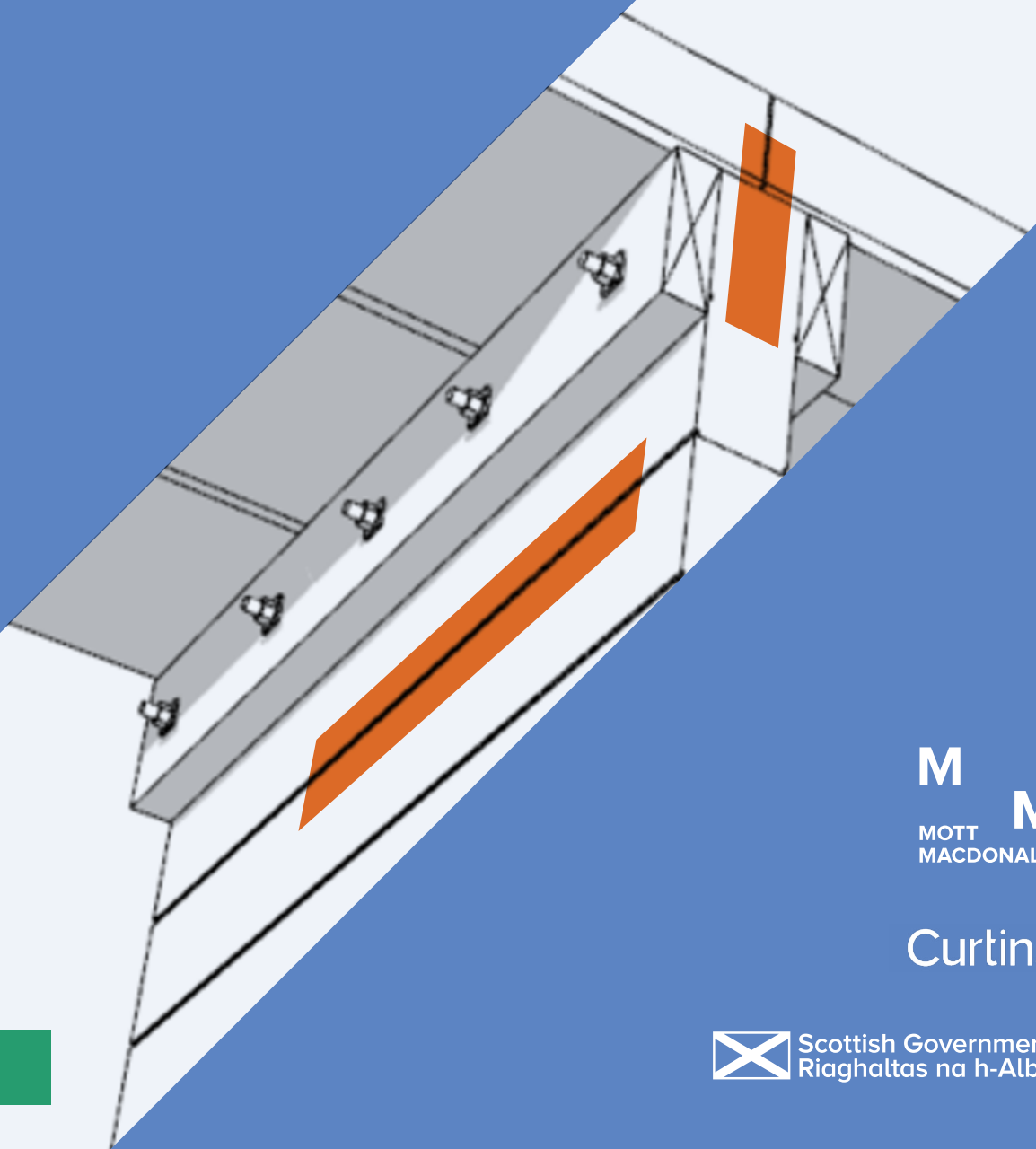


# RAAC Scottish residential property guidance (Scotland)

Part 1



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## 1.0 Background and aims of this guidance

This guidance is specifically provided for the appraisal, assessment and remediation of Reinforced Autoclaved Aerated Concrete (RAAC) roofs in residential properties in Scotland. Part 1 of the guidance is intended to be adopted by Structural Engineers and Chartered Surveyors who will be responsible for initially appraising RAAC roof panel construction on a case-by-case basis using their own professional judgement, as part of a risk-based approach.

This document is aimed at individual residential properties in Scotland but is equally viable for residential estates with multiple properties. Building owners are encouraged to collaborate with others who have similar archetypes, as this can potentially unlock time efficiencies and achieve economies of scale.

In 2019, SCOSS published a safety alert 'Failure of Reinforced Autoclaved Aerated Concrete (RAAC) Planks' which identified additional concerns about the structural safety of this form of construction to those historically identified within (BRE 2002). In February 2022, the Institution of Structural Engineers (IStructE) published supporting guidance titled Reinforced Autoclaved Aerated Concrete Panels – Investigation and Assessment. In April 2023 the Institution of Structural Engineers (IStructE) published more guidance titled Reinforced Autoclaved Aerated Concrete (RAAC) Investigation and Assessment – Further Guidance which provided additional information for the assessment of RAAC panels. These two guides have been written by members of the IStructE RAAC Study Group to assist with the approach to RAAC assessment amongst the structural engineering community. It is recommended that the reader familiarises themselves with these guides as well as the SCOSS alerts on RAAC

By mid-2025 there were at least five publicly recorded RAAC panel failures; (CROSS, 2025) (HSE, 2025) (SCOSS, May 2019) (CROSS, October 2007) (CROSS, April 2020), although more failures are known of, but not reported. The Department of Education (DfE) cites less widely known failures in their updated guidance (DfE, Sep 2023) on RAAC that had the effect of temporarily closing a number of schools in England to allow for assessment and remediation measures to be put in place.

More recently, following a period of information collection on housing stock in Scotland, the Building Standards Division, Local Government and Housing Directorate (Scottish Government) approached IStructE to ask for guidance to be produced in relation to a significant number of Scottish residential properties that contain RAAC in their flat roof construction, due to safety concerns raised during information collection on RAAC in residential properties.

Concerns therefore persist with regards to recent RAAC failures. The IStructE guidance (IStructE, April 2023) states the eight key risk factors for RAAC, as noted below:

1. **Low End Bearing**
2. **Inadequate Anchorage reinforcement**
3. **Cut panels**
4. **Cracking**
5. **Builder works/building modifications**
6. **Water ingress**
7. **Deflection**
8. **Adverse loading**

Where RAAC roof panels are identified it is strongly recommended that access to the roof above those panels is strictly managed, in accordance with (HSE, 2025) until the adequacy of the panels is assured. Based on these concerns it is considered that works such as re-roofing or access to the RAAC roof panels should not proceed without proper assessment by a competent person as laid out in Part 2 of this guidance.

This guidance is focused on the application of RAAC within flat roofs. For the purposes of this guidance, and in line with the definition within BS 6229 (BSi, 2018), flat roofs are considered as those with roof coverings at slopes not exceeding 10° to the horizontal, or marginally greater than 10° provided the design conditions are similar. For sloped RAAC roof panels, and RAAC floor panels this guidance may also be applicable, but will require additional consideration, particularly in relation to bearing, end shear of a sloping panel on a flat bearing and increased loading. Load bearing or non-load bearing RAAC wall panels are not covered in the scope of this guidance.

This guidance is in relation to the structural aspects, other aspects such as those relating to fire, insulation, condensation risk are out-with scope of this guidance. It is worthy of note that adding insulation under RAAC panels during remediation may increase the moisture content in the panel and increase the risk of rebar corrosion and panel deterioration. Specialist advice should be sought as necessary.

## 2.0 Scope of guidance:

General guidance on the assessment and remediation of RAAC panels is set out in IStructE February 2022, April 2023 guidance. For residential properties a streamlined approach is recommended. It is intended to adopt a three-stage process, with a potential to avoid Stage 2. This is illustrated in Figure 1 below.

For the purposes of the guidance, it is considered that this person will be an experienced Structural Engineer or an experienced Chartered Surveyor familiar with asbestos recognition and identifying and assessing RAAC.

Part 2 of this guidance is prepared for the benefit of the Structural Engineer carrying out stage 2 and/or stage 3 of the process, who has been identified as being responsible for: -

- the detailed risk assessment and options appraisal of the residential properties that have been confirmed to contain RAAC panels as part of their flat roof structure. In accordance with the IStructE, April 2023 publication.
- the design of the appropriate permanent remedial solution

The Part 2 guidance includes typical structural remedial details and guidance on good practice. The actual remedials need to be designed / tailored for the individual property/archetype and submitted for building warrant. The structural designs should be carried out by a structural engineering practice and certified by an SER certifier for Scottish Building Standards purposes.

### 2.1 Stage 1 RAAC triage appraisal

#### Stage 1 – RAAC TRIAGE APPRAISAL

RAAC is identified, dimensions recorded and its visual condition recorded, by a Chartered Surveyor or Structural Engineer. At this stage any immediate requirement for propping will be highlighted to the owner, carried out in accordance with this Part 1 of the guidance.

### 2.2 Stage 2 - DETAILED ASSESSMENT (IF REQUIRED)

RAAC detailed assessment is carried out in accordance with (IStructE, April 2023), including intrusive investigation.

### 2.3 Stage 3 – PERMANENT SOLUTIONS

Assessment by a Structural Engineer on the most appropriate form of Permanent Solution. Carried out in accordance with Part 2 of the guidance.

Part 1 of this guidance is prepared for the benefit of the person carrying out stage 1 of this process, who has been identified as being responsible for: -

- the information collection and
- initial visual survey and risk appraisal of the RAAC panels

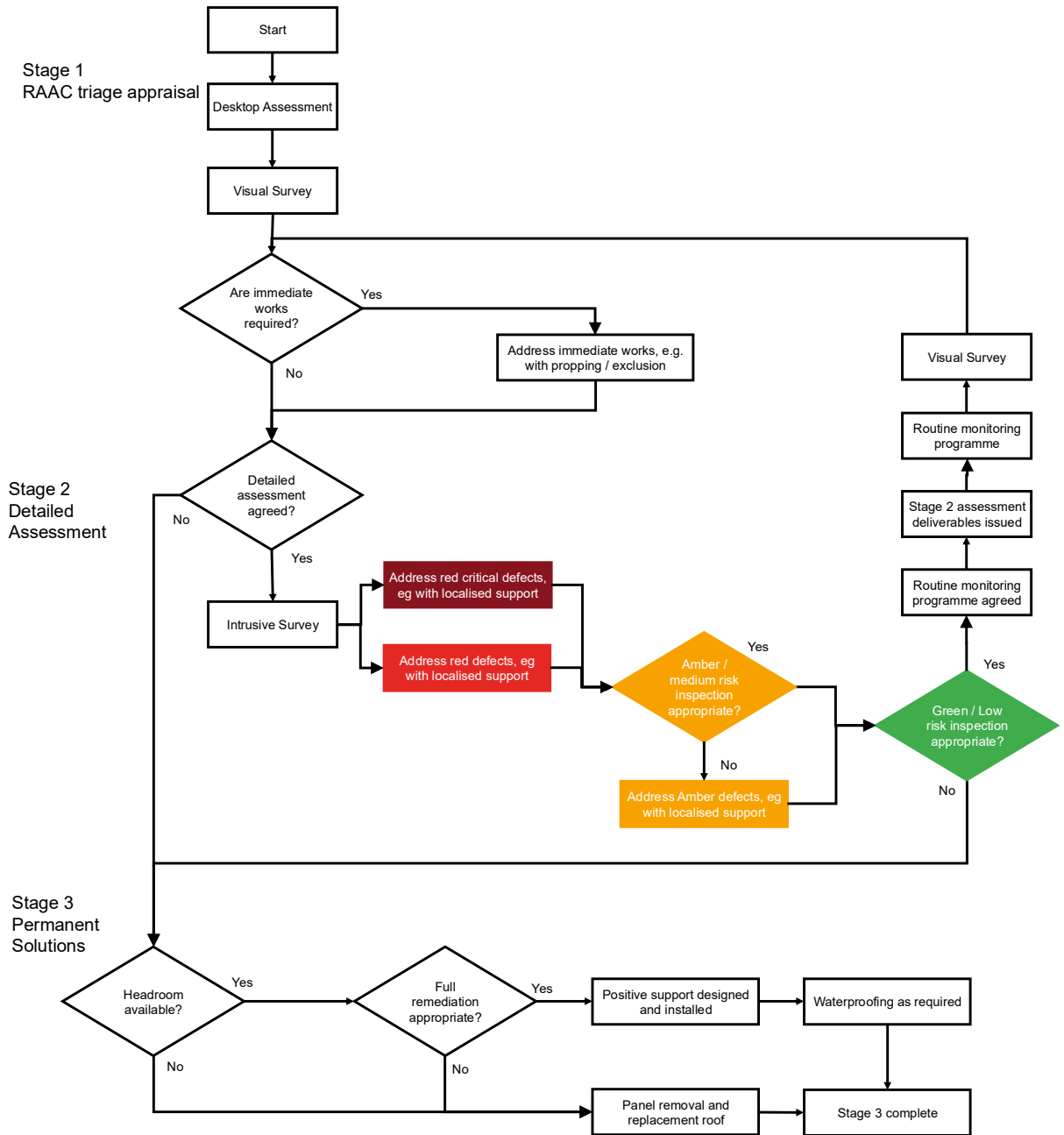


Figure 1: Flow Chart

## 3.0 Stage 1 – RAAC Triage/ Information Collection

### This is split into Desktop preparation, survey and deliverables

It is assumed that the presence of RAAC has been confirmed or is suspected.

### 3.1 Stage 1a - Desktop assessment & initial survey

The desktop assessment gathers accurate information about the property prior to the inspection.

1. **Review Relevant RAAC Guidance:** Such as the latest guidance as provided in references section.
2. **Collate Building Records:** Gather all available building information, such as:
  - Initial construction date.
  - Historic building plans, sections, elevations, details and specifications.
  - Record photographs.
  - Information on alterations, extensions, or interventions involving RAAC panels.
  - Re-roofing works. Dates for this and whether roofing was replacement or overlay.
  - Consult any available asbestos register and study the drawings and specifications for any references to asbestos or asbestos containing material (ACM) and/or references to RAAC to inform the later process. If there is no asbestos register, an asbestos survey will be required prior to any intrusive works.
3. **Consider Property Age:** Assess the construction and modification dates of the properties to identify the risk of the presence of RAAC. Buildings constructed between 1950 and 1995 are at the highest risk of the presence of RAAC, but modifications to older buildings may also involve RAAC.
4. **Raise Awareness:** Inform owners about potential risks if buildings are identified as containing RAAC. Owners are responsible for making their tenants aware. Depending on the condition, RAAC may be classified as a fragile roof.
5. **Archetypes:** For multiple properties, group the properties' "archetypes" and name or reference each house archetype at this stage, as required.

6. **Make Enquiry:** If multiple properties are being assessed, enquire from the client whether the archetype(s) in question has been previously assessed.
7. **Carry out a basic measured survey:** if appropriate building records are not available. Capture any architectural information that may be required later. For example, identify spans, support conditions, estimated wall thicknesses. The locations of any ceiling mounted items such as lighting and smoke/fire detection units should be recorded.
8. **Create plans:** on which the collated information can be recorded as the survey proceeds. This will allow the panels to be numbered individually, and defects identified. The plans should be at scale to identify and log defects.
9. **Anecdotal Information:** Record anecdotal information to enhance information collected by other means where appropriate and verify with the building owner, where unavailable through record keeping.
10. **Plan the stage 1 b Initial visual survey:**
  - Carry out risk assessments in advance of the survey in accordance with RICS guidance, considering inter alia fragile roofs and lone working (RICS, eff. February 2019).
  - Do not disrupt finishes whilst carrying out the visual survey. In the instances where full ceilings are present, the scope for appraisal may be very limited, it is recommended in these situations that an appropriate amount of ceiling will need to be removed as part of stage 2.
  - Do not traverse the roof unless it has been risk assessed, and mitigation measures put in place if required. In accordance with HSE guidance (HSE, Nov 2008, p. 5), the roof should be treated as fragile unless, or until, confirmed that it is not.
  - Surveys taken, immediately following a period of rain can be particularly useful in establishing whether the roof is ponding and to what extent.
  - Consider also safe vantage positions which may overlook, considering height and safety risks.
  - Online interactive imagery and panoramas e.g. from Google Streetview or Bing Maps can be useful in planning the inspection but beware of the limitations of this method.
  - Assimilate the information on asbestos from the Information Collection stage and seek advice from an asbestos specialist as required.
  - If it is found that ceilings obscure the RAAC soffit, undertaking a RAAC inspection may not be possible within an inhabited property. Defer the removal of ceilings or the creation of hatches to stage 2.

## 3.2 Stage 1b Visual Survey

Conduct an initial visual survey to confirm the presence of RAAC panels, appraise their condition, and identify risk factors. This may be carried out by annotating the Stage 1a measured survey.

### **Carry Out the Visual Survey to each Property Address:**

The aim of the survey is to triage the RAAC to inform the appropriate pathway from the flow chart in Figure 1. The Stage 1 Outcomes will be:

- I. Obtain dimensions and details for Stage 2 & 3
- II. RAAC risk appraisal - are immediate works required?

### **Visual Observations**

The key aspects of the visual survey are noted below. The (IStructE, April 2023) gives guidance on the form and scope of the site surveys and the defects that should be recorded. It is considered that the following risk factors should be recorded, if possible, during the visual inspection. For examples of RAAC defects, refer to Appendices 1.

For completeness, the (IStructE, April 2023) numbered references are shown: -

#### **1. Panel thickness (IStructE, April 2023, p. 3 (Section 2.2))**

- To be measured if accessible. This may reveal itself at service penetrations or roof lights.

#### **2. End bearing (IStructE, April 2023, pp. 5 (Section 3.1,3.2))**

- Measure supporting structure (wall, beams etc) widths, where accessible. If the load bearing walls cannot be clearly defined, measure all wall thicknesses.
- All visible steel beam widths onto which RAAC panels bear should be recorded.
- Service penetrations might reveal further information regarding the bearing length onto external walls but it is accepted that intrusive works are likely to be needed in this regard.

#### **3. Panels cut after manufacture (Visibly cut, eg at roof lights, tapering panels) (IStructE, April 2023, p. 6 (Section 3.3))**

- Record any openings for roof lights/services and take dimensions of the opening and the length of the panels either side.

#### **4. Cracking / Spalling / bossed areas defects (as viewed from the underside) (IStructE, April 2023, p. 6 (Section 3.4))**

- Record all cracking to the RAAC panels.

- Consider the location of the crack, particularly cracks within 500mm of the support.
- Attention is drawn to the potential of cracking in close proximity to the bearing, which may be difficult to detect if the crack occurs along the arris of the wall and the ceiling.
- Cracks may not be evident in photographs, sketch the crack patterns on the plans.
- Crack extents should also be recorded, as well as whether they are longitudinal or transverse to the panel. (IStructE, April 2023, p. 6 (Section 3.3))

**5. Builders work/ Modifications / Penetrations (IStructE, April 2023, p. 6 (Section 3.4))**

- Examples include chimneys, roof lights, vent pipes, where pipes have penetrated the panels, tapering panels or atypical panel lengths indicating cut panels.
- Record and take dimensions of any openings, including size and the positioning of the opening within the panel and width of the panels either side.

**6. Water ingress (IStructE, April 2023, p. 7 (Section 3.6))**

- Note current or historic water Leaks / Ingress / Condensation (Damp Survey) is the panel saturated?
- Take moisture readings in each room, only if asbestos not contained within any ceiling coating applied to the RAAC soffit, or the technique is fully non-intrusive. Moisture meter readings to be taken with the appropriate substrate setting. For moisture meter readings directly to RAAC panels the 'wood moisture equivalent' scale has been found to be appropriate.

**7. Deflection (IStructE, April 2023, p. 7 (Section 3.7))**

- A minimum recommended sample size for deflection measurements should be proportional to the size and scale of the building or structure being assessed but should typically not be less than 10% of the total number of panels
- Visual assessment is required to ensure the worst-case deflections are measured.
- Record if any panels sag below neighbouring panels and the magnitude of the step at worst. This is an indication that any key between these panels may be lost.
- Assess the worst deflection in each room and measure. Use of a self-levelling laser and tripod set above head height. (The midspan deflection  $\delta = \frac{1}{2}(L + R - 2M)$  where L, R = height above laser at left, right hand supports and M = height above laser at centre support)

## **8. Adverse Changes in Loading (IStructE, April 2023, p. 6 (Section 3.3))**

- Conduct a visual inspection, taking photographs of each panel and each significant load for future assessment purposes and longer-term monitoring purposes.
- Record ponding on the roof (review planks below ponding for signs of water ingress/excessive deflection)
- Record the siting of plant/water tanks/ air conditioning units
- Record the position of each photo and load on the drawing

## **9. General**

- Record any visible soffit reinforcement bar
- Record any ghosting or shadowing of rebar visible on the panel soffit.
- Record any other defects that are worthy of record and will assist in informing the intrusive part of the investigation.
- Note floor to ceiling heights for building warrant information. For stairs, ramps, and landings, it will be necessary to maintain a minimum clear headroom of 2.0m across the entire effective width, measured vertically from the pitch line of the flight or the landing surface. In enhanced apartments (e.g. living room) and kitchens, activity spaces require a minimum headroom of 1.8m. Where ceiling heights are to be altered, consult the local authority Building Standards department for verification.
- Note window locations and the height above each window and door as this will inform a suitable potential structural zone e.g. for structural support timbers. When modifying window heights or sizes, ensure compliance with building regulations, including ventilation, daylighting, collision safety, thermal performance, safety glass, safe cleaning, protective barriers, and escape window requirements.

### ***Dimensional survey***

Mark up the plan as the survey proceeds; include details including panel clear span and width, direction, number units. Refer to Appendix 2 for example.

### ***Immediate Propping Assessment***

The risk appraisal of the panels should be carried out based on the (IStructE, April 2023) criteria.

It is recommended that the surveyor/structural engineer engineer highlight critical risk RAAC panels, or those that are likely to become critical within the period prior to remediation, which may be in the region of 6-12 months or longer, to the building owner and act in accordance with IStructE guidance. These timescales are proposed on the basis that

the design and warrant submission process will generally involve a 6-12 months lead in prior to the remedial works commencing. It is recommended that any propping is designed and detailed by a Structural Engineer, with on-going monitoring.

“Critical” risk panels to the (IStructE, April 2023) *“requires urgent remedial works which may include taking out of use or temporary propping to allow the safe ongoing use of a building. Depending on the extent, this may be part or all of the building.”*

Examples of panel defects, requiring urgent action are noted below, please refer to (IStructE, April 2023) for more details on these definitions):

- Saturated panels – panels that are wet to the touch or have a moisture reading in excess of 20%
- Cut or modified panels; around a roof light.
- Bearing less than 75mm (with poorly placed transverse reinforcement)
- Panels with major cracking or spalling
- Panels with cracking with 500mm of the support
- Panels with excessive deflections particularly when ponding (i.e deflections > span/200)

Refer to Appendix 1 for examples of defects.

Where urgent action is required, the owner should be advised immediately, followed up with a formal report, with propping or decant recommended.

### 3.3 Stage 1c: Deliverables

**The stage 1 deliverable is expected to be a report, containing:**

- Known asbestos information and risks
- Any areas which are obscured by view, i.e. where by a ceiling/coating has prevented RAAC panels being observed.
- Panel information (refer to 3.2 above).
- Sketches/drawings and photographs, with critical span and bearing dimensions, as appropriate.
- Any areas where immediate action is required immediately (Follow up the verbal and email advice as soon as is reasonably practical).
- Information regarding potential loading changes, particularly over-roofing/re-roofing works.

These deliverables should provide the structural engineer with all necessary information to progress to stage 2/3. For multiple properties, this could also identify potential properties for carrying out intrusive surveys as part of the next phase of work, such as identifying vacant units or units exhibiting the worst examples of the aggregate of defects for consideration by the Structural Engineer in the next phase, if required.

## 4.0 Next steps following Stage 1 appraisal

To progress, following completion of Stage 1 there are four possible solutions, two permanent and two management strategy options with on-going monitoring, as identified in the Figure 1: Flow Chart.

### 1. Management Strategy

Application of the solutions require actions described in part 2 of the guidance with on-going monitoring. Monitoring frequency is to be in accordance with (IStructE, April 2023).

### 2. Permanent Solutions

This would include a positive support methodology, where RAAC has sufficient residual integrity. In situations where the RAAC has lost its integrity there is a potential for panel removal.

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BRE 2002 Building (Amendment) Regulations 2002 (SI 2002/440)

## Appendix 1 – Photographs of RAAC defects



**Appendix 1 – 1,2** Builderswork - panel holed for downpipe, with evidence of water ingress



**Appendix 1 – 3** Builderswork panel holed for downpipe – spalling, corroded longitudinal and transverse cut bars



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**Appendix 1 – 4** Builderswork has caused spalling of panel face exposing rebar



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**Appendix 1 – 5** Builderswork trimmings around skylights / roof hatches



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**Appendix 1 – 6** Exposed steel trimming strap supporting cut panel



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**Appendix 1 – 7** Cracking: crazing panel cracks within 500mm of bearing - visible through 'artex' type coating.



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**Appendix 1 – 8** Full transverse panel cracks within 500mm of the bearing

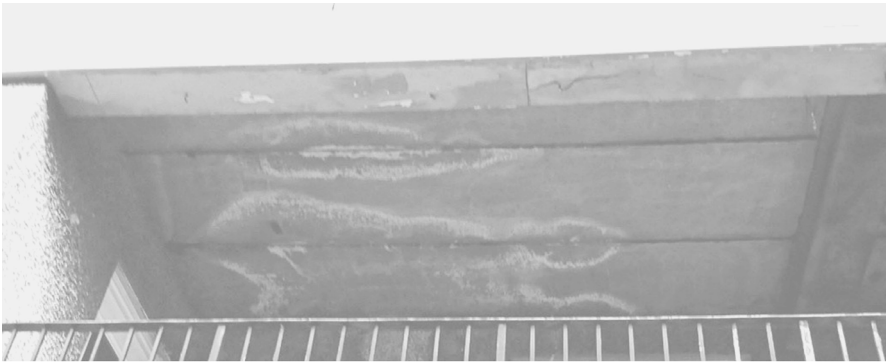


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**Appendix 1 – 9** Minor longitudinal cracking between panels. By itself not usually a significant concern



**Appendix 1 – 10,11** Severe water ingress: Damage at Skylight location



**Appendix 1 – 12** Water ingress: Severe in exposed soffit primarily through longitudinal joints. (Photo adjusted for brightness)



**Appendix 1 – 13** Water ingress: Rebar ghosting/shadowing evidencing water ingress



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**Appendix 1** – 14 Panels stepped down below adjacent panels





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