments should be confirmed.

## 10.2.2 Construction Types 1 (Timber), 3 (Cement Panel) & 4 (Copper Panel)

### Compliance with ADB

Junctions with compartment floors do not comply with ADB because the combustible sheathing board is continuous behind the EPS fire break detail (*fire barrier* at the junction with the compartment floor), the render over the *fire barrier* is not mechanically fixed and the *internal component* is not masonry construction.

The details at the junction with compartment walls have not been investigated. However, if the floor junction fire break is repeated in this orientation, the same variances from ADB apply.

There is insufficient fire tests data available on the fire performance of the *external wall construction* to determine whether it adequately resists fire spread.

In addition, for these construction types, junctions with compartmentation do not comply with ADB because there is no *fire barrier* provision within the cladding voids; and, for Construction Types 1 & 4, combustible timber is continuous in front of the EPS fire break detail.

### Risk Assessment

Whilst at the time of writing it is not possible to quantify, there is an increased likelihood of harm to residents due to fire spread via the polystyrene and the associated risk requires mitigation.

### Government Building Safety Remediation Fund

The construction is not eligible for funding because the top *storey* of the building has a height less than 18m.

### Remediation Requirements for Compliance with ADB

Compliance with ADB would require:

- Installing full thickness *fire barriers* in line with compartment floors, compartment walls and around openings.

### Alternative Remediation Options

It is possible that external wall constructions achieve adequate safety without necessarily complying with ADB. It is possible that adequate resistance to fire spread can be achieved by one or more of the following:

- The installation of a residential sprinkler system to relevant parts of the building.
- Automatic detection and alarm system coverage of all rooms with an external wall.
- Provision of *fire barriers* at all junctions and edges of the over cladding systems.
- Replace timber over cladding with an alternative *non-combustible* system.

The following additional intrusive surveys and/or fire testing would be required to determine whether any of the above alternative remediation options would achieve an adequate standard:

- Confirmation of *fire barrier* provision at compartment wall junctions, including the separating wall between the stair and other spaces, and details of that provision.
- Confirmation of the method used to close cavity edges, including around penetrations and openings.
- The fire resistance of the substrate should be determined. Therefore, the internal plasterboard type and thickness should be confirmed.
- The sheathing board should be tested to determine its reaction to fire, see Appendix A.6.
- The detection and alarm system(s) in apartments should be confirmed.

### 10.2.3 Attachments

#### Compliance with ADB

The external walkway does not comply with ADB because the floor does not provide fire resistance, and the floor and balustrade are not imperforate.

#### Risk Assessment

Whilst at the time of writing it is not possible to quantify, there is an increased likelihood of harm to residents due to exposure to fire and combustion products from below when using the external walkway, and the associated risk requires mitigation.

### Remediation Requirements for Compliance with ADB

Compliance with ADB would require adherence with Appendix G.3.1.5, including:

- The structure, including the floor, must achieve at least *30REI*.
- The walking surface must be imperforate;
- Adjacent external walls within 1800mm must achieve at least *30RE* up to a height of at least 1100mm.

### Alternative Remediation Options

It is possible that an external walkway achieves adequate safety without necessarily complying with ADB. It is possible that adequate fire resistance can be achieved as follows:

- The external walls provide fire resistance in lieu of the external walkway floor. This would include replacement of non-fire resisting windows with fire resisting construction.

The following additional intrusive surveys and/or fire testing would be required to determine whether any of the above alternative remediation options would achieve an adequate standard:

- The fire resistance of the substrate should be determined. Therefore, the internal plasterboard type and thickness should be confirmed.
- The fire resistance of the doors and windows of the adjacent external walls would also need to be confirmed.

### 10.3 Interim Measures

In this instance, the increased risk of fire spread via Construction Type 2 might not be significantly greater than that associated with an ADB compliant construction. It is possible that further investigations and fire testing (see Section 8.4) could conclude that remediation is not required.

Therefore, it is possible that interim measures are not required, or that if interim measures are required, provision of self-contained fire alarms within any rooms at the perimeter of the building might be adequate.

Regarding Construction Types 1, 3 & 4, the increased risk of fire spread is greater than the minimum requirements within ADB. Therefore, it does not meet the adequacy requirements for compliance with Article 8(1)(a) and (b) of the FSO as it presents a risk to relevant persons in the event of a fire.

Therefore, interim measures should be implemented, and automatic smoke detection in all rooms used for sleeping with Construction Type 1, 3 or 4 *external wall construction* is proposed.

In the instances of external walkways, the increased risk to occupants is greater than the minimum requirements within ADB. Therefore, it does not meet the adequacy requirements for compliance with Article 8(1)(a) and (b) of the FSO as it presents a risk to relevant persons in the event of a fire.

Therefore, interim measures should be implemented. The appropriate interim measure is not immediately obvious; with a waking watch not fully mitigating the risk presented, as it directly impacts the escape route.

A method of raising alarm throughout the building should be considered and use of thermal imaging camera detection may be suitable in lieu of a waking watch. If a temporary method of protecting external walkways from below is not identified, windows onto the walkway could be boarded with fire resisting construction. The building FRA process should consider the external walkways and, as part of an interim measures study, may identify alternatives.

This should be discussed and agreed with the Fire and Rescue Service.

### 10.4 Form EWS 1

The EWS 1 form will be completed following the conclusion of further investigations.

## 11 Next Steps

Table 10: Suggested next steps

| Action | Description                                                                                                                | Responsibility     | Likely Timeframe |
|--------|----------------------------------------------------------------------------------------------------------------------------|--------------------|------------------|
| 1      | Discuss the findings of this report with the fire and rescue service to agree immediate, interim and remediation measures. | Client             | ASAP             |
| 2      | Meet with leaseholders, residents and other stakeholders to present findings and next steps.                               | Client             | ASAP             |
| 3      | Obtain specifications and costs for interim options.                                                                       | Client / Thomasons | TBC by Thomasons |
| 4      | Agree preferred interim option with relevant stakeholders and implement.                                                   | Client             | TBC by Client    |
| 5      | Identify manufacturer of render system and contact them for test evidence for the installed system.                        | Client / Thomasons | TBC by Thomasons |
| 6      | Obtain high level costs remediation options.                                                                               | Client / Thomasons | TBC by Thomasons |
| 7      | Meet with leaseholders, residents and other stakeholders to present remediation options.                                   | Client             | TBC by Client    |
| 8      | Agree preferred remediation options.                                                                                       | Client             | TBC by Client    |
| 9      | Detailed design, tender and implementation of preferred remediation options.                                               | Thomasons          | TBC by Thomasons |
| 10     | Update this report at appropriate stages to reflect progress made.                                                         | DFC                | TBC              |

## Appendix A – Definitions and Terminology

### A.1 Building Components

- Gallery: A floor which is less than one-half of the area of the space into which it projects.
- Element of structure: structural frames, beams, columns, loadbearing walls (internal and external), floor structures and gallery structures.
- Storey: includes any gallery if its area is more than half that of the space into which it projects and a roof unless it is accessible only for maintenance and repair.

### A.2 Building Heights

- Storey height: height of top storey measured from upper floor surface of top floor to ground level on lowest side of building (excludes roof-top plan areas and any top storeys consisting exclusively of plant rooms).
- Building height: mean roof level to mean ground level.

### A.3 Materials, Components and Products

- Material: single basic substance or uniformly dispersed mixture of substances, e.g. metal, stone, timber, concrete, mineral wool with uniformly dispersed binder or polymers.
- Component: a material which forms part of a product.
- Product: material, element or component.
- Primary Products: *products* within the external wall construction that are used in sufficient coverage that they could be a medium for fire spread over the walls of the building and in sufficient volume that fire spread could result in a risk to health and safety. Primary products would constitute insulation, filler material, etc. in the context of ADB 2006 and MHCLG advice.
- Secondary Products: *products* within the external wall construction that are either not used in sufficient coverage to constitute a medium for fire spread over the walls of the building (e.g. sealants and gaskets) and/or that do not have sufficient volume for fire spread to result in a risk to health and safety (e.g. membranes). Secondary products would constitute gaskets, sealants and similar in the context of ADB 2006. Secondary products include the permitted exemptions listed in Regulation 7(3) of the 2018 amendment to the Building Regulations.

### A.4 Constructions

- External wall construction: the full depth of the wall construction from the inside face of the internal linings to the outside face of outermost surface including cavity barriers, window frames, spandrel panels, infill panels etc.
- Internal Components: The components of the *external wall construction* that maintain the integrity of the *external wall construction* between *cavity barriers* at junctions with compartments, *cavity barriers* at junctions between compartment walls and *cavity barriers* (or similar) at cavity edges around openings (including window openings). Typically, the inner construction is an inner leaf of blockwork or a structural framing system.
- Structural framing system (SFS): an *internal component* of an *external wall construction* comprising plasterboard, a structural frame (potentially insulated) and a sheathing board.

## A.5 Fire Resistance Standards

Fire resistance standards in accordance with BS EN 1363-1<sup>6</sup> or BS 476-20<sup>7</sup>, and are expressed as:

xxxREI, xxxR, xxxEI or xxxE xxxI

where:

R - loadbearing capacity: resistance to collapse (loadbearing capacity), which applies to loadbearing elements only.

E - integrity: resistance to fire penetration through separating elements.

I - insulation: resistance to the transfer of excessive heat on unexposed faces of separating elements.

## A.6 Reaction to Fire

### European Class

Where possible, *products'* reactions to fire are specified in accordance with BS EN 13501-1<sup>8</sup> (i.e. European class).

The classification is designated as Class A1, Class A2-sx, dx or Class B2-sx, dx, Class C, Class D or Class E.

where:

sx – is the smoke production index

dx – is the droplet index

### National Class

Where appropriate or necessary, *products'* combustibility and surface spread of flame characteristics are specified in accordance with the national system, where:

- Non-combustible is a product that achieves Class A1, or has been tested as such in accordance with BS 476-4 or BS 476-11, or is a material listed in Table A6 of ADB:2013.
- Limited combustibility is a product that achieves Class A2 or has been tested as such in accordance with BS 476-11, or any material listed in Table A7 of Approved Document B:2013.
- Combustible is a material that is not either non-combustible or of limited combustibility.
- Class 0 means national class 0 in accordance with BS 476-6 and BS 476-7.
- Class 1 means national class 1 in accordance with BS 476-7.

### European vs National Classes

- A product that is *Class A1/non-combustible* also achieves *Class A2/limited combustibility*.
- A product that is *Class A2/limited combustibility* also achieves *Class B/Class 0*.

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<sup>6</sup> BS EN 1363-1, 'Fire resistance tests. General Requirements', 2012.

<sup>7</sup> BS 476-20, 'Fire tests on building materials and structures. Method for determination of fire resistance of elements of construction (general principles)', 1987.

<sup>8</sup> BS EN 13501-1:2007+A1:2009, 'Fire classification of construction products and building elements. Classification using data from reaction to fire tests', 2009.

## A.7 Fire Barriers

For protection of junctions, ADB uses two terms:

- Firestopping is a continuation of any compartment floor or wall and is required to achieve the same fire resistance standard as the floor or wall, and
- Cavity barrier a barrier used within a cavity that is required to achieve a fire resistance standard of 30 minutes integrity and 15 minutes insulation.

Depending on the specific details of an external wall construction, DFC considers that there are instances where cavity barriers are required to protect compartmentation as well as prevent spread of fire and smoke within the cavity (i.e. they are barriers in a cavity but are required to achieve a higher fire resistance standard than a cavity barrier).

Therefore, the term 'fire barrier' is used in this report for both firestopping and cavity barriers, and the required fire resistance standard is explicitly specified.

Fire barriers can take either of the following forms:

- Closed-state: a barrier that forms a continuous seal across the gap in which it is installed. There are no active components.
- Open-state: a barrier that leaves holes or gaps within the gap in which it is installed. There is an active component (an intumescent) which seals the gaps when it gets hot. Such barriers are typically installed in ventilated cavities to allow the cavity to be ventilated in normal conditions.

## **Appendix B – Definition of Adequate Safety**

### **B.1 Building Regulations**

Since the first edition in 1985, Regulation 8 of the Building Regulations requires that Part B, “shall not require anything to be done except for the purpose of securing reasonable standards of health and safety for persons in or about buildings (and any others who may be affected by buildings, or matters connected with buildings).”

Therefore, Part B defines the minimum standard required for safety of building works (new buildings and for works within existing buildings) and if a building complied with Part B when it was built, then it is adequately safe (provided it is operated and maintained correctly). Conversely, if a building is adequately safe, it complies with Part B.

It is possible that the benchmark expectation of the standard of safety required for compliance with Part B changes between different editions of the Building Regulations. However, any increase in standard is not applied retrospectively. It is accepted that previous standards were adequate and new standards can be met progressively as buildings are replaced and renovated.

Therefore:

- If an external wall complied with the relevant Part B when it was constructed, it is adequately safe now (provided it has been operated and maintained correctly), and
- If an external wall is adequately safe now, it complied with relevant Part B when it was constructed (provided it has not been modified since completion).

### **B.2 Approved Document B**

The ADB relevant at the time of construction provided approved guidance for compliance with the relevant Part B at the time of construction. Therefore, it defined the benchmark expectation of the standard of safety at the time of construction.

Therefore, for common building situations, proof of compliance with the relevant ADB could be taken as complying with the relevant Part B.

That said, it is not mandatory to comply with ADB and alternative solutions can be viable. If the construction does not comply with ADB, there is potential subjectivity to compliance with Part B and it would be assumed that the construction does not comply with Part B compliance is adequately demonstrated.

### **B.3 Regulatory Reform (Fire Safety) Order**

Part B and the FSO are designed to work in conjunction such that Part B ensures that there are adequate physical fire precautions within buildings to enable compliance with the FSO.

Therefore, where an external wall construction complied with Part B at the time of construction, compliance with the FSO would be achieved by ensuring that the external wall construction is operated and maintained correctly.

Therefore, because compliance with ADB can be taken as compliance with Part B, compliance with ADB can also be taken as adequate for compliance with the FSO.

## B.4 MHCLG Advice

On 20 January 2020, MHCLG published consolidated advice<sup>9</sup> for building owners of multi-storey, multi-occupied residential buildings.

The purpose of the advice is to help building owners ensure that external wall constructions achieve adequate safety. The advice does not include an explicit benchmark for safety, but the assessment process is aligned to compliance with ADB.

In DFC's opinion, it is not MHCLG's intent to require buildings that complied with Part B at the time of construction to be upgraded to comply with current benchmark's of safety, but instead to ensure that buildings complied with Part B at the time they were construction and to ensure that they are being operated and maintained safely.

Therefore, because compliance with ADB can be taken as compliance with Part B, compliance with ADB can also be taken as adequate for compliance with MHCLG advice in respect of the external wall construction itself.

## B.5 Conclusions

For external wall constructions:

- Part B defines the requirement for adequate safety.
- Compliance with the relevant Part B at the time of construction is adequate safety now.
- Compliance with the relevant Part B at the time of construction is adequate for compliance with the FSO.
- Compliance with the relevant Part B at the time of construction and compliance with the FSO is adequate for compliance with MHCLG advice.
- Therefore, compliance with the relevant ADB at the time of construction is adequate for compliance with the relevant Part B, the FSO and MHCLG advice.
- Conversely, if an external wall construction is adequately safe now (and has not been modified), then it must have complied with Part B at the time of construction.
- If the construction does not comply with ADB, there is potential subjectivity to compliance with Part B and it would be assumed that the construction does not comply with Part B compliance is adequately demonstrated.

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<sup>9</sup> Ministry of Housing, Communities and Local Government, 'Advice for Building Owners of Multi-storey, Multi-occupied Residential Buildings', 20 January 2020.

## Appendix C – Methodology

### C.1 Principles

On 20 January 2020, MHCLG published consolidated advice<sup>10</sup> for buildings owners of multi-storey, multi-occupied residential buildings.

The advice note is currently guidance and is not in itself enforceable. However, note includes guidance on compliance with Building Regulations, the Housing Act and the Regulatory Reform (Fire Safety) Order, and the risk of not complying with the guidance could be high because:

- The guidance is likely to form the basis of any fire and rescue service or other enforcing authority considerations as to whether enforce remediation. Furthermore, it might be difficult to overturn any enforcement if it aligns with government guidance.
- If there were to be a fire in the future that resulted in spread of fire by the external wall construction, it might be very difficult to justify any decision to deviate from MHCLG advice.
- Other stakeholders (e.g. mortgage lenders, valuers and insurers) often require compliance or consideration of MHCLG guidance.

Therefore, the DFC assessment process follows the advice in the MHCLG consolidated advice note.

The author and/or checker of the assessment is a professional member of the Institution of Fire Engineers (i.e. CEng MIFireE).

### C.2 DFC Process

#### C.2.1 Identify External Wall Constructions

The external wall constructions (including products used and details of junction protection and cavity edge protection) are identified using a combination of drawings and intrusive site investigations.

For the *products* used in external wall constructions, it is not always possible or practicable to identify the product manufacture or product details. Similarly, it is not possible or practicable to ensure that all aspects (e.g. cavity barriers) of an external wall have been installed correctly over the whole external wall. Therefore, reasonable steps have been taken to identify the wall constructions in sufficient detail and with sufficient certainty to enable assessment. Where there is uncertainty, conservative assumptions are made.

#### C.2.2 Define Basis of Assessment

Unless there is evidence of an alternative approach having been taken at the time of construction, it is assumed that ADB is the basis of assessment.

#### C.2.3 Assessment against ADB

The relevant ADB at the time of construction defines an adequate benchmark for compliance with the Part B at the time of construction, the FSO and MHCLG advice (see Appendix B).

Therefore, the as-built external wall constructions have been assessed against the recommendations of the relevant ADB at the time of construction.

Where there is ambiguity on interpretation of ADB, DFC has used the MHCLG consolidated advice to assist with interpretation and ensure compliance with MHCLG expectations.

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<sup>10</sup> Ministry of Housing, Communities and Local Government, 'Advice for Building Owners of Multi-storey, Multi-occupied Residential Buildings', 20 January 2020.

## **C.2.4 Risk Assessment**

DFC has assessed the risk of each non-compliance with ADB by identifying the potential hazard resulting from that non-compliance and the likelihood of that hazard causing harm.

## **C.2.5 Determine Remediation Requirements**

### **ADB Compliance**

The relevant ADB at the time of construction defines an adequate benchmark for compliance with the Part B at the time of construction, the FSO and MHCLG advice (see Appendix B).

Therefore, compliance or equivalent with the relevant ADB at the time of construction ensures that adequate safety is achieved.

Therefore, where remediation is necessary, DFC stated the measures that would be required for compliance with the relevant ADB at the time of construction.

### **Alternative Options**

It is possible that external wall constructions achieve adequate safety without necessarily complying with ADB. Therefore, where constructions do not comply with ADB it is possible that remediation is not required, or an adequate standard can be achieved through remediation that does not result in compliance with ADB.

Where appropriate, DFC includes remediation options that do not comply with ADB, but which, in DFC's opinion, achieve adequate safety.

In some instances, additional inspections and/or fire testing are required because the option relies on fire resistance of elements of construction that are not required to resist fire for ADB compliance.

By necessity, the adequacy of these solutions is often subjective. Therefore, before selecting any of these options, DFC recommends that the fire and rescue service (as enforcers of the FSO) be consulted and / or a peer review be commissioned.

Furthermore, whilst an adequate standard would be achieved for compliance the FSO and MHCLG advice, these options do not necessarily meet the requirements of other stakeholders such as building insurers and mortgage providers.

## **C.2.6 Determine Interim Measures**

### **Principles**

Where remediation measures are required, it is because the external wall constructions do not adequately resist fire spread for the purposes of health and safety of residents. Therefore, interim measures are required to ensure adequate safety until the risk is removed or remediation is completed.

Any interim measures should be proportional to the risk of fire spread via the external walls (e.g. the measures required to mitigate the risk of fire spread between flats via defective cavity barriers can be less than those required to mitigate the risk of fire spread via widespread usage of cladding with an unmodified polyethylene core).

### **Immediate Actions**

Where remediation measures are required, DFC assesses any immediate actions required to reduce risk and engage with residents and stakeholders.

## General Measures

Where necessary, DFC assesses the general measures required to reduce or mitigate risk of fire spread via the external wall construction. The assessment includes considerations and items listed in MHCLG consolidated advice (see Appendix D.6.1).

### Appropriateness of Stay-put

Where necessary, DFC assesses whether a stay-put strategy remains appropriate, and if not, whether there are measures that can be implemented to enable a stay-put strategy. The assessment is conducted in accordance with MHCLG consolidated advice (see Appendix D.6.3) and should be discussed and agreed with the fire and rescue service.

Where a stay-put strategy is no longer appropriate, DFC assesses the measures required to affect a simultaneous evacuation safely.

MHCLG consolidated advice provides guidance on interim measures required pending remediation of cladding. The advice considers three components:

- General measures: measures that should be implemented as good practice and regardless of risk (see Appendix D.6).
- Professional assessment: measures that are required to mitigate the building specific risks.
- Stay-put evacuation strategy: assessment with the fire and rescue service as to whether a stay-put evacuation strategy remains appropriate.

## General Measures

General measures should be implemented by the residential management company.

### Specific Measures

Where remediation is required, DFC has assessed the building specific interim measures necessary to mitigate risk of fire spread via the external walls until such a time as the risk (e.g. combustible products) is removed or adequate remediation has been implemented.

## C.2.7 Assess Appropriateness of Stay-put

### MHCLG Advice

MHCLG recommends factors that should be considered when assessing whether a stay-put strategy remains appropriate. Appendix D.6.2 of this report lists those factors and DFC's interpretation of their relevance.

### Stay-put vs Alternatives

The stay-put evacuation strategy is well established in high rise residential buildings. It has been shown to be successful, has many advantages and is engrained in occupant and fire service mentality. Therefore, a decision to implement anything other than a stay-put evacuation strategy should not be taken lightly.

Similarly, a simultaneous evacuation is not risk free, particularly in blocks of flats where a simultaneous evacuation strategy might require multiple vulnerable people to evacuate at night at any time of year. Unless the risk of fire spread via the external wall construction is high (e.g. as associated with Category 3 ACM), implementation of a simultaneous evacuation could result in a higher risk to health and safety than allowing occupants to stay in their flat (and only evacuating them when necessary).

Therefore, any temporary change to the evacuation strategy should consider:

- Risk to occupants: Unnecessary, mass evacuation of residential buildings can put residents at risk (e.g. from trips and falls), particularly at night and/or in adverse weather conditions.
- Impact on fire service: Evacuation of residential buildings can impact on fire service operations (e.g. because residents are leaving when the fire service are trying to enter the building and residents would leave at different times and some not at all).
- Impact on management: There could be an increased management burden (e.g. having to temporarily relocate multiple residents and provide adequate welfare).

### **DFC Assessment**

Where necessary, DFC has reviewed the appropriateness of the stay-put evacuation strategy in accordance with MHCLG advice but also taking into consideration that where possible a simultaneous evacuation should be avoided.

The findings should be agreed with the fire and rescue service.

### **Measures to Affect a Simultaneous Evacuation Strategy**

Where it is decided that a simultaneous evacuation strategy is required, DFC provides two options for consideration:

- NFCC Compliance: the measures required to comply with NFCC guidance (see Appendix D.6.3).
- Building Specific Alternative: The NFCC guidance is generic and necessarily conservative.

### **MHCLG Guidance**

In addition to general interim measures (see Section C.2.6), MHCLG recommends assessment of whether a stay-put evacuation strategy is still appropriate for the building, including a number of factors that should be considered within the assessment.

MHCLG consolidated advice provides advice for situations where a stay-put strategy is no longer appropriate and also refers to NFCC Guidance (see below).

## Appendix D – MHCLG Advice<sup>11</sup>

### D.1 Reviewing the Safety of External Walls

#### D.1.1 Introduction

Building owners<sup>12</sup> are responsible for ensuring the safety of their buildings. Building owners should have an up to date fire risk assessment and understand the construction of external walls and the potential performance of those wall systems in the event of fire.

#### D.1.2 Understanding the Construction

External walls of residential buildings should not assist the spread of fire, irrespective of height.

It is important therefore to understand both the materials used in the external wall construction and whether the entire system has been designed, installed, and, maintained appropriately.

#### D.1.3 Understanding the Risk

All building owners of residential buildings of 18m or more and also buildings at any height with residents who need significant assistance to evacuate should follow the advice. Building owners of residential buildings below 18m should consider whether they need to follow some or all of the advice to inform their fire risk assessment.

The clearest way to demonstrate that materials in the external walls system do not present a risk of fire spread is to confirm that they are made using materials that achieve Class A2-s3, d2 or better.

Building owners should seek professional advice when combustible materials have been identified.

Assessments should consider the materials used, the building form, the geometry of the external wall and the overall design of the external wall system. This includes spandrel panels and infill wall panels, consideration to internal fire safety measures and any attachments (e.g. balconies).

It may not always be necessary to replace some combustible materials within a wall system subject to the advice of a competent adviser.

It may be appropriate, subject to expert advice and supported by test evidence, to retain cladding panels achieving class B-s3,d2 if any filler material within the products and any insulation material achieves Class A2-s3,d2 or better.

Where it has been determined that the external wall system does not meet an appropriate standard of safety, building owners should inform their local Fire and Rescue Service and put in place appropriate short-term interim measures. For the avoidance of doubt, the removal of unsafe material and action to remediate unsafe wall systems should be carried out as soon as possible.

Building owners should take reasonable steps to confirm that the system is installed and maintained appropriately, including the correct design and insulation of cavity barriers and fire stopping.

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<sup>11</sup> Ministry of Housing, Communities and Local Government, 'Advice for Building Owners of Multi-storey, Multi-occupied Residential Buildings', 20 January 2020.

<sup>12</sup> For the purposes of this MHCLG Advice the term 'building owner' means the owner of the building or the person, group, company or other entity on whom duties are imposed or enforcement action could be taken under the following legislation: (i) the Housing Act 2004 in relation to certain hazards; or (ii) the Regulatory Reform (Fire Safety) Order 2005 to ensure the safety of occupants of a building from fire (see Articles 3 & 5 of Regulatory Reform (Fire Safety) Order 2005 for those with duties).

#### **D.1.4 Test Evidence**

A successful BR135 classification following a BS 8414 test is an acceptable route to adequacy.

BS 8414 tests that have led to a BR135 certification should be available from manufacturers and can sometimes be accessed via their websites.

Where the system, or any product in the system, is to be assessed in lieu of carrying out a specific test, this should be carried out by a Chartered Engineer registered with the UK Engineering Council with suitable experience in the fire safety of high-rise residential buildings.

### **D.2 Aluminium Composite Material Panels**

ACM cladding (and other metal composite material cladding) with unmodified polyethylene filler (category 3) presents a significant fire hazard on residential buildings at any height with any form of insulation.

ACM cladding with fire retardant polyethylene filler (category 2) presents a notable hazard on residential buildings over 18m when used with rigid polymeric foam.

ACM cladding with fire retardant polyethylene filler (category 2) used with non-combustible insulation (e.g. stone wool) can be safe on residential buildings at any height, where materials have been fitted and maintained appropriately, including provision for adequate fire breaks and cavity barriers.

ACM cladding with A2 filler (category 1) can be safe on residential buildings at any height with foam insulation or stone wool insulation, if materials have been fitted and maintained appropriately, including provision for adequate fire breaks and cavity barriers.

### **D.3 High Pressure Laminate Panels**

High Pressure Laminate (HPL) panels can have a wide range of fire performance and it is important that building owners are aware of the fire performance of the panels that have been installed.

The Expert Panel has received no evidence that there is a public safety risk arising from adequately installed and maintained systems involving Class B-s1, d0 HPL panels and stone wool insulation.

Systems using Class C-s3, d2 or D-s3, d2 HPL panels on residential buildings of 18m or more to the height of the top occupied storey would not have met the functional requirements of Part B.

Building owners who have Class C-s3, d2 or D-s3, d2 HPL panels on residential buildings under 18m should also consider the risk from fire spread irrespective of building height.

### **D.4 Spandrel Panels**

Spandrel panels (including window panels, infill panels, etc) are part of the external wall of the building. Therefore, the principles set out in the advice on external walls above apply.

### **D.5 Balconies**

Balconies made with combustible materials are a potential source of rapid fire spread. The design of balconies should not assist fire spread along the external wall.

Building owners should therefore ensure that they understand the materials used in the construction of balconies.

The removal and replacement of any combustible material used in balcony construction is the clearest way to prevent external fire spread.

Where there is doubt over the materials used, or risk presented, building owners should seek professional advice. Assessment of risk should follow the principles of Appendix D.1.

## **D.6 Short-Term Interim Measures**

### **D.6.1 General Measures**

#### **Risk Assessment**

Ensure that a suitable and sufficient assessment of risk has been carried out within the last 12 months and actions have been completed and the assessment is up to date with any changes, or immediately instruct such an assessment.

The responsible person should ensure that the risk assessment is suitable and sufficient and that it acknowledges the external wall constructions as defined herein and the conclusions and recommendations of this report.

To be suitable and sufficient, DFC recommends that the risk assessment should be conducted against the fire strategy for the building and as a minimum it should:

- Be conducted by a competent person.
- Confirm adequacy of internal compartmentation (in particular between commercial units and the residential parts, between flats and common areas and around stairs and service risers).
- Confirm that any smoke control systems (including cause and effect) are working correctly.
- Confirm that fire fighting equipment (lifts and dry risers) are working correctly and adequate access is available for fire service vehicles.
- Include an assessment of risk of fire spread via the external wall construction (because the wall is used in common by all premises).

#### **Resident Engagement and Advice**

The findings of the risk assessment (including the findings of this report) should be communicated to leaseholders and residents (particularly if there is a change to the evacuation strategy). Regardless of any change to the evacuation strategy, there is considerable confusion and misinformation about the intent of a stay-put evacuation strategy. The principles of the stay-put strategy are as below and should be communicated to leaseholders and residents.

- Any people within an apartment in which there is fire or smoke should evacuate via any of the stairs. People requiring assistance should go to the closest stair and call or wait for assistance.
- Apartments and escape routes are enclosed in fire resisting construction. Therefore, people within apartments in which there is not fire or smoke are safe to remain within their flats unless otherwise directed to do so by building management or the fire service.
- Escape routes are enclosed in fire resisting construction. Therefore, anyone wishing to evacuate is also safe to do so.
- Unless otherwise directed, residents should make their own decision as to whether to evacuate their apartments.

In addition, leaseholders and residents should be advised:

- How to maintain and test the fire alarm system within each flat.
- Protected entrance halls within flats are there to protect against fire and help with escape from within flats. Residents should ensure that doors are closed whenever a room is not in use.
- Of any limitations with respect to barbeques, chimeneas, smoking and storage of combustible materials on balconies.

## General Precautions

In addition to the above, the following is advised:

- Residents should be surveyed in respect of their ability to evacuate the building without assistance.
- Remove, reduce and prevent external ignition sources that could result in risk (e.g. cars, materials on balconies, waste materials, etc.).
- Coordinate with any commercial premises as appropriate.

### D.6.2 Assessment of Appropriateness of Stay-put

MHCLG advice recommends that assessment of stay-put should consider the following:

- Fire and Rescue Service Attendance Time influences whether the fire service can assist with evacuation or inhibit fire spread before spread becomes a risk to health and safety.
- General Fire Precautions in the Building influences whether there are either enhanced measures to mitigate risk of fire spread via the external wall construction or conversely whether there are deficiencies that when considered in conjunction with the external wall construction mean that a stay-put evacuation strategy is no longer appropriate.
- Height of the Building influences the hazard posed by fire spread over external walls (because the rate of vertical fire spread and heat released increases exponentially with respect to the height of burning) and whether fire spread can be inhibited by the fire service from outside.
- Provision of Sprinklers might mitigate any risk associated with fire spread over external walls.
- Number of Flats influences the number of people at risk from fire spread, the number of people that might be required to evacuate simultaneously and the resource and complexity of fire service incident management.
- Type and Extent of Cladding System influences the likelihood, rate and extent fire spread.
- Number of Escape Stairways influences the reliance being placed on individual escape routes.
- Proximity of the Cladding System to Windows or Vents influences whether fire spread over the external walls is likely to spread back into the building.
- Risks of Ignition include fire spread from within the building, fire spread from outside the building to the external walls (e.g. from ignition of combustible materials outside the building and from balconies) and fire spread from within the wall construction (e.g. lighting and electric cables).

### D.6.3 Simultaneous Evacuation

#### MHCLG Advice

Where simultaneous evacuation is adopted, it will need to be managed, should an evacuation be necessary in the event of a fire. This is likely to require the presence of a “waking watch” on a 24/7 basis. A simultaneous evacuation policy is also likely to necessitate some form of fire alarm system to alert residents of the need to evacuate, unless there are sufficient staff in the “waking watch” to detect fire and initiate an evacuation at an early stage of a fire in the building.

MHCLG references the National Fire Chiefs’ Council guidance (NFCC Guide<sup>13</sup>) for guidance on the measures required to affect a simultaneous evacuation.

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<sup>13</sup> National Fire Chiefs Council, ‘Guidance to support a temporary change to a simultaneous evacuation strategy in purpose-built blocks of flats’, 1 May 2018.

## NFCC Guidance

The NFCC Guide provides guidance on changing to a simultaneous evacuation strategy. It does not provide guidance on when a simultaneous evacuation is required (relying instead on competent of assessment), but does state:

*“Buildings that have, for example, been identified as having an external wall system that does not adequately resist the spread of fire over the walls (e.g. ACM identified as hazardous by MHCLG because of large scale fire tests carried out on their behalf) is one example of circumstances where a simultaneous evacuation strategy may be needed.”*

The NFCC Guide recommends a change to a simultaneous evacuation strategy should only be temporary, and lists two essential principles of a temporary simultaneous evacuation strategy: early detection and warning of occupants, and management of the evacuation.

The NFCC Guide recommends a combination of automatic and human measures to achieve the above. However, the guidance is generic and therefore by necessity comprehensive. It is possible that adequate mitigation can be achieved without compliance with the NFCC guidance depending on the specifics of the situation.

## Appendix E – Relevant ADB 2000 Advice

The following paragraphs list recommendations of ADB: 2000<sup>14</sup>, ADB: 2002<sup>15</sup> and ADB: 2004<sup>16</sup> that are relevant to external wall construction. Paragraph numbers are quoted from ADB: 2004.

### E.1 Part B3

#### E.1.1 Fire Resistance

All elements of structure are required to achieve  $xxxR$ , where  $xxx$  is defined in ADB Table A2 depending on the *storey height*.

All floors and party walls between flats are required to achieve  $xxxEI$ , where  $xxx$  is defined in ADB Table A2 depending on the *storey height*.

#### E.1.2 Compartmentation

##### Paragraph 9.19

All floors should be constructed as compartment floors.

##### Paragraph 9.27

*“Where a compartment wall or compartment floor meets another compartment wall, or an external wall, the junction should maintain the fire resistance of the compartmentation.”*

Paragraph 11.14 makes recommendations as to what constitutes effective fire stopping.

#### E.1.3 Concealed Spaces (Cavities)

##### Paragraph 10.2

Table 13 states that cavity barriers are required:

- At junctions between an external cavity wall and every compartment floor and compartment wall (except where the cavity wall complies with Diagram 32).
- With the void behind the external face of rainscreen cladding at every floor level, and on the line with compartment walls abutting the external wall, of buildings which have a floor 18m or more above ground level.
- At the edges of cavities (including around openings).

##### Diagram 32

Diagram 32 recommends that:

- Cavities be faced internally and externally by brick or concrete each at least 75mm thick.
- Cavities be closed around openings.
- Cavities be enclosed at the top of the wall (unless the cavity is totally filled with insulation).

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<sup>14</sup> Department of Transport Local Government Regions, 'The Building Regulations 2000, Approved Document B – Fire safety, 2000, HMSO.

<sup>15</sup> Department of Transport Local Government Regions, 'The Building Regulations 2000, Approved Document B – Fire safety, 2000 edition amended 2000, HMSO.

<sup>16</sup> Office of the Deputy Prime Minister, 'The Building Regulations 2000, Approved Document B – Fire safety, 2000 edition consolidated with 2000 and 2002 amendments', HMSO.

- Combustible material should not be placed in or exposed to the cavity except for:
  - timber lintels, window or door frames, or the end of timber joists;
  - pipe, conduit or cable;
  - DPC, flashing, cavity closer or wall tie;
  - thermal insulating material; or
  - a domestic meter cupboard (subject to certain provisions).

### Paragraph 10.6

*“Every cavity barrier should be constructed to provide at least 30 minutes fire resistance. However, cavity barriers in a stud wall or partition may be formed of:*

- *a. steel at least 0.5mm thick;*
- *b. timber at least 38mm thick;*
- *c. polythene-sleeved mineral wool, or mineral wool slab, in either case under compression when installed in the cavity; or*
- *d. calcium silicate, cement-based or gypsum-based boards at least 12.0mm thick.*

*Note: Cavity barriers provided around openings (see Table 13, item 10) may be formed by the window or door frame.”*

The note to ADB paragraph 10.6 states that cavity barriers around openings may be formed by the window or door frame. It is ambiguous as to whether this means that the cavity barrier can be formed by the window or door frame provide it achieves a 30-minute standard, or whether it means that the frame is adequate regardless of whether it achieves a 30-minute standard.

## E.2 Part B4

### E.2.1 Flame Spread

#### Paragraph 13.5

*“The external surfaces of walls should meet the provisions in Diagram 40.”*

For a residential building greater than 18m in height with no part of any external wall within 1000mm of any boundary, Diagram 40 requires that:

- The external surface of any part of any external wall higher than 18m above adjacent ground must achieve class 0 (national standard) or class B-s3, d2 or better (European class).
- The external surface of any part of any external wall less than 18m above adjacent ground must:
  - achieve Index (I) not more than 20 (national standard) or class C-s2, d2 or better (European class) or better, or
  - be timber cladding at least 9mm thick.

## E.2.2 Combustibility

### Paragraph 13.7

*“The external envelope of a building should not provide a medium for fire spread if it is likely to be a risk to health or safety. The use of combustible materials for cladding framework, or of combustible thermal insulation as an overcladding or in ventilated cavities, may present such a risk in tall buildings, even though the provisions for external surfaces in Diagram 40 may have been satisfied.*

*In a building with a storey 18m or more above ground level, insulation material used in ventilated cavities in the external wall construction should be of limited combustibility (see Appendix A). This restriction does not apply to masonry cavity wall construction which complies with Diagram 32 in Section 10.*

*Advice on the use of thermal insulation material is given in the BRE Report Fire performance of external thermal insulation for walls of multi-storey buildings (BR 135, 1988).”*

### BR 135 Performance Criteria (Fire Testing Option)

ADB: 2000 made reference to BR 135 (1988), but it did not include fire testing as a route for compliance. ADB: 2006 and subsequent editions included fire testing as an option. Therefore, in DFC’s opinion an external wall that has been shown to meet the BR 135 performance criteria using BS 8414 test data would have achieved an adequate standard for compliance with ADB: 2000.

## E.2.3 Space Separation

### Paragraph 14.9

*“If an external wall has the appropriate fire resistance, but has combustible material more than 1mm thick as its external surface, then that wall is counted as an unprotected area amounting to half the actual area of the combustible material, see Diagram 43. (For the purposes of this provision, a material with a Class 0 rating (National class) or Class B-s3, d2 rating (European class) need not be counted as unprotected area).”*

## E.3 DFC Interpretations of Recommendations

### E.3.1 Junction and Cavity Edge Protection

The junctions between external walls and compartment floors and compartment walls should be adequately protected such that the external wall construction does not provide a medium for spread of fire around the compartmentation.

ADB diagram 31 provides one option for achieving this requirement, as summarised below:

- **Compartmentation:** Compartment floors and walls must be continuous up to the inside face of the external wall construction.
- **Internal Components:** Whilst not specified in ADB, it must be inferred that the *internal components* of the external wall must achieve an adequate fire performance (otherwise fire spread could occur via the internal components bypassing the fire stopping and cavity barrier).
- **Opening Protection:** Any openings in the internal components of the external wall must be adequately protected.
- **Cavity Barriers:** Cavity barriers must be provided between the internal components of the external wall and the outermost components.

An alternative to the ADB provisions that would meet the intent of ADB would be to continue the fire resistance of the compartmentation through the external wall construction to the outside of the building (i.e. forming a continuous line of fire resistance to the outside of the building).

Therefore, DFC considers that either of the following must be applied:

- Firestopping is provided in line with compartment floors or walls from the outside face of the floor or wall to the outside of the external wall. In this instance it is possible that protection around openings can be omitted.
- A layer (e.g. an inner blockwork layer) of the external wall construction achieves a fire resistance standard of 60 minutes (integrity and insulation). Fire stopping is provided at the junction between compartment floors and walls and the inside face of the fire resisting layer of the external wall. Cavity barriers are provided around any openings through the fire resisting layer of the external wall from the outside face of the layer to the outside of the building.

### E.3.2 Open-state Fire Barriers

Where cavity barriers are required, ADB recommends that they achieve a fire resistance standard in accordance with BS 476-22. Open-state cavity do not comply with the requirements of BS 476-22 because at the start of the test there is an integrity 'failure' until the barrier activates and closes the gap to the back of the cladding. When the barriers close, they achieve a fire resistance standard in accordance with ADB recommendations. Whilst the barriers don't necessarily comply with ADB, this does not mean that they do not achieve an adequate standard.

### E.3.3 Requirements for Rainscreens

ADB table 13 note 3 requires cavity barriers 'at the junction between an external wall and every compartment floor and compartment wall' (this provision does not apply where the cavity wall complies with Diagram 32) but note 3 is not relevant for rainscreen cladding

ADB Table 13 note 9, requires a cavity barrier 'within the void behind the external face of rainscreen cladding at every floor level, and on the line of compartment walls abutting the external wall, of buildings which have a floor 18m or more above floor level'.

There appears to be an implicit assumption in ADB:1992 and ADB:2000 (as amended) that the construction behind the rainscreen is an external wall and the rainscreen is used as an over cladding system to improve both thermal insulation and water ingress. This is supported by building regulations guidance documents published at the time<sup>[17,18]</sup>, which define rainscreen cladding as a system for application to existing buildings. Consequently, there is an implicit expectation that the external wall (or the *internal components*) of a rainscreen cladding system achieve an inherent fire resistance standard. For residential buildings, it is reasonable to assume that this is at least 60E.

The third clause of paragraph 13.7 references BR135:1988 for advice on the use of thermal insulation materials, which includes the following recommendation:

- Recommendation 1: Mineral insulations may be safely used either:
  - Attached to the wall and protected by adequately supported metal-reinforced cementitious renders; or
  - In cladding systems incorporating metal or non-combustible sheeting supported by steel or timber framework and ventilated by a continuous cavity; fire barriers are not essential.

<sup>17</sup> Bickerdike Allen Partners, 'The Design Principles of Fire Safety' (pg 178), 1996, Department of the Environment, HMSO.

<sup>18</sup> Powell-Smith.V and Billington. M.J, 'The Building Regulations Explained and Illustrated (Ninth Edition)' (pg 7.116), 1992, Blackwell Scientific Publications.

- Recommendation 4: Systems incorporating combustible insulants with sheeted over-cladding:
  - Fire barriers in the ventilated cavity every two storeys.
- Recommendation 5 - Combustible insulations incorporated in non-sheeted systems:
  - Thin renders with glass fabric reinforcement over thermoplastic insulants should be fitted with fire barriers (which also support the protective finish) at every storey from the second floor upwards. With satisfactory full-scale test evidence barriers may be omitted up to the 15m level.

Therefore, for buildings that do not have a storey more than 18m above ground level, ADB compliance requires the following for rainscreen cladding;

- The *internal components* must be at least 60E.
- There must be adequate protection around openings and penetrations.
- Either:
  - The insulation must be Class A2 or Class A1 or of limited combustibility or better (in which case cavity barriers are not required in the cavity behind the rainscreen), or
  - For sheeted over cladding, cavity barriers in the cavity behind the cladding every two storeys, or
  - For renders with glass fabric reinforcement over thermoplastic insulants should be fitted with fire barriers (which also support the protective finish) at every storey from the second floor upwards.

### **E.3.4 Combustibility of *Primary Products***

There are two possible interpretations of Paragraph 13.7:

- Interpretation 1: All three clauses of paragraph 13.7 are relevant. This interpretation means that it is not only ventilated cavities in buildings with a storey more than 18m or more above ground where measures might be required to comply with paragraph 13.7.
- Interpretation 2: The second clause of 13.7 is the active recommendation that achieves the intent of the first clause. Under this interpretation any construction complies with ADB paragraph 13.7 provided any insulation in any ventilated cavity in a building with storey more than 18m or more above ground is of limited combustibility.

In DFC's opinion Interpretation 1 is most appropriate because:

- The intent of ADB is to ensure an adequate standard of health and safety. Therefore, the first clause of paragraph 13.7 is relevant.
- The scope ADB is for more common building situations.
- Of the common external wall constructions at the time of writing, ventilated cavity construction and construction with thermal insulation were the constructions that were considered to be a hazard, which is why specific recommendations were made for those forms of construction.

## Appendix F – Private Balconies

### F.1 Introduction

There is ambiguity as to whether the construction of private balconies (as opposed to common balconies used for means of escape) is required to comply with Part B of Schedule 1 to the Building Regulations (Part B), and if it is, there is ambiguity as to what is required for compliance with Part B.

This appendix documents the relevant regulatory requirements, potentially relevant Approved Document B (ADB) guidance, and DFC's interpretation thereof for balcony construction in residential buildings.

It concludes that balcony construction is required to comply with Parts B3 and B4 of Schedule 1 and provides DFC opinion on options for achieving compliance for balconies on blocks of flats.

### F.2 Building Regulations

#### F.2.1 Scope

Since the 1985 edition of the Building Regulations:

- The definition of 'building' has been, "any permanent or temporary building but not any other kind of structure or erection, and a reference to a building includes a reference to part of a building."
- The definition of 'building work' in Regulation 3 has included, "the erection or extension of a building."
- Regulation 4 has required that building work shall be carried out such that it complies with the applicable requirements contained in Schedule 1.
- Regulation 8 has required that Part B of Schedule 1 "shall not require anything to be done except for the purpose of securing reasonable standards of health and safety for persons in or about buildings (and any others who may be affected by buildings, or matters connected with buildings)."

#### F.2.2 Requirements

Since the 1985 edition of the Building Regulations, the relevant parts of Schedule 1 have included requirements similar to those below (taken from the 2010 edition):

- Part B3(1) – The building shall be designed and constructed so that, in the event of fire, its stability will be maintained for a reasonable period.
- Part B3(3) – Where reasonably necessary to inhibit the spread of fire within the building, measures shall be taken, to an extent appropriate to the size and intended use of the building, comprising either or both of the following:
  - (a) sub-division of the building with fire resisting construction.
- Part B4(1) – The external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.
- Part B5(2) – Reasonable provision shall be made within the site of the building to enable fire appliances to gain access to the building.

## **F.3 Approved Document B**

### **F.3.1 Recommendations**

#### **F.3.1.1 Loadbearing Elements of Structures**

Since at least the 1992 edition:

- ADB has recommended that elements of structure such as structural frames, beams, columns, loadbearing walls, floor structures and gallery structures should have at least the fire resistance given in ADB Table A1. For residential buildings this is at least *60R* for structural beams and *60REI* for floors but can be reduced to *30REI* to any floor within a flat with more than one storey.
- An element of structure has been defined as:
  - a. a member forming part of the structural frame of a building or any other beam or column;
  - b. a loadbearing wall or loadbearing part of a wall;
  - c. a floor;
  - d. a gallery (but not a loading gallery, fly gallery, stage grid, lighting bridge, or any gallery provided for similar purposes or for maintenance and repair);
  - e. an external wall; and
  - f. a compartment wall (including a wall common to two or more buildings).
- ADB does provide some exclusions from the definition of elements of structure for the purposes of fire resistance, but balconies are not amongst these exclusions.

#### **F.3.1.2 Building Sub-division**

Since at least the 1992, ADB edition has recommended that floors and walls between flats should achieve at least *60EI*.

#### **F.3.1.3 Resistance to Fire Spread over Walls**

ADB does not make any specific recommendations in respect of balconies, but since at least the 1992 edition it has recommended that, “the external envelope of a building should not provide a medium for fire spread if it is likely to be a risk to health or safety.”

ADB does not define ‘external envelope’.

## **F.4 DFC Assessment**

### **F.4.1 Interpretations**

#### **F.4.1.1 Building Regulations Scope**

Balconies are part of a building and therefore are included in the definition of building and building works. As such they are required to comply with the Building Regulations, including Regulation 4. As such balconies are required to comply with Part B of Schedule 1 to the Building Regulations.

Where any provision of Part B refers to the “building” it also (due to the Building Regulations definition of “building”) refers to “parts” of the building [this is evidenced by Approved Document K which includes recommendations for guarding / edge protection of balconies].

Therefore, balconies are parts of the building and therefore must comply with any Part B requirement for buildings.

#### F.4.1.2 Balcony Definition

ADB does not make specific recommendations for the design of private balconies, but it does make recommendations for structures, floors, compartmentation and the external envelope. Therefore, how ADB recommendations apply to balconies depends on whether balconies are structures, floors and / or part of the external envelope.

#### F.4.1.3 Loadbearing Elements of Structures

Because they are parts of buildings, Part B3(1) requires that balconies should, in the event of fire maintain their stability for a reasonable period.

In the context of Part B3(1) and associated ADB recommendations, balconies are structures and floors because:

- They are not explicitly excluded from any definition of structure or floors,
- They are occupied by people within the building and failure of balcony structures would be a risk to health or safety,
- Their use is not limited to maintenance and repair (or similar),
- If a balcony qualifies as a gallery (defined by ADB as a floor or balcony that does not extend across the full extent of a building's footprint and is open to the floor below) it is still required to have fire resistance for compliance with ADB.

ADB recommends that elements of structure (including beams and floors) in flats should achieve at least *60R* (for beams) and *60REI* (for floors).

It might be possible that the above could be reduced to *30R* for beams and *30EI* for floors if the balcony construction does not contribute to the support of the building (which would normally be the case).

Therefore, in DFC's opinion any structure and flooring of balconies should achieve at least *30R* for beams and *30EI* for compliance with ADB.

#### F.4.1.4 Building Sub-division

Part B3(3) requires adequate fire resisting sub-division to inhibit fire spread within buildings appropriate to the intended use of the building.

The most common evacuation strategy in blocks of flats is a 'stay-put' strategy. This strategy relies upon fire not spreading between flats. Therefore, compliance with Part B3(3) requires that fire spread between flats (i.e. within the building) be adequately inhibited. Premature fire spread between flats would be a breach of Part B3(3) regardless of the medium for fire spread (i.e. fire spread via internal construction is the same outcome as fire spread via balcony construction).

The above interpretation is supported by the fact that ADB makes recommendation in relation to the design of external walls in the sections of the document relating to internal compartmentation.

ADB defines the benchmark for adequacy of the fire resistance construction, recommends that flats should be separated from each other by construction that achieves *60EI*.

Therefore, for compliance with Part B3(3):

- If balconies are parts of flats (which would depend on their configuration and usage), then the balconies themselves should be separated from other flats (and their balconies) by construction that achieves *60EI*, or

- If it is assumed that balconies are not part of flats, balcony construction should resist fire spread between flats to a standard equivalent to that of internal construction that achieves 60EI.

#### F.4.1.5 Fire Spread over Walls

Part B4(1) requires that external walls of the building shall adequately resist the spread of fire over the walls and from one building to another.

Whilst it could be considered that balconies are not within the scope of Part B4(1), in DFC's opinion they are because:

- The intent of Part B4(1) is to resist spread of fire over the walls of the building (regardless of the mechanism for spread of fire), and as such, any part of the building that could result in spread of fire over the walls must be within the scope of Part B4(1), and
- Balconies are parts of buildings that could be a mechanism for spread of fire over the walls of the building, and therefore, must be within the scope of Part B4(1).
- Alternatively put, any fire spread that occurred over the walls of a building as a result of part of the building that was not adequately resisted would be failure to comply with Part B4(1) regardless of whether the part of the building was part of the external walls of the building.

The BRE<sup>19</sup> also identifies that whether there are fire safety requirements imposed on balconies by Part B4(1) requires interpretation. The document concludes that there are no specific statutory requirements in respect of external fire spread for the incorporation of balconies to a structure. However, the basis for this conclusion appears to be that:

- ADB does not make specific guidance for balconies, and
- Balconies could be classified as fixtures and the only ADB recommendations for fixtures are in relation to means of escape.

DFC does not agree with this reasoning because:

- Absence of guidance cannot be taken as proof of no requirements,
- Balconies that are large enough to be occupied by people cannot be dismissed as being fixtures,
- The governing requirement of Part B4(1) is to resist fire spread over the walls; therefore, if balconies could be a medium for fire spread over the walls they are within the scope of Part B4(1) regardless of whether they are part of the external wall or fixtures, and
- It assumes that Part B4(1) is the only part of Part B that is relevant to balconies.

ADB does not provide specific recommendations for balconies. However, it recommends that the external envelope should not be a medium for fire spread if it is likely to be a risk to health and safety.

Balconies are part of the external envelope because they are connected to and influence the fire performance of the external walls of the building.

Therefore, balconies should not be a medium for fire spread that is likely to be a risk to health and safety. In residential buildings with a stay-put evacuation policy, fire spread over the walls of the building via balconies is likely to be a risk to health and safety; therefore, balconies should not be a medium for fire spread.

Therefore, for compliance with ADB:

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<sup>19</sup> Holland C, Shipp M and Crowder D, 'Fire safety issues with balconies', July 2016, BRE Global.

- Balconies should not be a medium for fire spread that is likely to be a risk to health and safety, and,
- In buildings with a storey height of more than 18m, either:
  - The balcony construction should be of limited combustibility or better, or
  - The external wall construction (including balconies) should be shown to meet the BR 135 performance criteria using data from BS 8414 tests.

#### **F.4.1.6 Fire Appliance Access**

Part B5(2) require reasonable provision to enable fire appliances to gain access to the building.

ADB recommends that, where a fire strategy for a building relies on fire service vehicles being able to access the perimeter of the building, overhead obstructions (which would include balconies) should not project within the fire service access route.

Therefore, balconies are within the scope of Part B5(2) and the construction.

#### **F.4.1.7 Conclusions**

In DFC's opinion, compliance with ADB for balconies requires the following:

- Balcony beams must achieve at least *30R*,
- Balcony floors / decks must achieve at least *30REI*,
- Balconies should not be a medium for fire spread that is likely to be a risk to health and safety, and,
- In buildings with a storey height of more than 18m, either:
  - The balcony construction should be of limited combustibility or better, or
  - The external wall construction (including balconies) should be shown to meet the BR 135 performance criteria using data from BS 8414 tests.

#### **F.4.2 Methodology**

Compliance with ADB is not mandatory and there can be alternative means of complying with Part B of the Building Regulations. Therefore, where balcony construction does not comply with DFC's interpretation of ADB recommendations (see Section F.4.1.6), DFC assesses adequacy by reference to the BR 135 performance criteria as summarised below:

- The BS 8414 test arrangement includes Level 1 and Level 2 thermocouples located at 2.5m and 5.0m above the top of the opening of the combustion chamber.
- 2.5m would be representative of a minimum floor-to-floor height that would occur in a residential building (i.e. the Level 1 would be the flat above the flat of fire origin and Level 2 would be the flat above that).
- The BS 8414 test rig must be at least 6m above the top of the opening of the combustion chamber.
- The fire is extinguished after 30 minutes.
- The BR 135 performance criteria are such that temperatures at Level 2 must not exceed 600°C within 15 minutes of the test start time, and BS 8414 requires flames should not protrude over the top of the test rig within 60 minutes of the start time.
- The above means that:
  - Fire spread to the storey above the flat of fire origin within 15 minutes is acceptable,

- Fire spread beyond two storeys above the flat of fire origin with 15 minutes is not accepted,
- Self-sustaining vertical combustion is not accepted.

Therefore, DFC considers that for balcony constructions to adequately resist fire spread over the walls of the building.

*Table 11: Requirements for balconies in buildings with a storey height more than 18m*

|                              | ADB Compliance                                                                             | Alternative 1                                                                                        | Alternative 2                                                                                                                   |
|------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Fire Resistance</b>       | Beams must achieve at least <i>30R</i> . Floors / decks must achieve at least <i>30REI</i> | Beams must achieve at least <i>30R</i> . Floors / decks must achieve at least <i>30REI</i>           | Construction does not require fire resistance provided any occupants would be aware of fire in early stages and can escape away |
| <b>Building Sub-division</b> | Floors / decks must achieve at least <i>30EI</i>                                           | Floors / decks must achieve at least <i>30EI</i>                                                     |                                                                                                                                 |
| <b>Fire Spread</b>           | Construction materials must be of limited combustibility                                   | Construction materials can be combustible if they are adequate protected by the fire resisting floor | Desktop assessment to ensure balconies are not a medium for fire spread                                                         |
| <b>Fire Service Access</b>   | Balconies should not project into fire service access routes.                              |                                                                                                      |                                                                                                                                 |

*Table 12: Requirements for balconies in buildings with a storey height less than 18m*

|                              | ADB Compliance                                                                             | Alternative 1                                                                                        | Alternative 2                                                                                                                                |
|------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Fire Resistance</b>       | Beams must achieve at least <i>30R</i> . Floors / decks must achieve at least <i>30REI</i> | Beams must achieve at least <i>30R</i> . Floors / decks must achieve at least <i>30REI</i>           | Construction does not require fire resistance provided any occupants would be aware of fire in early stages and can escape away              |
| <b>Building Sub-division</b> | Floors / decks must achieve at least <i>30EI</i>                                           | Floors / decks must achieve at least <i>30EI</i>                                                     |                                                                                                                                              |
| <b>Fire Spread</b>           | Construction materials must be of limited combustibility                                   | Construction materials can be combustible if they are adequate protected by the fire resisting floor | Desktop assessment to ensure balconies are not a medium for fire spread between balconies within 15 minutes and adequate fire service access |
| <b>Fire Service Access</b>   | Balconies should not project into fire service access routes.                              |                                                                                                      |                                                                                                                                              |

## Appendix G – Common Balconies (Deck Approach)

### G.1 Introduction

Unlike private balconies, see Appendix F, there is no ambiguity as to whether common balconies (aka external walkways or deck approach) are required to comply with Part B of Schedule 1 to the Building Regulations (Part B); as common circulation space Part B must be met. However, there is ambiguity as to what is required for compliance with Part B.

This appendix documents the potentially relevant Approved Document B (ADB) guidance, and DFC's interpretation thereof for common balcony construction in residential buildings.

It concludes that balcony construction is required to comply with Parts B1, B3 & B4 of Schedule 1 and provides DFC opinion on options for achieving compliance for common balconies on blocks of flats.

### G.2 Approved Document B

#### G.2.1 Recommendations

##### G.2.1.1 Protection to Escape Routes

Since at least the 1992 edition:

- ADB has recommend fire resistance to external walls adjacent to external escape routes; and,
- Defines its guidance relates to “common building situations” and makes reference to alternative approaches and guidance for use in less common situations, including reference to BS 5588-1 for residential premises. BS 5588-1 and subsequent replacement publication BS 9991 provide explicit recommendations for common balconies/deck approach.

##### G.2.1.2 Loadbearing Elements of Structures

Since at least the 1992 edition:

- ADB has recommended that elements of structure such as structural frames, beams, columns, loadbearing walls, floor structures and gallery structures should have at least the fire resistance given in ADB Table A1. For residential buildings this is at least *60R* for structural beams and *60REI* for floors but can be reduced to *30REI* to any floor within a flat with more than one storey.
- An element of structure has been defined as:
  - a member forming part of the structural frame of a building or any other beam or column;
  - a loadbearing wall or loadbearing part of a wall;
  - a floor;
  - a gallery (but not a loading gallery, fly gallery, stage grid, lighting bridge, or any gallery provided for similar purposes or for maintenance and repair);
  - an external wall; and
  - a compartment wall (including a wall common to two or more buildings).
- ADB does provide some exclusions from the definition of elements of structure for the purposes of fire resistance, but balconies are not amongst these exclusions.

### **G.2.1.3 Resistance to Fire Spread over Walls**

ADB does not make any specific recommendations in respect of common balconies, but since at least the 1992 edition it has recommended that, "the external envelope of a building should not provide a medium for fire spread if it is likely to be a risk to health or safety."

ADB does not define 'external envelope'.

## **G.3 DFC Assessment**

### **G.3.1 Interpretations**

#### **G.3.1.1 Protection to Escape Routes**

Part B1 requires appropriate means of escape in case of fire from the building to a place of safety outside the building capable of being safely and effectively used at all material times.

ADB guidance includes the definition of escape routes as floors, see Section G.3.1.2, and requires single direction corridors serving bedrooms to be enclosed in fire resistance. Although, common balconies differ from corridors the principle is retained throughout ADB with external escape routes requiring any part of an adjacent external wall within 1800mm should be constructed of fire resisting construction (*30RE* minimum) up to a minimum height of 1100mm.

Although common balconies are not identified in sections that outline the need to protect escape routes from smoke, DFC consider this to be based on deck approach access being a less common building situations and guidance should be sought in relevant guidance, e.g. BS 9991.

#### **G.3.1.2 Loadbearing Elements of Structures**

Because they are parts of buildings, Part B3(1) requires that balconies should, in the event of fire maintain their stability for a reasonable period.

In the context of Part B3(1) and associated ADB recommendations, balconies are structures and floors because:

- They are not explicitly excluded from any definition of structure or floors;
- They are occupied by people within the building and failure of balcony structures would be a risk to health or safety;
- Their use is not limited to maintenance and repair (or similar);

ADB recommends that elements of structure (including beams and floors) in flats should achieve at least *60R* (for beams) and *60REI* (for floors).

It might be possible that the above could be reduced to *30R* for beams and *30EI* for floors if the balcony construction does not contribute to the support of the building (which would normally be the case).

#### **G.3.1.3 Fire Spread over Walls**

Part B4(1) requires that external walls of the building shall adequately resist the spread of fire over the walls and from one building to another.

Whilst it could be considered that balconies are not within the scope of Part B4(1), in DFC's opinion they are because:

- The intent of Part B4(1) is to resist spread of fire over the walls of the building (regardless of the mechanism for spread of fire), and as such, any part of the building that could result in spread of fire over the walls must be within the scope of Part B4(1); and

- Balconies are parts of buildings that could be a mechanism for spread of fire over the walls of the building, and therefore, must be within the scope of Part B4(1).
- Alternatively put, any fire spread that occurred over the walls of a building as a result of part of the building that was not adequately resisted would be failure to comply with Part B4(1) regardless of whether the part of the building was part of the external walls of the building.

ADB does not provide specific recommendations for balconies. However, it recommends that the external envelope should not be a medium for fire spread if it is likely to be a risk to health and safety.

Balconies are part of the external envelope because they are connected to and influence the fire performance of the external walls of the building.

Therefore, balconies should not be a medium for fire spread that is likely to be a risk to health and safety. In residential buildings with a stay-put evacuation policy, fire spread over the walls of the building via balconies is likely to be a risk to health and safety; therefore, common balconies should not be a medium for fire spread.

#### **G.3.1.4 Firefighter Facilities**

Part B5(1) requires the building to be designed and constructed so as to provide reasonable facilities to assist firefighters in the protection of life.

For a building of this use and height, ADB recommends that the internal access routes are used as firefighter access. Therefore, deck approach routes and their construction are within the scope of Part B5(1).

#### **G.3.1.5 Conclusions**

In DFC's opinion, compliance with ADB for common balconies requires the following:

- The structure, including the floor, must achieve at least *30REI*;
- The walking surface must be imperforate;
- Adjacent external walls within 1800mm must achieve at least *30RE* up to a height of at least 1100mm;
- Doors onto common balconies should achieve at least *FD30S*;
- Window openings should not extend below a height of 1.1m above the deck;
- Surface materials of the facing wall, balcony soffit and balustrade should be *Class 0*; and
- Balconies should not be a medium for fire spread that is likely to be a risk to health and safety.

In addition, to meet a reasonable standard of protection from smoke, it is considered that common balconies require the following:

- The external balustrade should be imperforate.
- The sectional profile should be such that any fire plume breaking out of a flat is directed outward and upwards, and should be arranged such that smoke does not leak laterally along the soffit. Balconies should be as open as possible to allow for the dispersal of smoke originating in a flat. At least 50% of the vertical section should be open and the areas of opening should be uniformly spread around the surface. The opening for ventilation should be at least between the top of the balustrade at 1.1m and the soffit of the balcony above.
- The soffit above a balcony or deck having a width of more than 2m should be designed with down-stands placed at 90° to the face of the building (on the line of separation between individual flats).

Down-stands should project 0.3m to 0.6m below any other beam or down-stand parallel to the face of the building, or should be determined by calculation.

- Where the balcony is adjoined to the building wall only at the place where there is an entrance to a flat, unless it is a minimum of 1.8m away from the face of the building, it should, in the case of single direction escape routes, be proved by calculation that the escape route is not subjected to hazardous exposure levels or smoke logging.

**Quality Assurance**

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| Revision | Date         | Issue Description             | Author                                                                             | Checked                                                                             |
|----------|--------------|-------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 00       | 30 Sept 2020 | Issued for review and comment | S Murphy                                                                           | N Butterworth                                                                       |
|          |              |                               |  |  |