

RAAC Scottish residential property guidance (Scotland)

Part 2

IStructE Guide

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Scottish Government
Riaghaltas na h-Alba

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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. There are specific considerations for residential properties that make them different to other forms of RAAC containing buildings. This guidance should be read in conjunction with “RAAC – Residential property guidance (Scotland) Part 1”, which dealt with initial appraisal of RAAC roof panel construction. Part 2 of the guidance is intended to be adopted by Structural Engineers who will be responsible for carrying out a detailed assessment of the 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. 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 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 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 (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 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: The assessment process

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 Stage 2 possibly optional. See Figure 1 below for the proposed assessment process. Stage 1 of the process is covered in detail in Part 1 of this guidance and is summarised for completeness here. This guide concentrates on stages 2 and 3 of the assessment and remediation process.

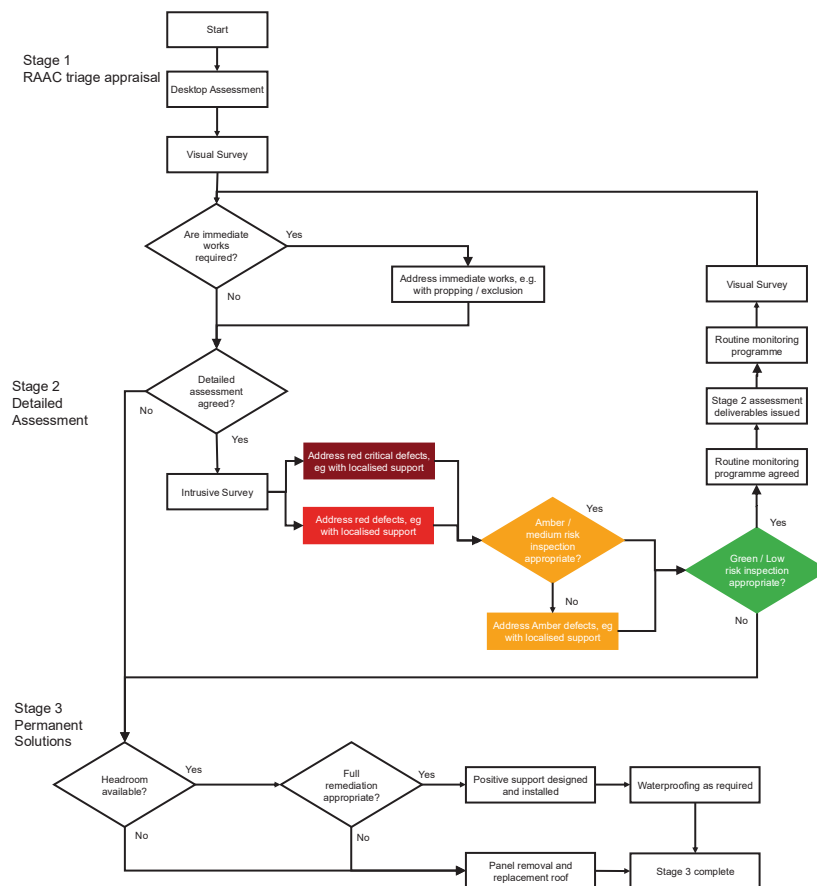


Figure 1: RAAC Assessment Process Flow Chart

2.1 Stage 1 – RAAC TRIAGE APPRAISAL

RAAC is identified, with its dimensions and visual condition documented and appraised by a Chartered Surveyor or Structural Engineer, following the procedures outlined in Part 1 of this guidance. Any immediate need for propping should have been communicated to the property owner and addressed with the assistance of a Structural Engineer at that time.

The quantum and quality of data that has been collected and presented, in accordance with Part 1 of the guidance should be assessed and considered by the Structural Engineer. The Structural Engineer should liaise with the consultants who prepared the Stage 1 data and seek any further necessary information or clarification. For the situation where multiple properties are being considered that share the same archetype, common issues should be compiled, compared and contrasted. This will assist meaningful dialogue between Structural Engineer and property owner.

2.2 Stage 2 - DETAILED ASSESSMENT & MANAGEMENT STRATEGY (IF AGREED)

Agreement between the Structural Engineer and the property owner is reached on whether to proceed with the detailed assessment and a monitoring-based management strategy. Following the assessment, any panels identified as critical red, or red will require Stage 3 Permanent Solutions.

Where panels are rated amber, these may be remediated or monitored under a management regime. It may be beneficial to include the amber rated panels within the Stage 3 Permanent Solution works to reduce the burden of ongoing inspections.

Factors influencing this decision include cost, disruption and future access requirements. Access for any future monitoring needs to be carefully considered and may require the inclusion of ceiling hatches in any false ceilings. Where a management strategy is implemented, future monitoring may identify a change in condition that will result in Stage 3 being adopted, a full permanent solution. The structural engineer should communicate the benefits and limitations of the proposed mitigation strategy to the client and gain agreement.

2.3 Stage 3 – PERMANENT SOLUTIONS

Permanent solutions comprise installation of supporting structures to the RAAC panels or removal and replacement of the RAAC with an alternative product.

Supporting structures must be designed by a Structural Engineer and may comprise supports to all the RAAC panels. Structural timber joists are the preferred support option, although steel may be appropriate in some circumstances. Although fire protection is not often required for roof structures, this should be considered.

Removal and replacement of RAAC is likely to be applicable to properties in the following scenarios:

- there is insufficient headroom to install a support system,
- where the RAAC is in such a poor condition that support is unlikely to be able to achieve the desired level of safety,
- where there are cost, programme or embodied carbon savings compared to the installation of support systems.

3.0 Stage 2 RAAC Assessment & Management Strategy

3.1 Investigation Approach

The (IStructE, April 2023) gives guidance on the form and scope of the site surveys and the defects that should be recorded. This is further described within Part 1 of this guidance.

3.1.1 Residential Properties with Plasterboard ceilings

Significant variance in RAAC construction within individual properties has been identified. The IStructE 2023 guide states “it is recommended that all panels are visually assessed.” For properties with plasterboard or similar ceilings it is likely that no visual assessment information will be available. To undertake a full visual inspection, removing plasterboard, in an occupied domestic property would cause significant disruption. The situation may be further complicated by the existence of asbestos or asbestos containing material (ACM) on or within the ceiling material or the ceiling void. It is possible that the presence of ACM varies from room to room. Where ACM is present, the material will need to be removed by a specialist contractor, prior to inspection.

The disruption needs to be balanced against the risk of missing a significant defect. The decision on the extent of RAAC to be exposed, is to be decided following a risk assessment by the Structural Engineer.

Replacement ceilings should not be fixed to the RAAC. If installing a subframe ceiling, permanent support to the RAAC could be installed with little extra disruption.

3.2 Methodology

The purpose of the panel intrusive investigation is to confirm the following in accordance with the IStructE RAAC panel guidance (IStructE, April 2023):

- a) Panel bearing lengths
- b) Panel thickness
- c) Position of transverse anchorage reinforcement at bearings.
Especially at locations of cut panels
- d) Reinforcement quantities and diameter of both longitudinal and transverse bars such that calculations may be undertaken.

To minimise disruption, consider investigating items a) and b) at the same location, for bearing length and panel thickness. Similarly, items c) and d) can likely be assessed at the same location.

Firstly, identify any likely suitable properties useful for carrying out intrusive surveys, for example vacant units or units exhibiting the worst condition.

Intrusive investigations of bearings need to be carefully managed and supervised to minimise damage to the panel / bearing interface. Do not use methods that would damage reinforcement. Examples have been noted where unnecessarily large holes have been made in panels, and transverse bars or walls supporting planks have been damaged during investigations. Use small diameter drill holes (approx. 10mm diameter) to assess bearing width, and transverse reinforcement over the bearing. Refer to Appendix A for a suitable methodology. (Small trial holes do not require to be remediated). Use non-destructive techniques like cover meters to identify bar size and spacing away from bearings.

Where individual properties are being assessed, a representative sample of panel type should be determined and the initial panel intrusive investigation developed based on the severity of visible defects. A minimum recommended sample size should be proportionate to the size and scale of the building or structure being assessed. The sample size should consider the number of different panel lengths used in a property and inspection of the bearings and anchorage rebar for each panel length identifying non-load bearing walls. Avoid overlooking short panels even if these are of small quantity as shorter panels may be the result of cut-offs from longer panels. It is recommended to check both ends of the same panel for anchorage rebar and bearing length to avoid missing a cut end or misplaced panel reinforcement.

The Structural Engineers is to set out the assessment plan, following a risk appraisal. The number of panels subject to intrusive investigation should typically not be less than 10% of the total number of panels (checking bearing both ends) with a minimum sample size of 8. There may be cases where this represents a significant proportion of the RAAC in a property. If the property has fewer than 8 panels, then all panels must be inspected.

Pay close attention to the presence of skylights and roof access hatches, as they often present multiple risk factors, including poor end bearing on hangers, lack of anchorage reinforcement due to site-trimmed panel ends, and susceptibility to water ingress. Panels tapering in plan indicate partial or complete trimming which may have removed anchorage reinforcement.

Equally, steel beams supporting panels each side should be investigated to ascertain the bearing widths.

If all the samples investigated have acceptable bearing lengths and transverse steel present, there is no need to undertake further investigations. If any samples do not meet the required bearing length or do not have transverse steel present, full remediation will be required unless intrusive testing is carried out to all panels. Structural calculations may also provide an option to demonstrate the acceptability of the conditions found.

When assessing multiple properties of similar construction, built during the same period, and found to be in a comparable condition based on the initial appraisal, the Structural Engineer may, with caution and at their discretion, utilise any consistent findings of the panel intrusive investigations from one or more properties for the consideration on a larger number of properties, if

they share the same archetype. In this instance the minimum sample size of panels being investigated should be increased to cater for the increased overall population size of panels being investigated to achieve a similar confidence level.

3.3 Detailed Assessment

Following the intrusive works, the visual defects should be assessed against the “risk categories” as outlined in (IStructE, April 2023) and the red critical/red/amber/green risk updated. The intrusive data on end bearing should also be assessed, along side transverse and longitudinal reinforcement to determine panel capacity and risk. The risks should be considered as to decide whether a management strategy is feasible, or remediation action is required.

3.3.1 Immediate Action

The property owner should be notified of any panels assessed as red critical or red as soon as practical. Assist the property owner, if requested, on the extent of any suitable exclusion zones, temporary propping or enhanced monitoring as necessary. Safe means of escape needs to be considered if props are to be installed in common areas or escape routes.

If any representative properties are found to have red critical or red category risks, all properties within the same archetype may share these defects. These properties should be prioritised for investigation and remediation in the same manner and timeline as those that underwent intrusive investigations.

3.3.2 Follow up Action

A second round of intrusive investigations may be necessary to address specific concerns identified during the initial intrusive assessment.

As with general best practice for building maintenance, it is recommended that gutters and outlets are cleared to limit the chance of ponding water. Works should be carried out without traversing the roof in consultation with a Structural Engineer if roof access is required. (Refer Part 1 of this guidance).

3.4 Management and Remediation Strategy

The stage 2 deliverable is expected to be a report, containing:

The most appropriate strategy should be discussed with the property owner considering the further data from the intrusive investigation.

Any panels assessed as having red critical or red high-risk category will require urgent action in accordance with the guidance. (IStructE, April 2023, Section 4) such as immediate propping.

Any panels assessed as amber risk category have the potential to be monitored on a regular basis (defined by the Structural Engineer) or until such time as a remediation is carried out.

Panels assessed as green require to be monitored on an occasional basis (defined by the Structural Engineer).

It should be noted that if a management strategy is employed that includes routine inspections - future inspections may identify further propping or remedial measures are required.

3.5 Stage 2 Assessment Deliverables

It is recommended that the deliverables should take the form of a clear panel risk drawing at appropriate scale. The drawing should contain:

- all relevant survey information,
- risk ranking of panels
- location of any inaccessible panels
- locations where support to panels has been included
- company details of the Engineer responsible
- a signed inspection statement.

It is recommended that this drawing should include the following wording:

“The property identified on this drawing is being managed in accordance with STAGE 2 of the current issue of [THIS DOCUMENT]. The next inspection is due every [INSERT FREQUENCY] OR by [INSERT DATE]. Failure to inspect the RAAC by this date means the property is no longer being managed in accordance with this document.”

On completion of the work, the survey plans should be provided to the property owner.

4.0 Stage 3 Permanent Solutions

In some cases, replacement of RAAC may be necessary. However, a less disruptive and less expensive option may be to add structural support below RAAC panels.

4.1 Positive Remedial Supports

Structural timber has been used widely to provide a support structure below RAAC and is considered likely to be the preferred solution for residential settings. Timber is a familiar material for builders to work with, particularly in a roofing environment. Timber is lightweight and less likely to require strengthening of the existing building components. Timber solutions can accept fixings from plasterboard and can be notched and holed within prescribed limits to allow the passage of building services. Furthermore, timber is generally considered to be a low carbon construction (IStructE, 2025).

Appendix C provides typical structural support details and guidance. The actual structural support will need to be designed 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.

The typical solution adopts timber joists below RAAC panels, aligned parallel span. Joists are supported on timber wall plates on existing load-bearing walls to span. This maintains the existing load-path. Ply or OSB sheet may be added between the RAAC planks and joists if the RAAC is in very poor condition. However, it is preferable to leave the underside of the RAAC exposed, such that any deterioration can be observed.

The support system should consider the available structural depth; including the heights over windows and doors, which gives an indication of what space is available to install the structural support. Where space is limited, other support solutions may be required. This might take the form of steel sections – however this is less preferable given the cost and inability to easily adapt on site.

4.2 Loadings

For initial sizing calculations, it may be appropriate to employ conservative assumptions for the roof make up. Finishes, suspended ceilings, services, access loads and any additional loading should be included in accordance with current codes, e.g. BS EN 1991-1-1.

The density of RAAC panels is noted within manufacturers' details of between 550kg/m³ and 650kg/m³. The depth of RAAC panels should be determined from the site investigation works or estimated based on the span and arrangement of the building.

RAAC may be saturated. However, with installed remediation it is expected that this will be a temporary condition and therefore the weight of the extra water within the RAAC is not considered in the above.

If there is evidence of ponding on the roof structure, due to deflected RAAC panels, an allowance ponding of water may be included within the design.

An example of proposed loading is provided in Appendix B. Where the assumed figures result in excessive timber sizes, a more accurate assessment of the loading may prove beneficial.

The Structural Engineer should demonstrate that the extra dead load from the supporting structure is capable of being supported by the substructure.

4.3 Deflection

The remedial support framing should be stiff enough to act as the primary load bearing element of the roof without causing observable deflection, distress to the existing RAAC panels or damage to roof finishes when loaded. Where timber is adopted, this should be in accordance with (BS EN 1995 (BSI, 2004) (+A2:2014) (incorporating corrigendum June 2006))

It is recommended that the existing RAAC is considered as an applied load for deflection purposes.

4.4 Diaphragm Action

Where the new structural support is to provide a diaphragm at roof level for overall building stability, i.e. where the condition of the RAAC is very poor, the design should adopt approved timber tie details.

In this instance, additional strapping will be required to the existing wall construction and finishes (sheathing board/plasterboard) assessed as the new diaphragm for overall stability.

4.5 Non-structural considerations

Remedial solutions will require a building warrant under the Scottish Building Regulation system. In addition to meeting structural conditions, other compliance considerations include the following:

4.5.1 Headroom

The Scottish Building Regulations require a minimum headroom of 1.8m generally and 2.0m for stairs, ramps and landings. This may mean additional supports for the RAAC are not possible and the roof will require replacement. A typical depth of remedial support is 225mm, to be designed by the Structural Engineer.

4.5.2 Fire Performance

Building control should be consulted on whether the support frame requires fire protection, in which fire boarding may be required below the frame. Framing should not breach fire compartments.

4.5.3 Thermal Performance & interstitial condensation

Building owners may decide to add thermal insulation to the roof construction, to improve thermal performance. In which case the roof build-up should be checked to ensure that interstitial condensation does not occur.

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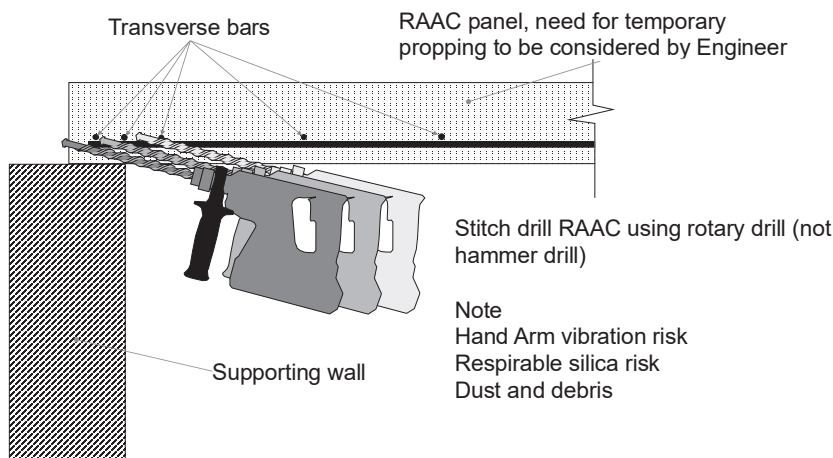
BS EN 1995 1-1 Eurocode 5. *Design of timber structures. General rules and rules for buildings*. Publisher is BSi.

HSE, 2025 guidance on roof access: <https://www.hse.gov.uk/construction/safetytopics/roofwork.htm>

Appendix A – Intrusive testing example for reinforcement over supports

Pilot holes for checking for transverse and longitudinal bars over supports:

1. Locate the longitudinal bars using a cover meter on the soffit, record the depth to the longitudinal reinforcement bar and mark the location on the panel.
2. At the mid-point between two longitudinal bars, a suitable distance from the wall, use a non-percussive drill with a 10mm bit to drill a hole into the panels beyond the depth of the longitudinal reinforcement.
3. Withdraw the drill from the hole and repeat closer to the wall.
4. Repeat until a transverse bar is encountered over the bearing, or the end of the panel is found.
5. Use the same opening to confirm the length of bearing is acceptable



Note – Where the support is a cavity wall the RAAC may cross the cavity and act as a closer and it may not be possible to locate the bar.

Appendix B - Example of proposed loading

AAC and RAAC planks have various weights given in the guidance:

Siporex standard guidance (dated 2015) states a density of 550kg/m³ but can vary from 450-600kg/m³

Autoclaved Aerated Concrete Roof & Floor Units Handbook 2 dated October 1977-79 states an insitu weight of 17kg/m² per 25mm thickness at normal equilibrium moisture content = 680kg/m³

The BRE - Reinforced autoclaved aerated concrete panels: review of behaviour, and developments in assessment and design (2002) states 'The bulk dry density of AAC (all uses) potentially ranges from around 300 kg/m³ to some 1000 kg/m³, but most products are likely to be within the 400 to 700 kg/m³ range. The density value of components in use will be somewhat higher than the dry density because of the residual moisture content of the AAC.'

Based on the above a minimum density of 650kg/m³ has been selected. This represents a reasonable assessment of saturated RAAC and is considered an upper bound. A more accurate number can be confirmed with on site sampling if required.

RAAC thickness – measured or assumed.

Permanent Loading

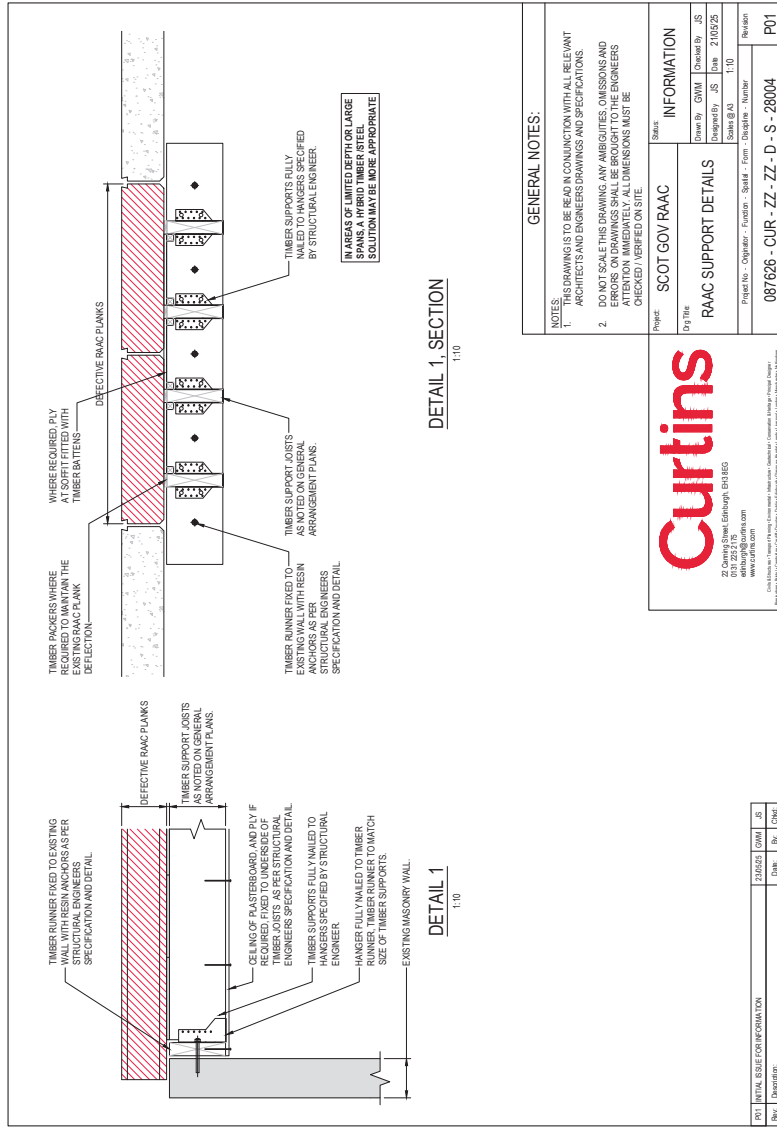
RAAC 0.25 thick (dry density)	1.63
External finishes – insulation, felt and chippings	0.35
Internal Finishes – plasterboard, skim & electrics	0.15
Allowance for new roof build-up and waterproofing	0.45
New Support structure	0.30

Dead Total 2.88kN/m²

Variable Loading

Roof load (access OR snow – excluding drifting)	0.75
	<i>Imposed Total 0.75kN/m²</i>

Reroofing (allows for a 25 gallon bitumen heater or two persons)	1.45 KN
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DETAIL 1, SECTION
1:10

DETAIL 1
1:10

GENERAL NOTES:

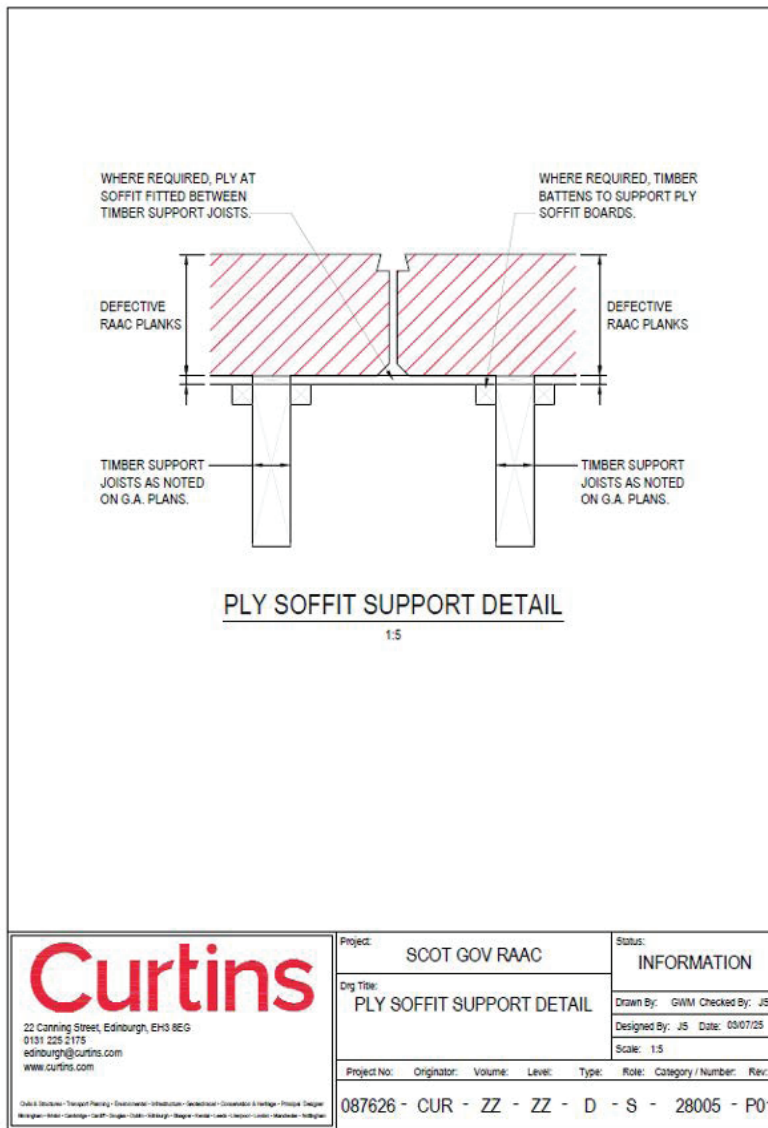
- NOTES:
 1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
 2. DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.

Project: SCOT GOV RAAC		Status: INFORMATION	
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Designed By: JS	Date: 2/10/25	Designed By: JS	Date: 2/10/25
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