City Island, Leeds

Fire Performance (All Buildings)

PAS 9980 Fire Risk Appraisal of External Walls (FRAEW)

Revision 02

3 April 2025

Summary

Brief and Scope

City Island is an existing residential development in Leeds (the "Development").

City Island Management Ltd has appointed Thomasons who have in turn appointed Design Fire Consultants Ltd ("DFC") to identify the construction details and, for those which require one, conduct a fire risk appraisal of the external walls ("FRAEW") in accordance with PAS 9980.

To enhance readability, eliminate unnecessary duplication, and streamline the process for future revisions, DFC has assessed the fire performance in a single report that is relevant to all buildings and produced Building Reports for each building that reference the Fire Performance Report.

This report is the Fire Performance Report. Its content is limited to the assessment of the fire performance of the external wall constructions (i.e. the fire performance factor as defined by PAS 9980). All building specific and other information are documented in the Building Reports.

As-Built External Wall Systems

Following review of construction documentation and the findings of intrusive surveys, the external wall constructions summarised below have been identified and assessed.

Wall Construction	Description	Features for FRAEW[Note 1]
EWS01 Brick	Type: Cavity Wall. A masonry cavity wall with brick (or stone) outer leaf, a cavity with *PIR* insulation and blockwork inner leaf.	The construction comprises an inner and outer leaves that are brick or concrete at least 75mm and cavity edges are adequately sealed.
EWS02 Render	Type: Cavity Wall. A rendered masonry cavity wall with blockwork outer leaf, a cavity with *PIR* insulation and blockwork inner leaf	The construction comprises an inner and outer leaves that are brick or concrete at least 75mm and cavity edges are adequately sealed and the render finish is not *combustible*.
EWS03 Metal Spandrel	Type: Spandrel. An aluminium spandrel with foam insulation, a membrane and PIR insulation on a blockwork substrate.	The construction is limited to the spandrel zone above some balcony door-sets.
EWS04 Glazed Spandrel	Type: Glazing. Glazing within aluminium framing and possibility of *combustible* insulation.	The construction is limited to the spandrel zone at floor levels.
EWS05 Roofing System	Type: Aluminium roofing facias.	The construction is limited to roof locations.

Notes:
1 These are the key features of the external wall construction that have been used in the FRAEW and on which the risk outcome relies.

Assessment and Outcomes

The assessment and outcomes are summarised below. The assessment and outcomes are referenced in the relevant Building Reports.

Construction Type	Likely Fire Spread Rate (compared to normal range)	Resultant PAS Outcome	Reason
EWS01 Brick	*Normal*	Low	Hazard is low.
EWS02 Render	*Normal*	Low	Hazard is low.
EWS03 Metal Spandrel	*Slightly faster*	Medium (Tolerable)	Fire performance and facade factors are positive.
EWS04 Glazed Spandrel	*Slightly faster*	Medium (Tolerable)	Fire performance and facade factors are positive.
EWS05 Roofing System	*Normal*	Low	Hazard is low.

Contents

1 Introduction

1.1 Background and Brief

City Island is an existing residential development in Leeds (the "Development").

Design Fire Consultants Ltd ("DFC") has been appointed by Thomasons, who were appointed by City Island Management Ltd to assess the external wall constructions of the Development in accordance with PAS 9980[1]. The purpose of the assessment is to:

- Identify the external wall constructions used on the Development in sufficient detail to enable an appropriately accurate and/or conservative assessment in accordance with PAS 9980.
- Determine (and document the associated reasoning) which (if any) external wall constructions can be considered as being low risk in accordance with PAS 9980 without the need for a fire risk appraisal of external wall constructions ("FRAEW").
- Conduct an FRAEW for all external wall constructions for which an FRAEW is required in accordance with PAS 9980.
- For each external wall construction, document the risk of fire spread via the construction as defined by PAS 9980.
- For any wall constructions where risk reduction is likely to be required, identify viable risk reduction measures (interim, repair, remediation and/or mitigation) for evaluation and selection by others.
- Provide information that can be used within a suitable and sufficient assessment of risk ("FRA") as required for compliance with the Regulatory Reform (Fire Safety) Order[2] ("FSO").

The list of buildings under the scope of this report are as per table below:

Table 1: List of buildings covered in this report

Building	Block Name	Address
A	Elba	Flats 1-28, City Island, Gotts Road, Leeds, LS12 1DD
A	Beringa	Flats 1-59, City Island, Gotts Road, Leeds, LS12 1DE
A	Santorini	Flats 1-93, City Island, Gotts Road, Leeds, LS12 1DP
B	Faroe	Flats 1-93, City Island, Gotts Road, Leeds, LS12 1DF
B	Catalina	Flats 1-59, City Island, Gotts Road, Leeds, LS12 1DH
B	Westray	Flats 1-34, City Island, Gotts Road, Leeds, LS12 1DJ
C	Bonaire	Flats 1-38, City Island, Gotts Road, Leeds, LS12 1DL

[1] British Standards Institution, PAS 9980, 'Fire risk appraisal of external wall construction and cladding of existing blocks of flats – Code of practice', January 2022
[2] Statutory Instruments, '2005 No. 1541 Regulatory Reform, England and Wales, The Regulatory Reform (Fire Safety) Order 2005', 2005

As the Development includes buildings which are developed, designed, constructed and operated by the same agencies, they have many shared architectural characteristics including the construction of external walls. Therefore, to enhance readability, eliminate unnecessary duplication, and streamline the process for future revisions, the following approach has been adopted:

- Fire Performance Report: The fire performance of the external walls has been assessed generically for all buildings.
- Building Reports: A building specific report has been produced for each building. Those reports all reference the Fire Performance Report as necessary for the fire performance of the external walls.

This report is the Fire Performance Report. Its content is limited to the assessment of the fire performance of the external wall constructions (i.e. the fire performance factor as defined by PAS 9980). All building specific and other information are documented in the Building Reports.

1.2 Professional Competence

See Building Reports.

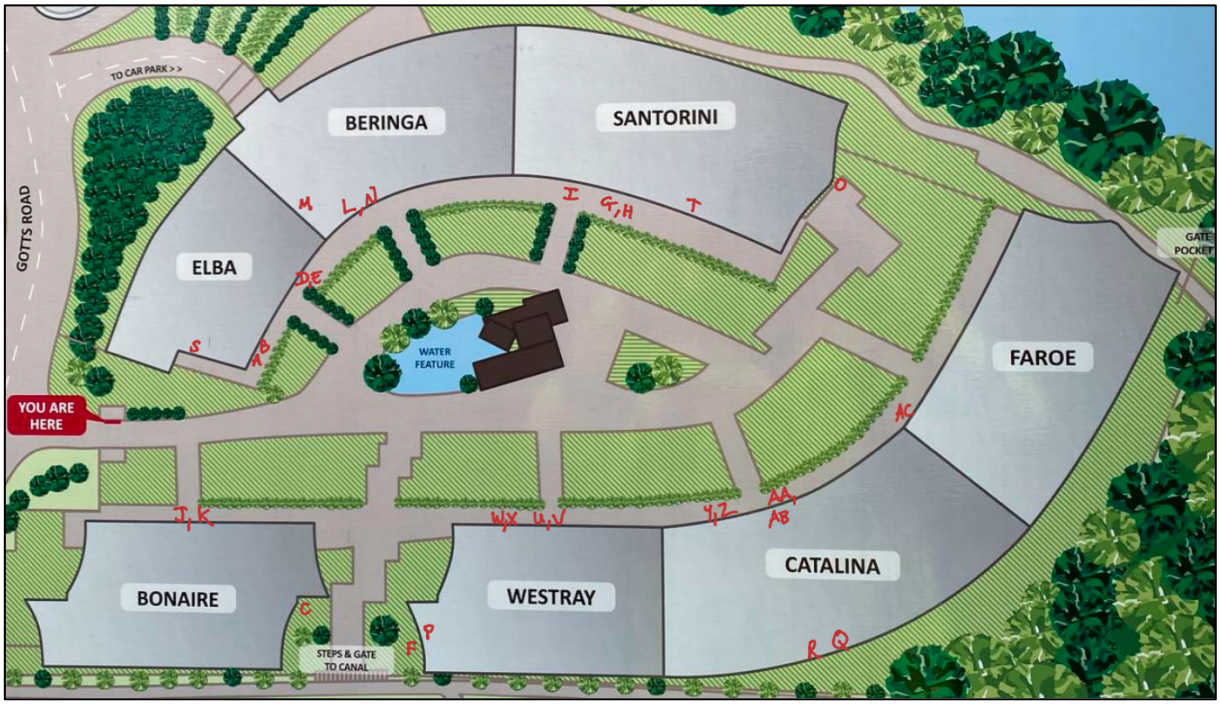
1.3 Scope and Exclusions

See Building Reports.

1.4 Available Information

The DFC assessment is based on construction drawings (the relevant ones have been reproduced in this report) and intrusive investigations (see Figure 1 for locations) conducted by Thomasons as documented in their report[3] (the "Thomasons Report").

Figure 1: Intrusive survey locations



[3] Thomasons, 'Record of the external walls following sample intrusive investigations at City Island Leeds LS12 1DD', Contract No: SB/BM1003, 21 March 2025.

Inevitably construction information is not always accurate and the number of sample locations and extent of 'opening-up' for intrusive inspections are necessarily limited in number and scope. Therefore, DFC's review is based on information available, and our opinion is subjective and includes uncertainty and our conclusions might change if new information becomes available (PAS 9980 clause 15.6).

Notwithstanding, to ensure conservative / robust conclusions, DFC had gathered information in accordance with principles discussed in Appendix B.3 and made both optimistic and conservative assumptions where there is uncertainty on the as-built construction or the fire performance of the external wall construction as discussed in Appendix B.

1.5 PAS 9980 Compliance

See Building Reports.

1.6 PAS 9980 Risk Outcomes

See Building Reports.

1.7 Definitions and Terminology

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

2 As-Built External Wall Constructions

2.1 Differentiation of Wall Constructions

Figure 2 (overleaf) shows a schedule of materials for typical elevation from the as-built drawing information. This is used solely to identify different wall treatments; whereas, the Thomasons Report has been relied upon for the actual as-built construction.

The building's external wall constructions can be divided in accordance with PAS 9980 Annex G.2.1 as summarised in Table 2.

Table 2: Summary of external wall constructions

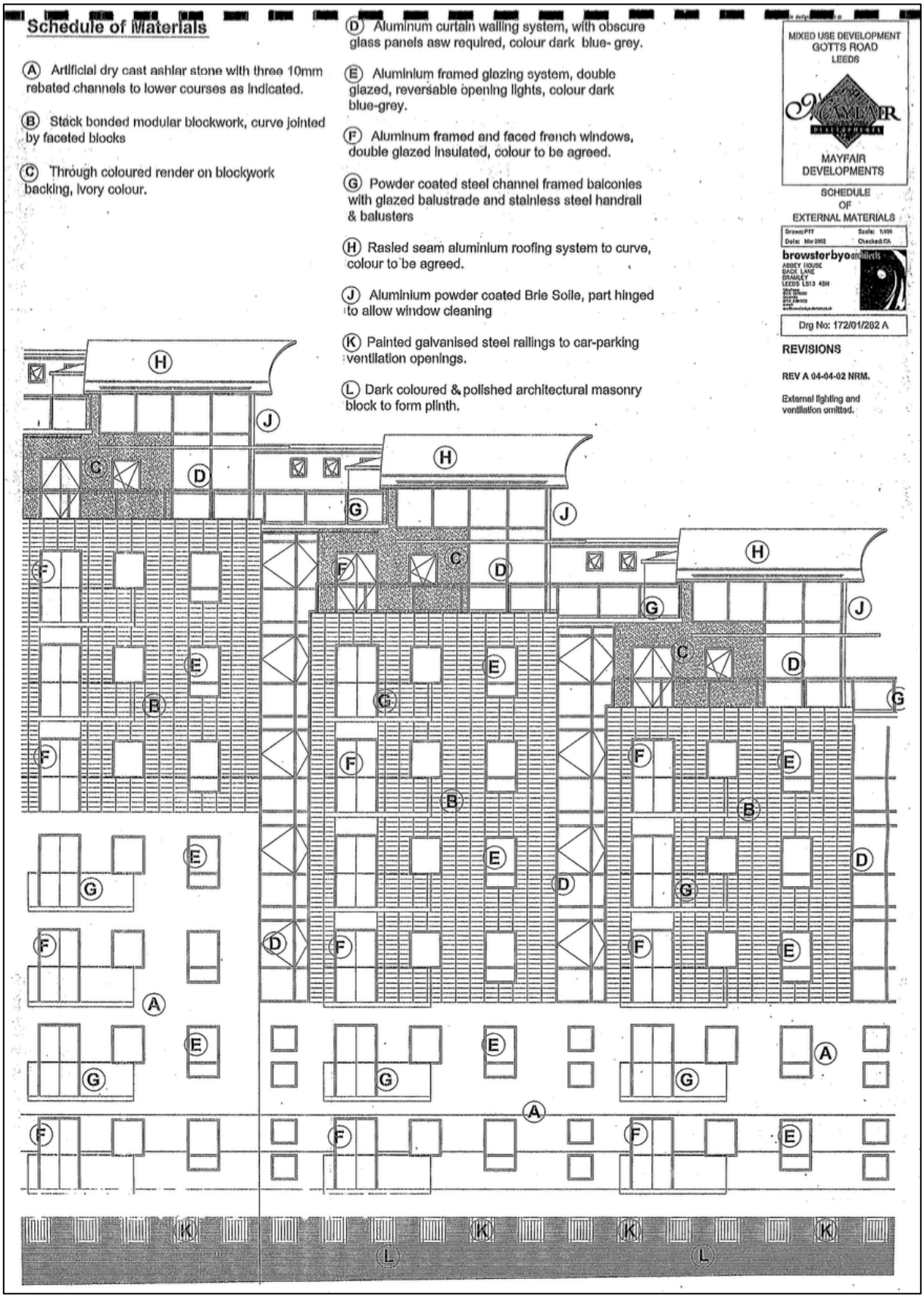
Wall Construction	Figure 2 Reference	Location	Description
EWS01 Brick	A, B, E and L	Located on the majority of elevations on all buildings. Stone is used in lieu of brick on the lower levels.	Type: Cavity Wall. A masonry cavity wall with brick (or stone) outer leaf, a cavity with *PIR* insulation and blockwork inner leaf.
EWS02 Render	C	Located on the upper-most storeys of each building.	Type: Cavity Wall. A rendered masonry cavity wall with blockwork outer leaf, a cavity with *PIR* insulation and blockwork inner leaf
EWS03 Metal Spandrel	F	Located on the heads of some balcony door sets.	Type: Spandrel. An aluminium spandrel with foam insulation, a membrane and PIR insulation on a blockwork substrate.
EWS04 Glazed Spandrel	D	Opaque glazed spandrels used within the curtain walling constructions on various parts of the buildings.	Type: Glazing. Glazing within aluminium framing and possibility of *combustible* insulation.
EWS05 Roofing System	H	Located on the upper-most storeys of each building.	Type: Aluminium roofing facias.

2.2 Balconies and Attachments

Balconies (Figure 2 reference G) are the subject of a separate DFC Report[4].

[4] Design Fire Consultants, 'City Island, Leeds – Balcony Fire Assessment – Detailed Report', Revision 00, 23 April 2020, 1442_R001.0_City Island Balcony Fire Detailed Assessment_200423,

Figure 2: Typical elevation



3 Constructions not Requiring FRAEW

3.1 PAS 9980 Step 1: Need for FRAEWs

There are some wall constructions that are obviously low risk without having to know much (if anything) about the details of the construction or without having to any assessment or FRAEW (see Appendix B.2.1.2).

It is reasonable to exclude these constructions from assessment at the outset. Such constructions are documented in the following sections.

3.2 EWS01 Brick

3.2.1 PAS 9980 Step 2: As-Built Construction Information

Information Certainty

There is a high degree of information certainty because

- DFC has been provided with adequate construction drawings to allow us to determine the key components of the as-built construction and any cavity protection details.
- The as-built construction has been adequately verified by intrusive investigations (as summarised below).

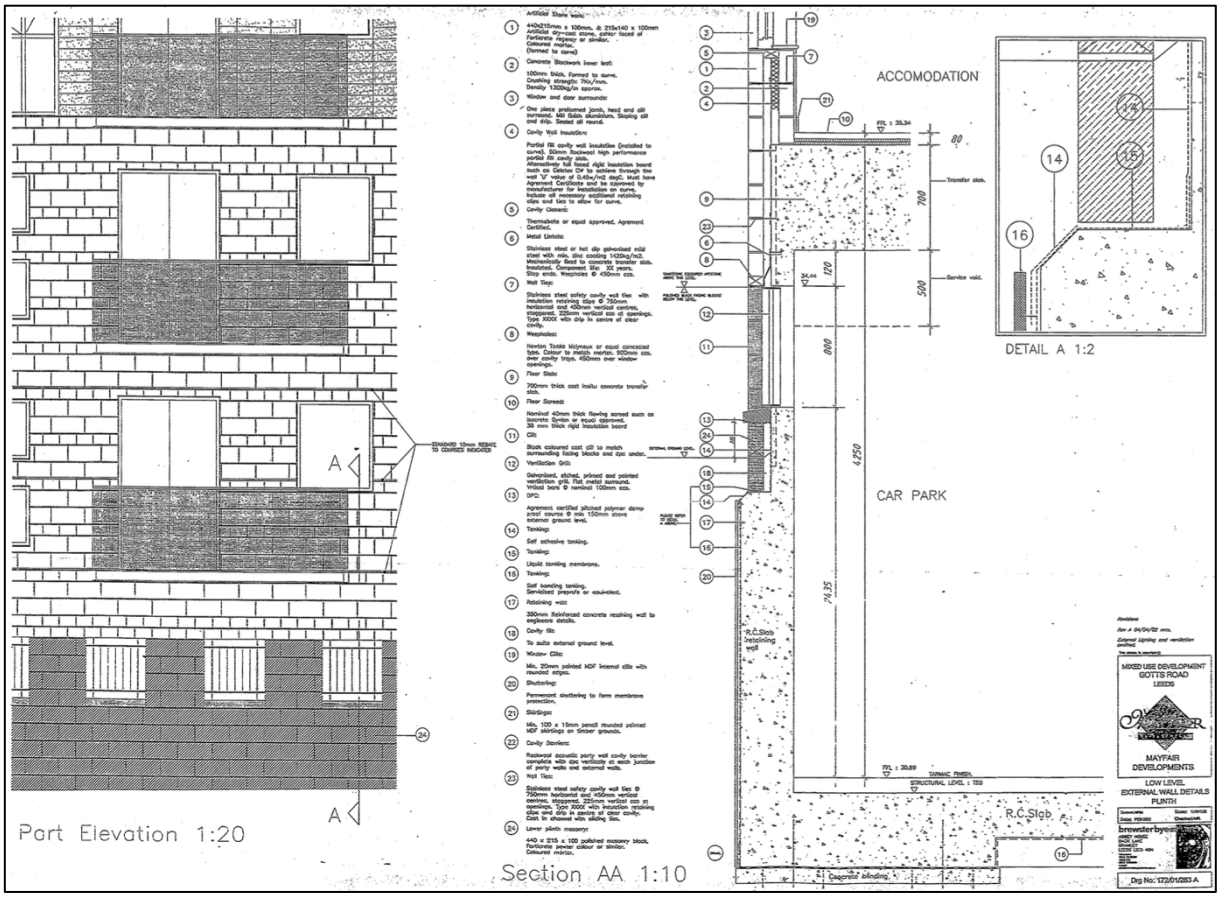
Figure 3: Investigation summary taken from the Thomasons Report

Sample Location	Block (Elevation)	Floor Level	Cavity	Horizontal Cavity Barrier	Vertical Cavity Barrier	Protection Around Openings
A	Elba (Front)	2	Yes	N/a	N/a	Yes
B	Elba (Front)	3	Yes	No	N/a	N/a
C (Stone)	Bonaire (Rear)	0	Yes	N/a	N/a	N/a
D	Elba (Front)	3	Yes	No	N/a	N/a
E	Elba (Front)	2	Yes	N/a	N/a	Yes
F (Stone)	Westray (Right)	0	Yes	N/a	N/a	Yes
G	Santorini (Front)	4	Yes	No	N/a	N/a
H	Santorini (Front)	4	Yes	N/a	N/a	Yes
I	Santorini (Front)	6	Yes	N/a	Yes	Yes
J	Bonaire (Front)	3	Yes	N/a	Yes	Yes
K	Bonaire (Front)	3	Yes	No	N/a	N/a
O (Stone)	Santorini (Right)	0	Yes	N/a	Yes	Yes
W	Westray (Front)	3	Yes	No	N/a	N/a
X	Westray (Front)	2	Yes	No	N/a	Yes
Y	Catalina (Front)	4	Yes	No	N/a	N/a
Z	Catalina (Front)	4	Yes	N/a	N/a	N/a
AA	Catalina (Front)	3	Yes	N/a	N/a	Yes
AB	Catalina (Front)	3	Yes	No	N/a	N/a
AC	Faroe (Front)	3	Yes	No	N/a	N/a

Key Components

Figure 4 shows a cross section through the construction.

Figure 4: Section through construction



The construction is a cavity wall. Therefore, the key materials and products (see Appendix E.2) and system components (see Appendix E.3.1) have been identified as documented below.

Table 3: Construction products and build-up

Figure 4 Reference	Component	Description	FRAEW Fire Performance
2	Inner Leaf	Concrete Blockwork	Concrete at least 75mm thick.
4	Insulation	Foil faced rigid insulation board.	*Combustible* insulation.
1, 11 or 24	Outer Leaf	Blockwork.	Blockwork at least 75mm thick.
5	Cavity Closer	Thermabate or equal cavity closer or steel lintel.	Adequate to seal cavity.

3.2.2 PAS 9980 Steps 3 and 4: Risk Appraisal

As per PAS 9980 commentary on Clause 13 item b, the construction can be concluded as being low risk without the need for further analysis (i.e. an FRAEW is not required) because it is a cavity wall construction where:

- The inner leaf is brick or concrete at least 75mm thick.
- The outer leaf is brick or concrete at least 75mm thick.
- Cavity edges are adequately sealed by a cavity closer or similar construction.

3.2.3 PAS 9980 Step 5: Risk Outcome

The risk outcome for the construction is Low.

3.3 EWS02 Render

3.3.1 PAS 9980 Step 2: As-Built Construction Information

Information Certainty

There is a high degree of information certainty because

- DFC has been provided with adequate construction drawings to allow us to determine the key components of the as-built construction and any cavity protection details.
- The as-built construction has been adequately verified by intrusive investigations (as summarised below).

Figure 5: Investigation summary taken from the Thomasons Report

Sample Location	Block (Elevation)	Floor Level	Cavity	Horizontal Cavity Barrier	Vertical Cavity Barrier	Protection Around Openings
L	Beringa (Front)	8	Yes	N/a	N/a	N/a
M	Beringa (Front)	8	Yes	N/a	N/a	N/a
N	Beringa (Front)	8	Yes	N/a	N/a	N/a
P	Westray (Front)	5	Yes	N/a	N/a	N/a
Q	Catalina (Front)	8	Yes	N/a	N/a	N/a
R	Catalina (Front)	8	Yes	N/a	Yes	N/a
S	Elba (Front)	5	Yes	N/a	N/a	N/a
T	Santorini (Front)	13	Yes	N/a	N/a	N/a

Key Components

Figure 4 shows a cross section through EWS01 construction. The construction of EWS02 is substantially similar except that the outer leaf has a render topcoat applied.

The construction is a cavity wall. Therefore, the key materials and products (see Appendix E.2) and system components (see Appendix E.3.1) have been identified as documented below.

Table 4: Construction products and build-up

Figure 4 Reference	Component	Description	FRAEW Fire Performance
2	Inner Leaf	Concrete Blockwork	Concrete at least 75mm thick.
4	Insulation	Foil faced rigid insulation board.	*Combustible* insulation.
1, 11 or 24	Outer Leaf	Brick or stone.	Brick (or equivalent) as least 75mm thick.
5, 6	Cavity Closer	Thermabate or equal cavity closer or steel lintel.	Adequate to seal cavity.
N/A	Finish	Render	Not *combustible*.

3.3.2 PAS 9980 Steps 3 and 4: Risk Appraisal

As per PAS 9980 commentary on Clause 13 item b, the construction can be concluded as being low risk without the need for further analysis (i.e. an FRAEW is not required) because it is a cavity wall construction where:

- The inner leaf is brick or concrete at least 75mm thick.
- The outer leaf is brick or concrete at least 75mm thick.
- Cavity edges are adequately sealed by a cavity closer or similar construction.
- The render finish is not *combustible* and is not a medium for fire spread.

3.3.3 PAS 9980 Step 5: Risk Outcome

The risk outcome for the construction is Low.

3.4 EWS05 Roofing

3.4.1 PAS 9980 Step 2: As-Built Construction Information

Information Certainty and Key Components

It is visually obvious that the construction is a roof canopy.

3.4.2 PAS 9980 Steps 3 and 4: Risk Appraisal

The construction can be concluded as being low risk without the need for further analysis (i.e. an FRAEW is not required) because it is not an external wall and is not a medium for fire spread over the walls of the building or between flats.

3.4.3 PAS 9980 Step 5: Risk Outcome

The risk outcome for the construction is Low.

4 FRAEWs

4.1 EWS03 Metal Spandrel

4.1.1 PAS 9980 Step 2: As-Built Construction Information

Information Certainty

There is a reasonable degree of information certainty because the as-built construction has been adequately verified by intrusive investigations in a single location on Westray and this is likely to be representative of all other locations.

Key Components

Figure 6 shows the construction details of the spandrels as identified by Thomasons.

Figure 6: Construction details

The construction is a spandrel panel comprising (from inside to outside):

- Substrate: Blockwork.
- Insulation: Rigid foam insulation (appears to be *PIR*).
- Cladding: Aluminium with a foam insulation backing (appears to be polystyrene).

BR 135 Benchmarking

PAS 9980 requires that the fire performance be benchmarked against BR 135 compliance. This is to help the assessor position the fire performance on a hazard spectrum from low (e.g. brick cavity wall, limited combustibility or a BR 135 compliant construction) to high (e.g. *Category 3 ACM*).

Spandrel panels do not span extensively over the walls of the building. As such, it would not be appropriate to test them (at least not without adjacent wall construction) in accordance with BS 8414, nor would it be appropriate to benchmark them against BR 135. Therefore, instead of benchmarking against BR 135, the construction is assessed in accordance with Appendix D:

4.1.2 PAS 9980 Steps 3 and 4: Risk Appraisal

The construction is a spandrel and has been assessed in accordance with the method detailed in Appendix D and as summarised below.

Panel Type

The panel could be defined as a Type 3 panel because, whilst the inner face is not steel, it is blockwork and would prevent direct fire spread between flats via the panel.

Notwithstanding, the panel includes a *thermoset* insulation.

Therefore, to ensure conservatism it has been that the fire performance could be between that associated with Type 3 panels and that associated with Type 4 panels.

Fire Performance

The resultant overall fire performance factor is defined against PAS 9980 ratings and benchmark example wall constructions as summarised below.

Figure 7: Fire performance benchmarking

Benchmark Examples	Type 4		Type 3	Type 2	Type 1
EWS03					
Rating	High	Medium	Tolerable	Low	
Likely Rate	*Very fast*	*Fast*	*Faster*	*Normal*	
Likely Extent	*Uncontrolled*	*Far*	*Further*	*Normal*	
Likely Heat	*Very high*	*High*	*Higher*	*Normal*	

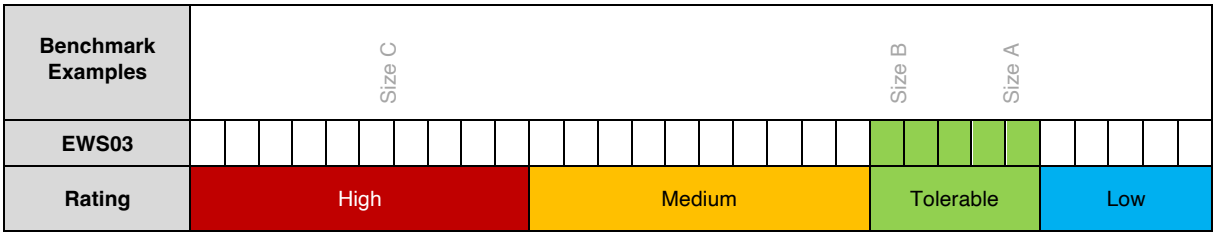
Therefore, the risk outcome could be High when considering the fire performance factor in isolation and risk cannot be confirmed as being sufficiently low without consideration of the facade configuration factor.

Facade Configuration

The panel is a Size B panel because it is less than half storey-height / flat-width.

Therefore, the risk rating when considering fire performance and facade configurations is as below.

Figure 8: Fire performance and facade configuration benchmarking



Therefore, the risk outcome is Medium (Tolerable) / Low when considering the fire performance and facade configuration factors in isolation and risk has been confirmed as being sufficiently low without the need to consider fire strategy factor.

4.1.3 PAS 9980 Step 5: Risk Outcome

It has been confirmed with sufficient confidence and/or conservatism that the risk outcome is at least as low as Medium (Tolerable) because the fire performance and facade configuration factors are clearly such that the construction is not a medium for fire spread between flats, or over the walls of the building, or between buildings.

4.1.4 Confidence

Despite there being some uncertainty in the as-built construction information, there is a high degree of confidence that the risk outcome is at least as low as Medium (Tolerable) because:

- The construction is only located above some balcony door sets.
- Only the rigid foam insulation (*thermoset*) spans up to the compartment floor slab.
- The cladding insulation (*thermoplastic*) does not span across internal compartmentation).
- At worst, the construction is a medium for fire spread that could result in one secondary fire.

4.1.5 Recommended Action

Even under conservative assumptions the risk is sufficiently low that it can be tolerated, and as such, the resultant actions are:

- The *FRA* should be updated to accommodate the findings of this assessment.
- Consideration should be given as to whether risk can be reduced further via *risk-proportionate action* through the *FRA* process.
- Subject to confirmation from the *FRA*, a *stay-put* evacuation strategy remains viable.

4.2 EWS04 Glass Spandrel

4.2.1 PAS 9980 Step 2: As-Built Construction Information

Information Certainty

There is a reasonable degree of information certainty because the as-built construction has been adequately verified by intrusive investigations in a single location on Westray and this is likely to be representative of all other locations.

Key Components

Figure 9 shows the construction details of the spandrels as identified by Thomasons.

Figure 9: Construction details above entrance (LHS) and at a floor junction (RHS)

The construction is a spandrel panel comprising (from inside to outside):

- Substrate: Blockwork or concrete floor slab.
- Insulation: None.
- Cladding: Glass.

BR 135 Benchmarking

PAS 9980 requires that the fire performance be benchmarked against BR 135 compliance. This is to help the assessor position the fire performance on a hazard spectrum from low (e.g. brick cavity wall, limited combustibility or a BR 135 compliant construction) to high (e.g. *Category 3 ACM*).

Spandrel panels do not span extensively over the walls of the building. As such, it would not be appropriate to test them (at least not without adjacent wall construction) in accordance with BS 8414, nor would it be appropriate to benchmark them against BR 135. Therefore, instead of benchmarking against BR 135, the construction is assessed in accordance with Appendix D:

4.2.2 PAS 9980 Steps 3 and 4: Risk Appraisal

The construction is a spandrel and has been assessed in accordance with the method detailed in Appendix D and as summarised below.

Panel Type

The panel could be defined as a Type 1 panel because where inspected there is no insulation (i.e. there are no combustible primary products).

Notwithstanding, due to the low number of inspection locations, it is possible that there are panels include a *thermoset* insulation.

Therefore, to ensure conservatism it has been that the fire performance could be between that associated with Type 3 panels and that associated with Type 4 panels.

Fire Performance

The resultant overall fire performance factor is defined against PAS 9980 ratings and benchmark example wall constructions as summarised below.

Figure 10: Fire performance benchmarking

Benchmark Examples	Type 4		Type 3	Type 2	Type 1
EWS04					
Rating	High	Medium	Tolerable		Low
Likely Rate	*Very fast*	*Fast*	*Faster*		*Normal*
Likely Extent	*Uncontrolled*	*Far*	*Further*		*Normal*
Likely Heat	*Very high*	*High*	*Higher*		*Normal*

Therefore, the risk outcome could be High when considering the fire performance factor in isolation and risk cannot be confirmed as being sufficiently low without consideration of the facade configuration factor.

Facade Configuration

The panel is a Size B panel because it is less than half storey-height / flat-width.

Therefore, the risk rating when considering fire performance and facade configurations is as below.

Figure 11: Fire performance and facade configuration benchmarking

Benchmark Examples	Size C		Size B	Size A	
EWS04					
Rating	High	Medium	Tolerable		Low

Therefore, the risk outcome is Medium (Tolerable) / Low when considering the fire performance and facade configuration factors in isolation and risk has been confirmed as being sufficiently low without the need to consider fire strategy factor.

4.2.3 PAS 9980 Step 5: Risk Outcome

It has been confirmed with sufficient confidence and/or conservatism that the risk outcome is at least as low as Medium (Tolerable) because the fire performance and facade configuration factors are clearly such that the construction is not a medium for fire spread between flats, or over the walls of the building, or between buildings.

4.2.4 Confidence

Despite there being some uncertainty in the as-built construction information, there is a high degree of confidence that the risk outcome is at least as low as Medium (Tolerable) because:

- The construction is only located at floor level.
- At worst, the construction is a medium for fire spread that could result in one secondary fire.

4.2.5 Recommended Action

Even under conservative assumptions the risk is sufficiently low that it can be tolerated, and as such, the resultant actions are:

- The *FRA* should be updated to accommodate the findings of this assessment.
- Consideration should be given as to whether risk can be reduced further via *risk-proportionate action* through the *FRA* process.
- Subject to confirmation from the *FRA*, a *stay-put* evacuation strategy remains viable.

5 Conclusions

5.1 As-Built Construction

Following review of construction documentation and the findings of intrusive surveys, the external wall constructions summarised in Table 5 have been identified and assessed.

Table 5: As-built external wall constructions and assessment assumptions

Wall Construction	Description	Features for FRAEW[Note 1]
EWS01 Brick	Type: Cavity Wall. A masonry cavity wall with brick (or stone) outer leaf, a cavity with *PIR* insulation and blockwork inner leaf.	The construction comprises an inner and outer leaves that are brick or concrete at least 75mm and cavity edges are adequately sealed.
EWS02 Render	Type: Cavity Wall. A rendered masonry cavity wall with blockwork outer leaf, a cavity with *PIR* insulation and blockwork inner leaf	The construction comprises an inner and outer leaves that are brick or concrete at least 75mm and cavity edges are adequately sealed and the render finish is not *combustible*.
EWS03 Metal Spandrel	Type: Spandrel. An aluminium spandrel with foam insulation, a membrane and PIR insulation on a blockwork substrate.	The construction is limited to the spandrel zone above some balcony door-sets.
EWS04 Glazed Spandrel	Type: Glazing. Glazing within aluminium framing and possibility of *combustible* insulation.	The construction is limited to the spandrel zone at floor levels.
EWS05 Roofing System	Type: Aluminium roofing facias.	The construction is limited to roof locations.

Notes:
1 These are the key features of the external wall construction that have been used in the FRAEW and on which the risk outcome relies.

5.2 Appraisal of As-Built Construction

DFC has assessed each wall construction in accordance with PAS 9980. To account for uncertainty, the rating in accordance with PAS 9980 is determined from assessments based on upper and lower bound assumptions. Table 6 summarises the results of the assessment for each wall construction.

Table 6: Summary of assessment

Construction Type	Likely Fire Spread Rate (compared to normal range)	Resultant PAS Outcome	Reason
EWS01 Brick	*Normal*	Low	Hazard is low.
EWS02 Render	*Normal*	Low	Hazard is low.

Construction Type	Likely Fire Spread Rate (compared to normal range)	Resultant PAS Outcome	Reason
EWS03 Metal Spandrel	*Slightly faster*	Medium (Tolerable)	Fire performance and facade factors are positive.
EWS04 Glazed Spandrel	*Slightly faster*	Medium (Tolerable)	Fire performance and facade factors are positive.
EWS05 Roofing System	*Normal*	Low	Hazard is low.

5.3 Evacuation Strategy and Interim Measures

See Building Reports.

5.4 Form EWS 1

See Building Reports.

5.5 Recommendations

See Building Reports.

Appendix A – Definitions and Terminology

A.1 Regulatory Reform (Fire Safety) Order

- Responsible person(s) means:
  a. in relation to a workplace, the employer, if the workplace is to any extent under his control;
  b. in relation to any premises not falling within paragraph (a)-
  – (i) the person who has control of the premises (as occupier or otherwise) in connection with the carrying on by him of a trade, business or other undertaking (for profit or not); or
  – (ii) the owner, where the person in control of the premises does not have control in connection with the carrying on by that person of a trade, business or other undertaking.
- Relevant persons means:
  c. any person (including the responsible person) who is or may be lawfully on the premises; and
  d. any person in the immediate vicinity of the premises who is at risk from a fire on the premises.
- General fire precautions means:
  a. measures to reduce the risk of fire on the premises and the risk of the spread of fire on the premises;
  b. measures in relation to the means of escape from the premises;
  c. measures for securing that, at all material times, the means of escape can be safely and effectively used;
  d. measures in relation to the means for fighting fires on the premises;
  e. measures in relation to the means for detecting fire on the premises and giving warning in case of fire on the premises; and
  f. measures in relation to the arrangements for action to be taken in the event of fire on the premises, including-
  – (i) measures relating to the instruction and training of employees; and
  – (ii)measures to mitigate the effects of the fire.
- Risk: The probable *consequence* to the safety of persons from fire.
- Fire Risk Assessment (FRA): The suitable and sufficient assessment of risk required by the FSO.

A.2 Risk and Risk Reduction

- Consequence: The impact a *hazard* poses on safety of persons. Typically, a consequence is in respect to the fire strategy (e.g. means of escape, fire spread between compartments, fire spread between buildings and/or access and facilities for the fire service).
- Hazard (see also *consequence*): The potential to cause harm as a result of fire or smoke spread via the external wall construction. Typically, this would be a function of the potential rate and/or extent of fire or smoke spread via the external wall construction.

- Mitigation: Measures to reduce the probability and/or *consequences* of fire spread via an external wall construction. Mitigation does not reduce *hazard* and is unlikely to require works to the external wall system itself.
- Remediation: Measure to reduce *hazard* of fire spread via an external wall construction. Remediation is likely to require works to the external wall system itself.
- Risk: The probable *consequence* to the safety of persons from fire.
- Risk-proportionate Action[5]: Action taken to reduce risk where the cost of the action is proportionate to the magnitude of risk being reduced and the magnitude of the risk reduction. Cost is in the widest context and includes capital and operational expenditure, time, disruption and practicality. For example, the cost of risk-proportionate action would less for a medium-risk construction than a high-risk construction and action would only be risk-proportionate where the resultant reduction in risk is commensurate with the cost of the action.

A.3 Building Features and Parameters

- Evacuation zones: zones within a building that have been separated by fire resisting construction to enable different zones to be evacuated independently of each other.
- Stay-put evacuation strategy:
  - Occupants of flat(s) of fire origin / alarm evacuate.
  - Occupants of other flats are safe to remain within their flats until instructed otherwise.
  - All occupants are safe to evacuate should they choose to do so.
- Simultaneous evacuation: All occupants within an evacuation zone are required to escape on detection of fire and/or activation of the fire alarm.
- 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.
- 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.4 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

[5] PAS 9980 refers to but does not define risk-proportionate action. Therefore, this definition has been inferred.

that fire spread could result in a risk to health and safety. Primary products would constitute insulation, filler material, cladding, etc. in the context of ADB, MHCLG advice and Form EWS1.

- 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.5 Cladding Products:

- Aluminium Composite Material (ACM): A cladding panel comprising a core (typically around 3mm to 4mm thick) faced on each side with aluminium (typically 0.5mm thick). From a fire perspective, there are three generic types:
  - Category 3 (aka ACM PE): ACM panels with an unmodified polyethylene core.
  - Category 2 (aka ACM FR or ACM Plus): ACM panels with a polyethene core that include cement particulate (or similar) to reduce the combustibility of the core.
  - Category 1 (aka ACM A2): ACM panel that achieve *Class A2*.
- High Pressure Laminate (HPL): A cladding panel comprising cellulosic material bonded in a resin under high pressure. From a fire perspective, there are two generic types:
  - Standard Grade: Panels that do not include a fire retardant.
  - Fire Resistant (aka FR Grade): Panels that include a fire retardant to improve the reaction to fire classification.

A.6 Wall Systems

- 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 barrier*s 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*.
- Cavity wall: An external wall system comprising two skins / leaves (inner and outer) to create a hollow centre (cavity). The key components are inner leaf/skin, cavity and outer leaf/skin.
- External Thermal Insulation Composite System (ETICS): ETICS were developed to improve the thermal insulation of existing wall constructions (they would be applied to the outside of existing external walls). Herein, the term is used more generally to describe a layered system (typically comprising insulation with an external surface finish such as render) applied to a substrate. The key components are substrate, insulation and topcoat.
- Rainscreen: An external wall system where the cladding stands off from the moisture resistance surface of an air/water barrier applied to the sheathing board of the substrate to create a cavity to allow drainage and evaporation. The key components are a substrate, ventilated cavity and rainscreen cladding.

- Spandrel Panel: A panel that is applied at the junction of a floor or wall that is different from the rest of the external wall construction surrounding it. Spandrel panels form junctions with internal compartment floors and/or internal compartment walls.
- Structural framing system (SFS): an *internal component* of an *external wall construction* comprising plasterboard, a structural frame (potentially insulated) and a sheathing board.
- Window / Infill Panels: Infill panels are that are provide within the surrounds of another external wall construction. Infill panels do not form junctions with internal compartment floors or internal compartment walls.

A.7 Fire Spread Rates

- Normal: The rate of fire spread via the external construction is likely to be in the normal range (where ADB compliance is used as the benchmark of the normal range). for the building in question.
- Faster: The rate of fire spread via the external wall construction is faster than the normal range but might not be significantly so.
- Fast: The rate of fire spread via the external wall construction is significantly faster than the normal range to an extent that it is likely to constitute a high risk unless there are mitigating facade configuration or fire strategy factors in place.
- Very Fast: The rate of fire spread via the external wall construction is significantly faster than the normal range to an extent that it is likely to constitute an unacceptable risk unless there are mitigating facade configuration or fire strategy factors in place.

A.8 Fire Spread Extents

- Normal: The external wall construction does not contribute to fire spread and as such fire spread via the external walls is limited to that associated with flame projecting from any openings such as windows.
- Further: The external wall construction does contribute to fire spread and but only to the extent that fire spread via the external walls is limited to the vicinity of flames projecting from any openings such as windows.
- Far: The external wall construction is such that fire spread via the external walls could be significantly beyond the vicinity of flames projecting from any openings such as windows.
- Uncontrolled: The external wall construction is such that fire spread via the external walls could extend the full extent of the wall construction.

A.9 Fire Spread Heats

- Normal: The external wall construction does not contribute to the heat of the fire.
- Higher: The external wall construction would slightly increase the heat of the fire.
- High: The external wall construction would significantly increase the heat of the fire.
- Very High: The external wall construction would considerably increase the heat of the fire.

A.10 Fire Resistance Standards

Fire resistance standards in accordance with BS EN 1363-1[6] or BS 476-20[7], and are expressed as:

nREI, nR, nEI or nE nI

where:

n - the fire resistance standard expressed in minutes.

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.11 Reaction to Fire

European Class

Where possible, *products'* reactions to fire are specified in accordance with BS EN 13501-1[8] (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 ADB and BS 476-6 and BS 476-7.
- Class 1 means national class 1 in accordance with ADB and BS 476-7.

European vs National Classes

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

[6] BS EN 1363-1, 'Fire resistance tests. General Requirements', 2012
[7] BS 476-20, 'Fire tests on building materials and structures. Method for determination of fire resistance of elements of construction (general principles)', 1987
[8] 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 product that is *Class A2*/*limited combustibility* also achieves *Class B*/*Class 0*.

A.12 Foam Insulations

- Thermoset: A charring, thermoset polymer insulation such as phenolic foam or polyisocyanurate (PIR).
- Thermoplastic: A thermoplastic insulation such as polystyrene derivatives.
- Charring: The process of char formation when a material (e.g. wood or some thermosetting polymers) sublimes on heating an a char residue forms near the surface of the material.

A.13 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 is a barrier used within a cavity that is required to achieve *30E 15I* [for protection of cavity edges around window openings, ADB includes alternatives to cavity barriers].

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 – DFC Appraisal Process

B.1 Principles

DFC has developed the following methodology in accordance with PAS 9980[9] and in recognition of MHCLG Advice.

An assessment in accordance with PAS 9980 is called (by the PAS) a fire risk appraisal of external wall constructions ("FRAEW").

PAS 9980 supplements the information given in PAS 79-2: 2020[10].

B.2 Process

Prior to starting the PAS 9980 approach, it is necessary to identify all different external wall constructions. Then, for each wall construction, the PAS 9980 Figure 3 five step approach (see Table 7) is applied.

Table 7: PAS 9980 Figure 3

Step	Objective
1	Confirm that a full FRAEW is required (EWS Triage)
2	Gather all necessary information to complete the FRAEW
3	Identify and group factors that are significant in determining the risk rating
4	Consider each group of risk factors to determine their potential contribution to the overall risk
5	Review the risk factor analysis against benchmark success criteria to determine an outcome

B.2.1 PAS 9980 Step 1: Confirm that a full FRAEW is Required

B.2.1.1 Building Review

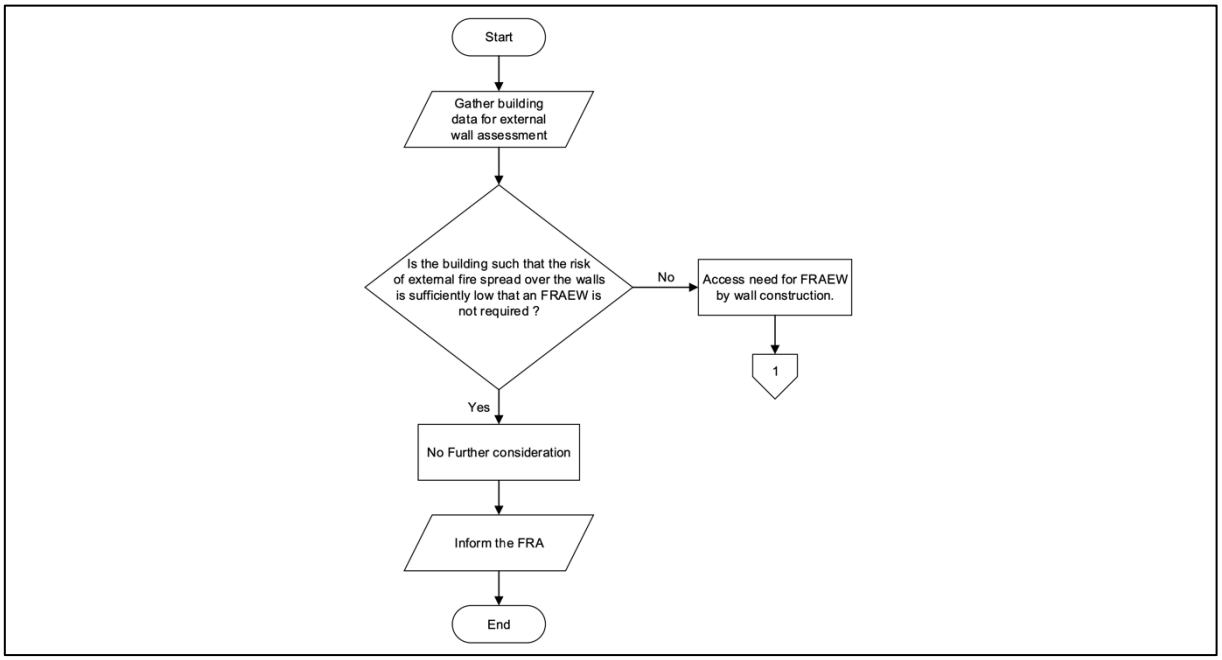
Figure 12 shows the parts of PAS 9980 Figure 4 that are relevant to the building level review of whether a full FRAEW is required.

PAS 9980 Section 0.2 and PAS 9980 Figure 4 recognises that:

- An FRAEW will not be required for all blocks of flats. In many cases is will be manifestly obvious that risk to life from fire spread does not warrant an FRAEW.
- FRAEWs require specialist skills and resource available for FRAEWs is limited and should be used judiciously (i.e. where risk of fire spread is sufficiently low, this should be accepted without further appraisal).

[9] British Standards Institution, PAS 9980, 'Fire risk appraisal of external wall construction and cladding of existing blocks of flats – Code of practice', January 2022
[10] British Standards Institution, PAS 79-2, 'Fire risk assessment, Housing, Code of practice', 2020

Figure 12: Building review component of PAS 9980 Figure 4



With consideration of PAS 9980 Section 0.2, Table 8 defines the buildings for which DFC considers risk of fire spread is sufficiently low such that no further appraisal is required provided there is no significant, visually obvious evidence to the contrary.

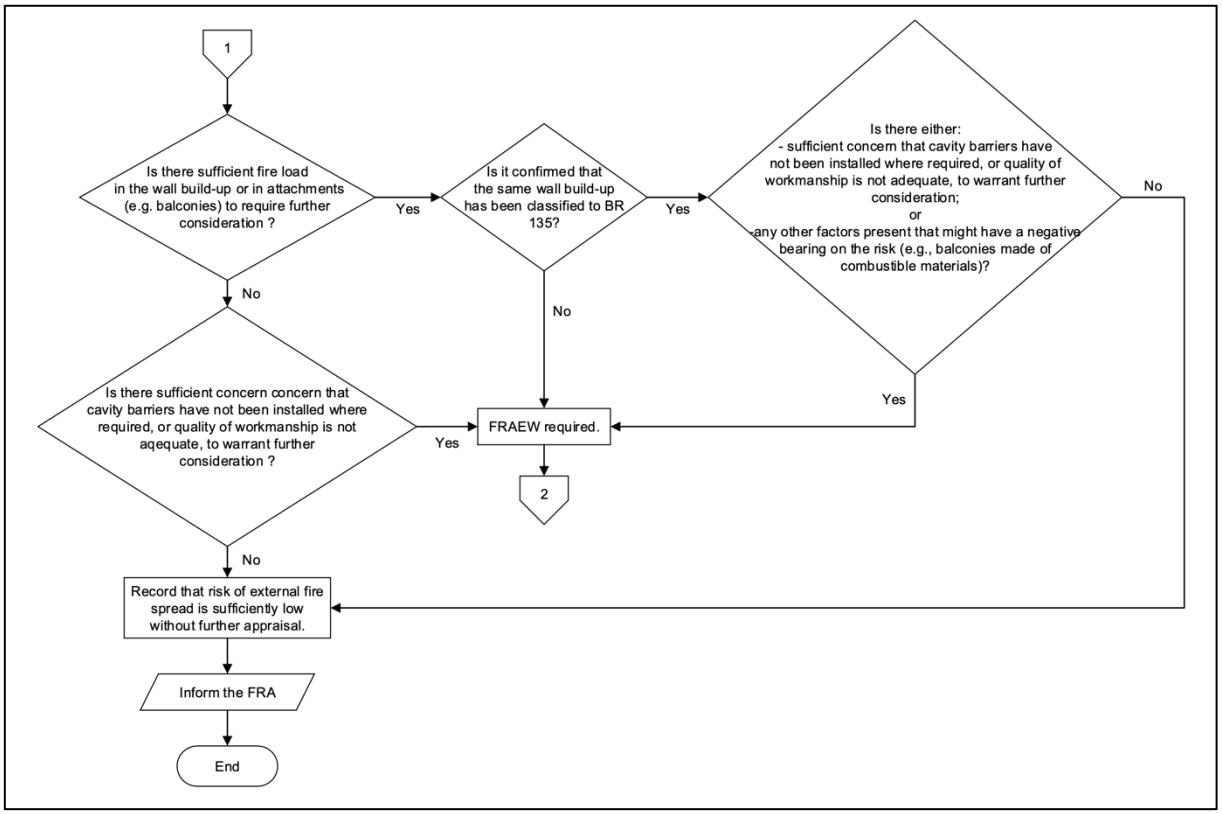
Table 8: Buildings not requiring appraisal in accordance with PAS 9980

Option	Number of Storeys	Wall Construction
1	Not more than 2	Any, but no Category 3 (i.e. polyethylene cored) ACM/MCM permitted.
2	Not more than 4	No Category 3 (i.e. polyethylene cored) ACM/MCM permitted and the combined area of any of the following should not exceed 25% of the total wall area (for each elevation separately): • External walls incorporating rainscreen cladding, with or without insulation within any associated cavity, • External thermal insulation composite systems (ETICS), • Insulated core (“sandwich”) panels, • Glazed facades with infill/spandrel panels, • Substrates including structural framing systems (SFS), timber framing and structural insulated panels (SIPs), and • Curtain walling.
3	Any	Walls wholly constituting masonry/concrete cavity walls (each leaf being either masonry or concrete) or solid masonry construction without a cavity.

B.2.1.2 External Wall Review

PAS 9980 Figure 4 and PAS 9980 Section 13 commentary to Step 1 indicate a full FRAEW is not required in any of the circumstances described below, and that in such situations the risk rating of 'low' can be assigned without further assessment.

Figure 13: Wall construction review component of PAS 9980 Figure 4



Fire Load

In answering the question about fuel load, there would not be sufficient fire load if:

- *Primary products* and any attachments are of *limited combustibility* or better, or
- Any *primary products* that are *combustible* are within a cavity wall construction with adequately constructed brick (or concrete or concrete block) inner and outer leaves, or
- The extent of coverage of the wall construction is sufficiently limited and isolated that the construction would clearly not be a medium for fire spread between.

BR 135 Classification

A full FRAEW is not required if the construction is the same wall build-up as a system that met the BR 135 performance criteria, and:

- There are not sufficient concerns that cavity barriers not been installed where required, or quality of workmanship is not adequate, and
- There are no other factors (e.g. balconies made of combustible materials) that might have a negative bearing on risk.

For this option, DFC requires sufficient information to confirm the materials used in the build-up of the external wall construction and some evidence that cavity barriers have been installed correctly.

Cavity Barriers

In answering the question about cavity barrier concerns, there would not be sufficient concern if:

- The construction does not span across internal compartment floors or walls (because cavity barriers would not be required), or
- There is sufficient evidence to show that cavity barriers have been installed correctly, such as:
  - Construction photographs showing adequate installation.
  - Construction site inspection records.
  - Intrusive surveys.

B.3 PAS 9980 Step 2: Gather Information

B.3.1 Principles

PAS 9980 encourages a proportionate approach to FRAEWs and risk reduction. By implication, this requires a proportionate approach to gathering information and in particular the necessity for intrusive surveys (which can be costly, disruptive and damaging).

The amount of information required depends on the potential risk and the types and coverage of external wall construction, and it is possible that Steps 2 to 5 need to be iterated with more information required in each iteration of Step 2.

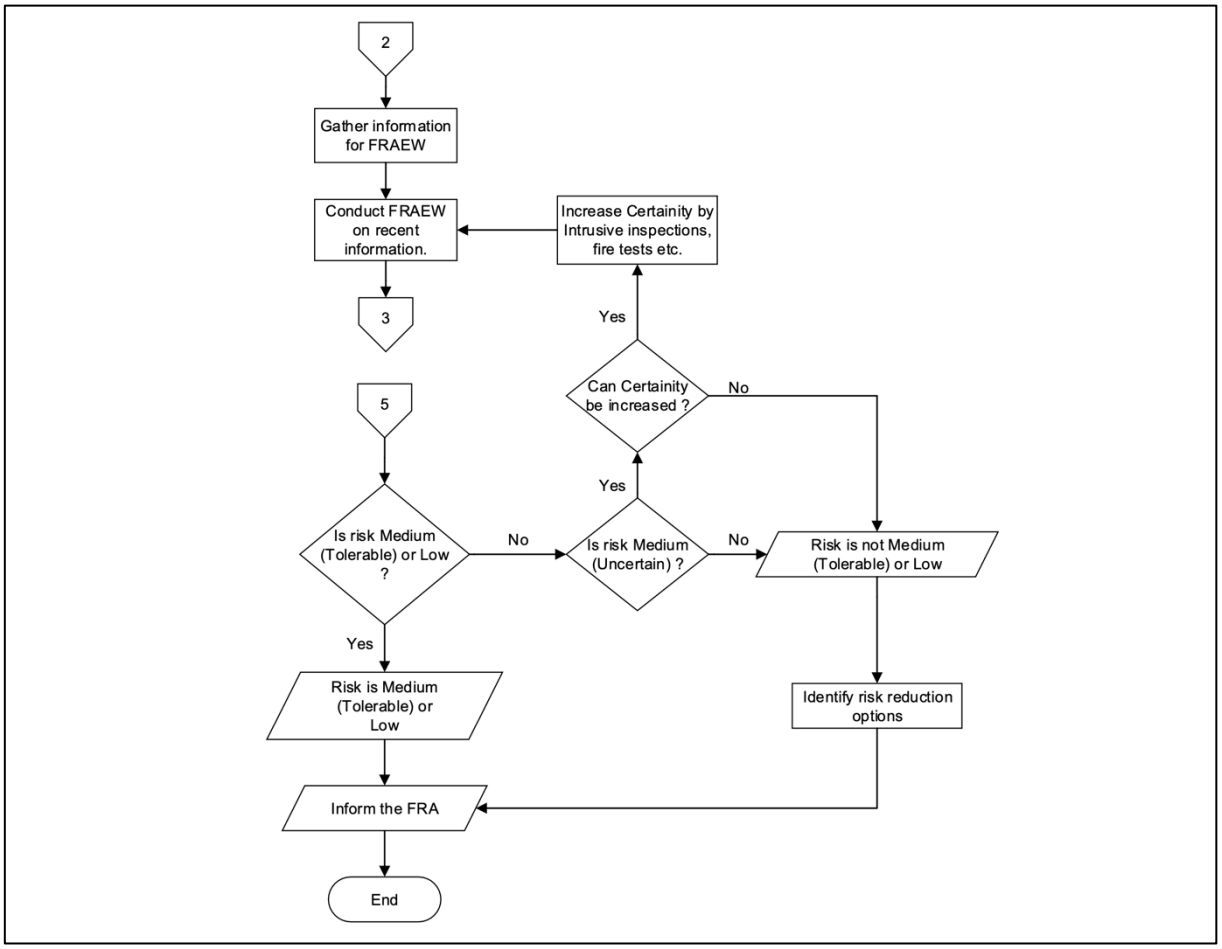
For example, where the building risk is low or external wall types are implicitly low risk (e.g. brick cladding with an SFS substrate), the amount / detail of information required might be low comparted to a higher risk building or a higher risk wall construction (e.g. a rainscreen with combustible cladding or combustible insulation).

Similarly, in a first iteration conservative assumptions can be made. For example, it can be assumed that there are no positive fire strategy features in the building or that cavity barriers are missing. If the risk is tolerable despite these conservative assumptions, additional information is not required. Alternatively, if the risk is not tolerable, additional information might be required to determine if the conservative assumptions can be refined for a second iteration of appraisal.

Therefore, DFC applies an iterative approach to PAS 9980 Steps 2, 3, 4 and 5 as defined in Figure 14, and summarised below:

- Step 2: Enough information is gathered to make a first FRAEW (and subsequent FRAEWs if required).
- Steps 3 and 4: Depending on the situation, either a Basic FRAEW or a Fire Engineered FRAEW is conducted.
- Step 5:
  - If the FRAEW confirms with sufficient confidence that risk is low enough to be Tolerable, end.
  - If the FRAEW confirms with sufficient confidence that risk is high enough to require risk reduction, identify appropriate risk reduction options and end.
  - If the FRAEW cannot confirm with sufficient confidence that risk is low enough to be Tolerable and it is not possible to increase confidence, identify appropriate risk reduction options and end.
  - Otherwise, gather additional information (e.g. by intrusive surveys, fire testing, etc.) to increase confidence and repeat from Step 2.

Figure 14: Iterative process applied to Step 2, 3, 4 and 5 to ensure intrusive surveys are proportionate



B.3.2 Building Information

The building information required will vary between appraisals (see Appendix B.3.1). Typically, some or all of the following might be required:

- Evacuation strategy (i.e. stay-put, simultaneous or hybrid).
- General arrangement plans for each floor level.
- Elevational drawings to show building heights and locations of external wall constructions.
- Fire protection features and system, such as sprinklers, fire alarm, smoke control and fire service systems.
- Site plan or information about proximity of adjacent buildings.
- Building egress and access locations.

B.3.3 External Wall Constructions

The external wall information required will vary between appraisals (see Appendix B.3.1). Typically, some or all of the following might be required:

- Construction typology (e.g. rainscreen, curtain wall, cavity wall, external wall insulation such as render systems, or architectural wall panels).

- Materials used within the external wall construction, including, cladding, insulation, membranes, and sheathing boards.
- Where there are cavities, details of junction protection and cavity edge protection.

The information can be gathered using a combination of drawings and site investigations (which might need to be intrusive).

As per PAS 9980 Annex J, it is important to gather enough information to enable assessment, but equally, it is important to avoid unnecessary intrusive surveys. Therefore, DFC's approach to information gathering is an iterative one (in some instances, only one iteration is required):

- In the first iteration DFC gathers enough information to enable Upper and Lower Bound FRAEW. Where there is uncertainty in the as-built construction the Upper Bound FRAEW makes conservative assumptions and the Lower Bound FRAEW makes optimistic assumptions.
- If both the Upper Bound and Lower Bound FRAEWs conclude that risk is at least as low as Medium (Tolerable), no further information is required (because even based on the conservative assumptions of the Upper Bound FRAEW risk is low enough to be tolerated and increased certainty cannot increase risk).
- If both the Upper Bound and Lower Bound FRAEWs conclude that risk is not at least as low as Medium (Tolerable), no further information is required (because even based on the optimistic assumptions of the Lower Bound FRAEW risk is not low enough to be tolerated and increase certainty cannot reduce risk).
- Where the FRAEW does not provide adequate certainty (i.e. the Upper Bound risk is not at least as low as Medium (Tolerable) and the Lower Bound risk is at least as low as Tolerable) and, as such, either (depending which is more practicable and proportionate):
  - Additional information is required (e.g. via intrusive surveys or fire testing) to enable a reduction in the conservatism associated with the Upper Bound FRAEW and/or the optimism associated with the Lower Bound FRAEW. In this instance, additional information is gathered and the appraisal repeated; or
  - Risk reduction measures must be implemented such that the Upper Bound FRAEW concludes that risk is at least as low as Medium (Tolerable) even when conservative assumptions are made regarding the as-built construction.

B.4 Steps 3 and 4: Risk Appraisal

B.4.1 Principles

B.4.1.1 Risk-Based Benchmark Criteria

In the context of a risk-based approach, the risk of fire spread via an external wall is a combination of:

- The probability of combustible materials being ignited.
- If ignited, the probability of undue fire spread over the external walls of the building.
- The probable *consequences* of any such fire spread to occupants.

B.4.1.2 Acceptability Criteria for a Risk-Based Approach

PAS 9980 clause 5.5 requires that a risk-based approach includes consideration of the following in determining whether an existing block of flats is safe:

- The combustibility and fire performance of external wall construction and cladding.

- The likelihood of secondary fires.
- Whether a secondary fire is likely to result in direct harm to occupants or prevent them escaping.
- The role of fire and rescue service intervention, its effectiveness and its limitations.
- The time it might take for adverse *consequences* to occur and whether this can be mitigated by, for example, suitable fire safety design.
- The extent and effectiveness of fire safety management for the building.

In accordance with the commentary to PAS 9980 clause 5, the *consequences* of an external fire set out below are deemed as not unsafe and can form the basis of acceptability criteria for a risk-based approach. The below has therefore been adopted as the basis of the benchmark with which to judge an existing building's external wall construction.

- Fire spread that that is likely to result in only limited secondary fires and/or either occur at a rate within expectations for a building of this height, or at a higher but still tolerable rate, given the circumstances at the building in question.
- Occupants in places to which fire has spread are not unduly harmed, or prevented from escaping, by the time such secondary fires occur.
- Secondary fires do not compromise the communal means of escape before those needing to use the escape routes have left the building.
- Fire and rescue service intervention is likely to be effective in avoiding undue secondary fires, or in ensuring that occupants at risk are not prevented from escaping or can be rescued.

From the above, the following (singly or in combination) are indicative of a situation which is unsafe:

- Extremely rapid external fire spread.
- Fire spread that gives rise to widespread secondary fires, resulting in occupants being harmed or unable to escape.
- A fire that spreads in such a way that communal means of escape are compromised before occupants can use them.
- A fire that compromises fire and rescues entry or exit points or the inability of the fire and rescue service intervention to prevent the above.

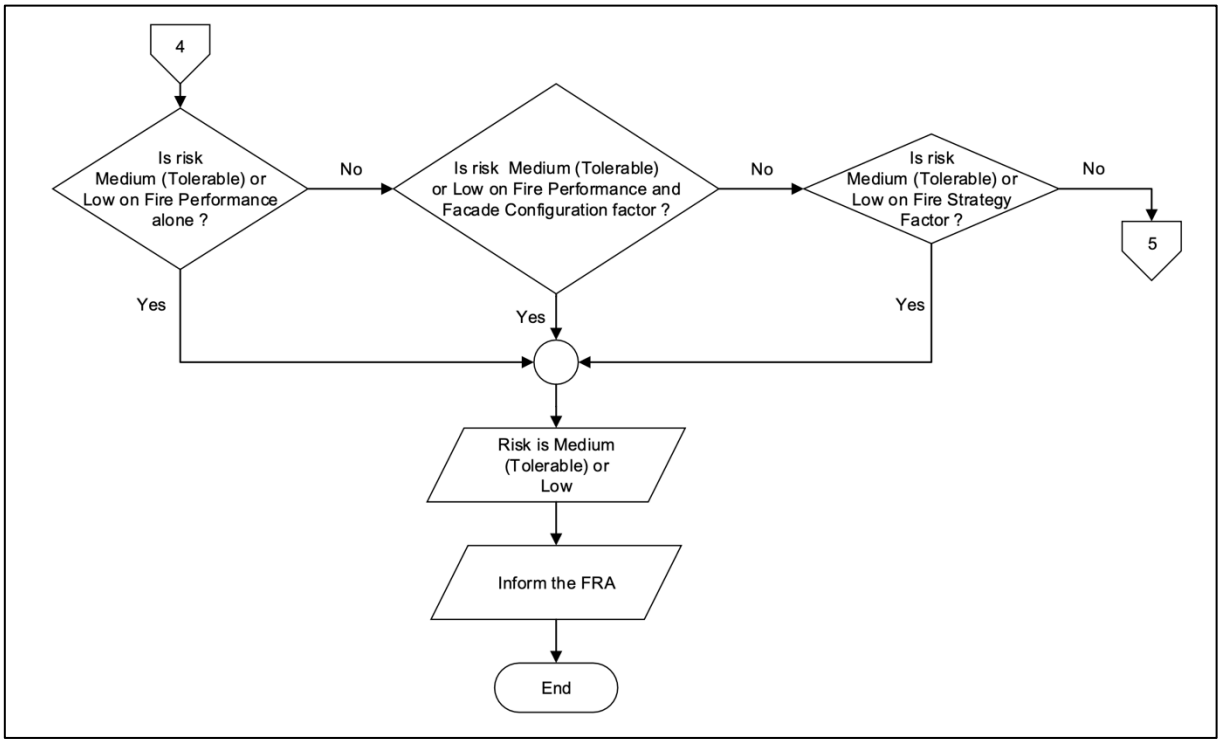
B.4.2 Risk Rating (Methods)

PAS 9980 Section 7 states that risk should be scaled (relative to 'normal' external wall construction) from low to high, with examples of masonry construction being cited as low, and Category 3 ACM being cited as high.

PAS 9980 also expects that the level of detail required for the FRAEW be proportionate to the risk and or complexity of the external wall construction, and it includes for a Basic or a Fire Engineered appraisal.

The methods documented in this report follow the Basic appraisal as summarised in Figure 15.

Figure 15: The DFC Basic appraisal method



B.5 Step 5: Review and Determine Outcome

B.5.1 Risk Outcome

PAS 9980 Step 5 is to benchmark risk and determine an overall risk outcome.

With reference PAS 9980 Figure 2 and associated informative text, PAS 9980 uses risk outcome terminology as summarised below:

- Low: The rate and extent of fire spread via the external wall construction is within normal expectation and risk is sufficiently low that no remediation is required.
- Medium (Tolerable): Risk and/or extent is heighted but is nevertheless considered to be tolerable. There is potential to accept the heightened risk (subject to periodic review) provided any *risk-proportionate actions* are undertaken.
- Medium (Uncertain): Risk might be heighted, but it is not possible to determine that the risk is so high as to require risk reduction or sufficiently low that it can be tolerated.
- Medium (Upper): Risk is heightened to an extent beyond that which can be tolerated and *risk reduction* is required.
- High: Risk is significantly heightened, and *risk reduction* (*remediation* or *mitigation*) is required.

Any assessment in accordance with PAS 9980 is subjective and includes uncertainty. Therefore, DFCs assessment typically requires lower and upper bound assessments:

- Lower Bound: Assessment of as-built construction as accurately as possible, and where there is uncertainty, err towards optimism.
- Upper Bound: Assessment of as-built construction as accurately as possible, and where there is uncertainty, err towards conservatism.

B.5.2 Benchmarking of Risk Ratings

PAS 9980 Step 5 requires that the overall risk rating be benchmarked against known outcomes.

DFC has used the guidance in PAS 9980, fire incident data, fire testing data and engineering knowledge and experience to derive the benchmarking of risk as shown in Figure 16.

Figure 16: DFC benchmarking of risk ratings and outcomes

Benchmark Examples	Cat 3 ACM	Polystyrene	HPL Standard	Thin timber	Thick timber	HPL Fire Retardant	Category 2 ACM	BR 135 compliant	Linear Route	Brick cavity wall
Rating	High			Medium		Tolerable		Low		
Likely Rate	*Very fast*			*Fast*		*Faster*		*Normal*		
Likely Extent	*Uncontrolled*			*Far*		*Further*		*Normal*		
Likely Heat	*Very high*			*High*		*Higher*		*Normal*		

Notes:
1 The benchmarks are based on experience and professional judgement, and as such are approximate. DFC is funding research to enable quantified benchmarking of different systems and will publish the information in due course.

B.5.3 Risk Reduction Action

Unless there is clearly only one single credible means by which risk can be reduced identification, evacuation and selection of risk reduction options requires input from multiple stake holders.

Therefore, in such circumstances, it is not possible for risk reduction measures to be defined by an assessment in accordance with PAS 9980 or an external wall risk appraiser in isolation and a separate study is required.

Appendix C – DFC FRAEW Methods

C.1 External Wall Constructions (General)

C.1.1 PAS 9980 Step 4: Identify Risk Factors

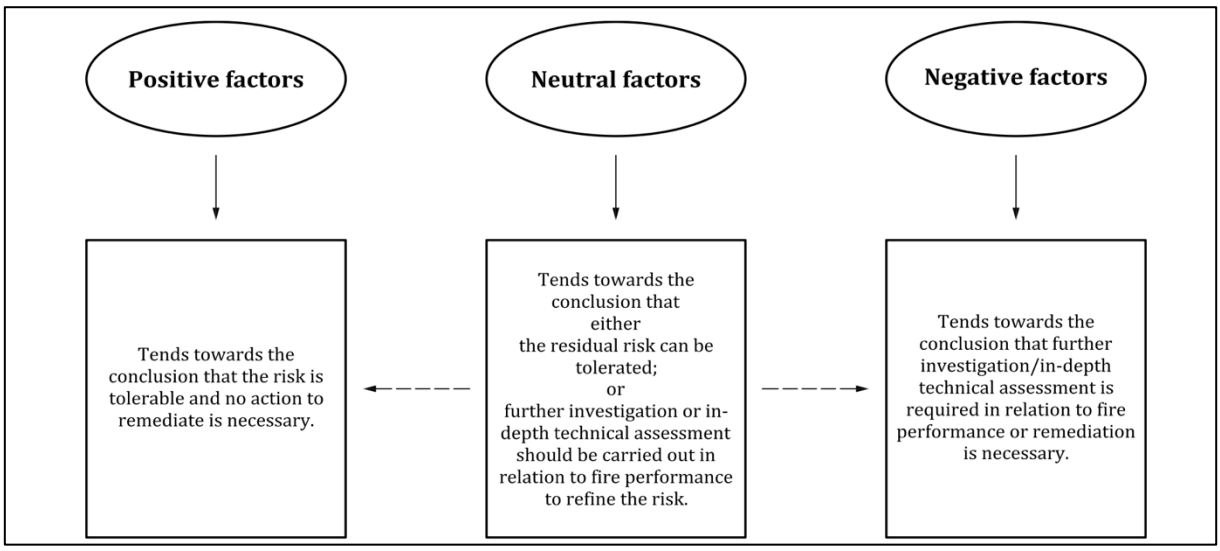
PAS 9980 Figure 1 identifies three key risk factors that should be considered in a Basic FRAEW:

1. **Fire performance risk factors** – are those influencing the likely speed and extent of fire spread by virtue of the fundamental properties, and fire behaviour, of the materials, components and systems comprising the external wall construction, how they are configured together and the quality of their installation within the wall build-ups on the building.
2. **Facade configuration risk factors** – are those factors influencing the likely speed and extent of fire spread by virtue of, for example:
   - The extent to which the building is covered by combustible cladding and external wall construction (e.g. partially clad or fully clad),
   - The continuity of combustible cladding sections and their orientation (e.g. horizontal or vertical),
   - The presence or otherwise of continuous cavities and how they are protected against undue fire spread via the cavity.
   - The extent of openings in the external building envelope that would allow ignition of the cladding from flaming combustion originating inside the building and entry routes back in, and
   - The location of the cladding in relation to the potential for fires of external origin to ignite the cladding.
3. **Fire strategy/ hazard risk factors** – are those which influence the ability of occupants to escape once fire occurs and spreads via the external wall construction to other parts of the building. It also includes those that influence the ability of the fire and rescue service to intervene effectively. Such factors relate to elements of the fire safety design of the building.

C.1.2 PAS 9980 Step 4: Consider Contribution to Overall Risk

PAS 9980 Step 4 recommends that the key contributors to overall risk be considered in terms of positive, neutral and negative impacts (see Figure 17).

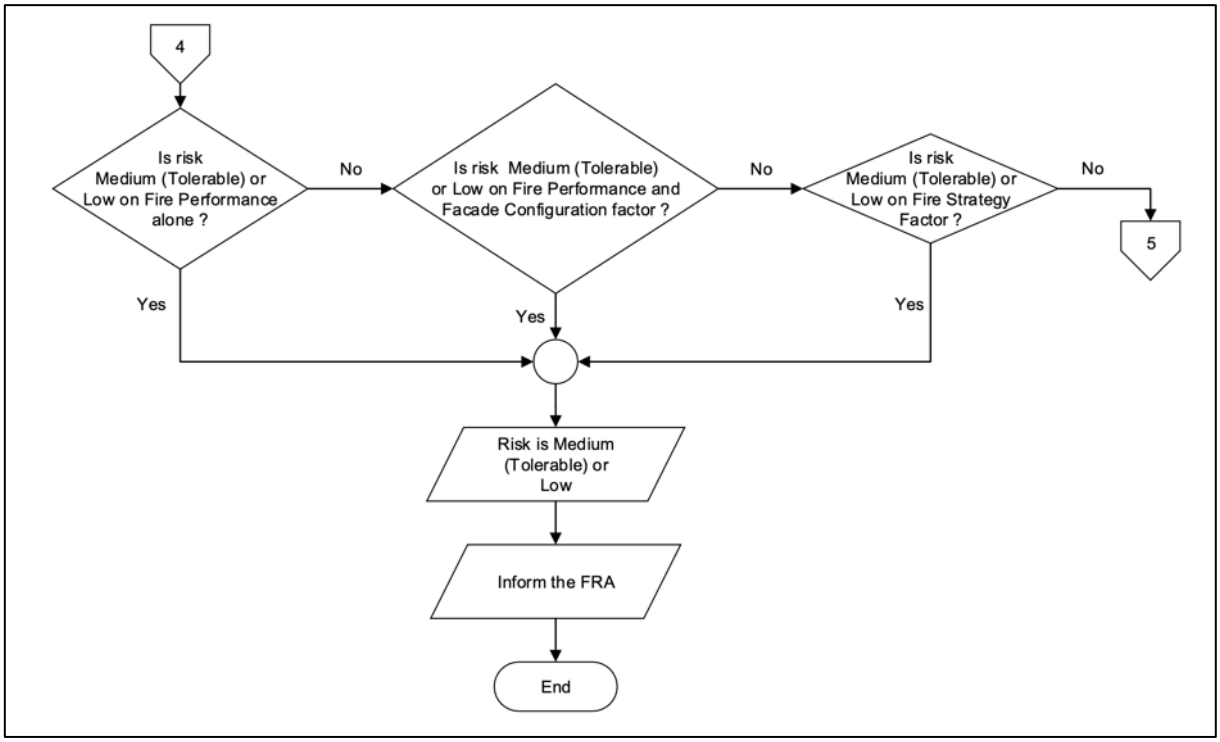
Figure 17: PAS 9980 Figure 5 – possible outcome of risk factor weighting



As per PAS 9980 Figures 6, 7, 8 and these contributors are applied sequentially to the fire performance factor, facade configuration and fire strategy factor in accordance with process defined below and in Figure 18 to arrive at an overall risk rating.

1. As a baseline, the highest risk of external fire spread on this scale equates to the extremely rapid fire spread seen in the fire at Grenfell Tower and in other fires involving similar cladding systems with metal composite material, particularly Category 3 ACM.
2. Risk factor analysis is intended to enable the positioning of the particular risk somewhere to the right of this baseline starting point. It is a three-stage process.
3. The fire performance factor considers whether fire spread via the external wall construction is unduly rapid (i.e. not low enough to be tolerable) or whether here is sufficient evidence to suggest that, while the rate of fire spread might be higher than normal expectations, it is still tolerable.
4. If by consideration of the fire performance factor alone, risk is not sufficiently low, the next step is to consider the facade configuration factor.
5. If by consideration of the fire performance factor and the facade configuration factor, risk is not sufficiently low, the next step is to consider the fire strategy factor.

Figure 18: Sequential application of contributors to overall risk rating



C.2 Spandrel Panels

Where appropriate, the risk associate with spandrel panels is assessed in accordance with the methodology defined in Appendix D.

Appendix D – Spandrel Panel FRAEW

D.1 Description and Type

Spandrel panels are typically used within other systems (e.g. glazed curtain walling systems) to cover junctions with internal floors or walls.

The scope of this Appendix is limited to sandwich panels comprising an internal face, a core and an external face. The following types of spandrels are within the scope of this Appendix. In all cases, it is assumed that there is no fire barrier within the panel.

Table 9: Spandrel panel types

Type	Inner Face	Core	Outer Face
1	None or not *combustible*	Not *combustible*	None or not *combustible*
2	None or not *combustible*	*Thermoset*, *charring*	Not *combustible*
3	Steel	*Thermoplastic*	Not *combustible*
4	Not steel	*Thermoplastic*	Any

Spandrel panels also vary in size as summarised below.

Table 10: Spandrel panel sizes

Size	Panel Height
A	Floor or wall zone only
B	Less than half a storey-height or flat width
C	More than half a storey-height or flat width

D.2 Fire Performance

Provided fire stopping to the rear of any spandrel panel is adequate, the fire performance of the panel types is as summarised below:

- Type 1: No *combustible materials*: *hazard* is no greater than that associated with ADB.
- Type 2: *Thermoset* insulations have a low thermal inertia and do ignite readily when their surfaces are *exposed*. However, the likelihood of ignition is reduced by encapsulating the insulation and they also char and do not exhibit self-sustaining combustion. Therefore, the *hazard* is slightly greater than that associated with ADB.
- Type 3: The *hazard* is not significantly greater than that associated with ADB provided at least the internal face of the panel is steel because the steel 'protects the insulation' and reduces the likelihood of fire spread via the spandrel.
- Type 4: Fire can spread rapidly and extensively via thermoplastics. Therefore, the *hazard* is greater than that associated with ADB.

Therefore, the fire performance benchmarks for spandrel panels are as summarised below.

Table 11: Fire performance benchmarking for spandrel panel types

Benchmark Examples	Type 4		Type 3	Type 2	Type 1
EWSxxx					
Rating	High	Medium	Tolerable	Low	
Likely Rate	*Very fast*	*Fast*	*Faster*	*Normal*	
Likely Extent	*Uncontrolled*	*Far*	*Further*	*Normal*	
Likely Heat	*Very high*	*High*	*Higher*	*Normal*	

Therefore, the risk rating is at least as low as Medium (Tolerable) for Types 1, 2 and 3 when considering the fire performance factor in isolation and risk can be confirmed as being sufficiently low without the need to consider the facade configuration or fire strategy factors.

D.3 Facade Configuration

For Type 4, the hazard is a function of the size, as summarised below:

- Size A: The panel is limited to the internal compartmentation zone, and as such, the probability of fire spread between flats via the panel is no greater than that associated with fire spread via windows or openings. Additionally, the panels are not large enough to constitute a medium for fire spread over the walls of the building. As such, the risk of fire spread is no greater than that associated with ADB.
- Size B: The panel size is such that the probability of fire spread between flats via the panel is greater than that associated with ADB, but the panels are small enough that they do not constitute a medium for fire spread over the walls of the building. As such, the risk of fire spread is slightly greater than that associated with ADB.
- Size C: The size of the panel is sufficiently large that panels could be a medium for fire spread over the walls of the building.

Therefore, the fire performance benchmarks for Type 4 panels can be modified as function of panel size as summarised below.

Table 12: Fire performance benchmarking for spandrel panel types

Benchmark Examples	Size C		Size B	Size A
Rating	High	Medium	Tolerable	Low

Therefore, the risk rating is as least as low as Medium (Tolerable) for Size A and Size B Type 4 panels when considering the fire performance and facade configuration factors in isolation and risk can be confirmed as being sufficiently low without the need to consider fire strategy factor.

For Type 4 Size C panels, the risk cannot be confirmed as being at least as low as Medium (Tolerable) when considering fire performance and facade configuration factors only, and as such, consideration must be given to the fire strategy factor.

Appendix E – Fire Performance Factors for FRAEWs

E.1 Principles

The fire performance factor reflects the external wall's resistance to fire spread, which is a function of the combustibility of the materials used in the external walls and any fire resistance provided by the internal construction or within the external walls. It is specific to the wall construction, but not influenced by the building specific usage of the wall construction (i.e. extent of coverage).

Where there is uncertainty about the materials used in the external wall construction or the resistance to fire spread within the wall construction, it should be conservatively assumed that the *hazard* associated with the wall construction is 'high'.

E.2 Materials and Products

The thermodynamic and thermomechanic characteristics of relevant products that are used to assess the fire performance factor are summarised below.

Brick

Brick is *non-combustible*. Non-loadbearing walls constructed from clay or concrete bricks at least 75mm thick achieve *60EI* from each side separately. Brick has a high thermal inertia and as such acts as a heat sink.

Therefore, the governing characteristics of brick are:

- Thermodynamic: Brick is not *combustible* and as such does not contribute to the rate or total heat release, nor is it a medium for fire spread over the walls of the building. Brick can also act as a heat sink and 'remove' heat from a fire (particularly heat within cavities).
- Thermomechanic: Provided it has been installed correctly, brick will remain in place and not deteriorate mechanically. As such it provides a high degree of encapsulation to cavities.

Polyisocyanurate (PIR) Insulation

Polyisocyanurate ("PIR") is a combustion modified, *thermoset*, *charring* polymer with low thermal inertia.

This means that the surface of the *product* is readily ignitable, and flame can spread rapidly over the surface, but that as the *product* pyrolyses a char forms that prevents / inhibits further combustion.

Many such insulation *products* include foil facings that inhibit ignition and inhibit / prevent flame spread across the surface.

PIR insulation *products* have a heat of combustion of around 26MJ/kg to 29MJ/kg. They are *combustible* and can have classifications of *Class B*, *Class C* or *Class D* (as influenced by the foil facing). Whilst these ratings are indicators of ignitability and rate of surface flame spread (in a room enclosure), they are not necessarily indicators of the relative contribution to fire spread, rate of heat release or total heat release in an external wall system.

Therefore, regardless of classification, the governing characteristics of PIR insulations are:

- Thermodynamic: The surface readily ignitable and rapid flame spread over the surface could occur. Unless used in combination with other *combustible products*, any burning would be limited to the immediate vicinity of any flames and the contribution to fire growth or overall heat of combustion is low.
- Thermomechanic: The *product* would char and eventually burn through where exposed to direct heat, but not rapidly. Thermal expansion is negligible. The rate of char is such that PIR and

phenolic boards can achieve fire resistance (both to structural framing systems and when used behind cavity barriers).

Polystyrene

Polystyrene is a rigid, closed cell, thermoplastic foam material that with a low thermal inertia. When exposed to temperatures of approximately 200ºC it melts or sublimes and combusts.

Typically, polystyrene that is used in external wall construction is in one of two forms; extruded polystyrene ("XPS") and expanded polystyrene ("EPS"). These products can have different properties at low heat fluxes, but at higher heat fluxes (as would occur in a building fire), they have similar properties.

Polystyrene has a heat of combustion of around 40MJ/kg.

This means that it is readily ignitable and can support self-sustaining combustion.

It will ignite when exposed to a naked flame around 360℃ and autoignite around 427℃. Once ignited it can sustain ignition and spread rapidly over its surface via dripping and flaming droplets with the ability to burn away from its source of ignition.

Therefore, the characteristics of polystyrene insulations (both XPS and EPS) are:

- Thermodynamic: The surface material is readily ignitable and can be a medium for fire spread beyond the area of flames (even in the absence of other combustible materials).
- Thermomechanic: The material burns, melts and can result in voids being created.

Aluminium

Aluminium is a metal and is not *combustible*. It starts to lose strength at around 200ºC and melts at around 600ºC.

Therefore, it does not burn. Whether it melts depends on its thickness and the extent of fire exposure. Thin aluminium (e.g. that used in *ACM* panels) would heat up quickly and is likely to melt when exposed to flames. However, thicker aluminium (e.g. 3mm thick aluminium cladding panels and cladding rails) does not necessarily melt, particularly if heat can be conducted and radiated away from the *product*.

Therefore, the characteristics of aluminium are:

- Thermodynamic: Aluminium will not burn and does not contribute to the heat of fire or spread of fire.
- Thermomechanic: Aluminium can melt and distort.

Glass

Glass is *non-combustible*, but laminated glass has *combustible* interlayers. That said, the hazard associated with typical laminated glazing is low to negligible.

Glass panels can crack and fracture when exposed to fire.

Therefore, the governing characteristics of brick are:

- Thermodynamic: Glass is not *combustible* and as such does not contribute to the rate or total heat release, nor is it a medium for fire spread over the walls of the building.
- Thermomechanic: Glass does not significantly degrade materially, but it can crack, fracture and detach.

E.3 Systems

E.3.1 Cavity Wall Construction

Hazards and Strategy Identification

PAS 9980 Annex G recommends that potential fire and smoke spread *hazards* be identified along with the associated strategy(s) for resisting fire and smoke spread. The purpose of this is to identify the components of the wall system that most important in resisting fire spread.

Cavity walls comprise four key components:

- Substrate: The inner part of the wall construction. They are typically brick, block, structural faming systems ("SFS") or structural insulated panels ("SIPs") that are constructed from the top surface of one floor to the underside of the floor above ("infill" systems).
- Cavity and insulation: There is a cavity (typically unventilated but might have a drainage cavity or weep holes) between the substrate and the cladding. The cavity might contain insulation that fills the cavity, insulation that partially fills the cavity or no insulation.
- Cladding: For cavity walls, the cladding is more of an outer leaf of wall construction than a cladding system. It is typically sealed (or has small holes such as weep holes) and encapsulates the cavity (as opposed to being a rainscreen).
- Cavity barriers: Whether or not *cavity barriers* are required depends on the degree of encapsulation provided to the cavity by the substrate and cladding. Where there is a high degree of encapsulation (e.g. brick substrate and cladding), *cavity barriers* are not required, but where the encapsulation is less robust, *cavity barriers* might be required.

The *hazards* associated with the construction are:

- Pathways for fire and smoke spread within the construction if the encapsulation and/or cavity barriers are not adequate.
- Fire spread via the cladding if it is *combustible*.

The *hazard* reduction strategy is a combination of:

- Isolation (i.e. limiting coverage): The location and extent of coverage of a wall construction system
- Encapsulation: *Combustible materials* and cavities are encapsulated by construction that is not *combustible* and is adequately fire-resisting (i.e. prevents fire penetration to the *combustible* material/cavity).
- Subdivision: *Combustible* materials and/or cavities are subdivided by construction that adequately resists fire spread.

Cavity wall construction resists fire spread by encapsulation or a combination of partial encapsulation and partial subdivision or partial (see PAS 9980 Annex G.3.5). Therefore, adequacy of resistance to fire spread around internal compartment walls and internal compartment floors, within concealed spaces and over the walls of the building is sensitive to:

- The fire resistance of the encapsulation (i.e. the substrate, the cladding, and cavity edge protection including around openings), or
- When encapsulation is partial, the fire resistance of any *cavity barriers* within the cavity.
- The combustibility of the cladding.

It can be shown that cavity walls comprising inner and outer leaves that achieve at least *60EI* from each side separately and a *limited combustibility* or better outer leaf adequately resist fire spread (i.e. have a positive fire performance factor in the context of PAS 9980).

Key Fire Performance Factors

Therefore, the principles summarised in table below are applied to fire performance factors and scoring where appropriate.

Table 13: Fire performance principles for cavity wall construction

Component	Positive	Neutral	Negative
Inner Wall Fire Resistance	*60EI.*	*30EI.*	Less than *30EI.*
Cavity Edge Fire Resistance	*30EI* or more.	Sealed so as to prevent air flows.	Not adequately sealed.
Cavity Materials (where encapsulation is total)	Any *combustibility*.	N/R.	N/R.
Cavity Materials (where encapsulation is not total)	No insulation or *Class B* or better.	*Class C* insulation.	*Class D* or worse insulation.
Cavity Subdivision (where encapsulation is total)	Subdivision not required.	N/R.	N/R.
Cavity Subdivision (where encapsulation is not total)	Fire resistance equal to compartment floors and walls.	*60EI.*	Less than *60EI.*
Cladding Fire Resistance	*60EI.*	*30EI.*	Less than *30EI.*
Fire Spread via Cladding	Cladding is not *combustible*.	Cladding is homogeneous and achieves *Class B* without fire retardants.	Cladding is readily ignitable and can lead to fire spread beyond the original fire.

E.3.2 Curtain Wall Construction

Hazards and Strategy Identification

Curtain wall systems typically comprise a framing system with glazing and might include some inner construction (e.g. a dry lined structural framing system) behind parts of the curtain wall (e.g. opaque glazing or infill panels).

The curtain walling system typically comprises:

- Areas of glazing and/or windows in a framing system.

- Spandrel zones / panels around floors and or internal walls.
- Opaque sections of glazing or infill panels.

Key Performance Factors

Therefore, the fire performance factor is determined from the inner construction performance, the spandrel performance and the 'cladding' performance (where the cladding is glazing and any infill panels).

The fire performance factors are typically as summarised below.

The inner construction could be a medium for fire spread itself.

Table 14: Inner construction fire performance

Sub-Item	Positive	Neutral	Negative
Combustible materials	Only small, isolated amounts of *combustible* inner construction.	*Combustible* materials are limited to thermoset, charring polymers such as Phenolic and PIR.	Extensive *combustible* materials that are not thermoset, charring polymers.
Protection of *combustible* materials	*Combustible* materials are encapsulated in fire resisting construction.	*Combustible* materials are encapsulated in construction that is not *combustible*, or *combustible* materials are contained within separate compartments by firestopping.	*Combustible* materials are exposed and could be a medium for extensive fire spread.

The spandrel zone provides resistance to fire spread around internal compartmentation via the external wall system and provides a potential 'fire break' to fire spread via the external surface of the cladding system.

Table 15: Spandrel zone fire performance

Sub-Item	Positive	Neutral	Negative
Internal Fire Spread	Spandrels are adequately fire stopped to the same standard as internal compartmentation.	Spandrels have some resistance to fire spread around internal compartmentation.	Spandrels would provide little resistance to fire spread around internal compartmentation.
External Fire Spread	Spandrels are not *combustible* or steel encased, thermoset, charring foam and are large enough to inhibit fire spread around internal compartmentation.	Spandrels are steel encased foam, or metal encased thermoset, charring foam and are large enough to inhibit fire spread around internal compartmentation.	Spandrels are *combustible* or not large enough to inhibit fire spread around internal compartmentation.

The cladding performance considers whether the cladding (glazing and infill panels) is a medium for fire spread.

Table 16: Cladding fire performance

Sub-Item	Positive	Neutral	Negative
Combustible Materials	H_c ~ 3MJ/kg or *Class B* or better that would be involved in fire.	H_c < 30MJ/kg or *Class C* that would be involved in fire.	H_c> 30MJ/kg or *Class D* or worse that would be involved in fire.
Panel construction	Will not fall off or deteriorate in fire and there small or no gaps within cladding.	Might fall off or deteriorate in fire and/or there are gaps within cladding.	Likely to fall off or deteriorate in fire and/or there are large gaps within cladding.

Quality Assurance

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Revision	Date	Issue Description	Author	Checked
02	03 Apr 2025	Typo corrections.	N Butterworth	N Butterworth
				
01	02 Apr 2025	Issued following Thomasons and internal review.	N Butterworth	N Swailes
				
00	31 Mar 2025	Issued for Thomasons review and comment.	N Butterworth	N Butterworth