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REPORT ON

CONDITION OF RAAC CONCRETE

AT

STROUD LIBRARY, LANSDOWN, STROUD

DATE: 15th March 2024

CONTRACT NO: 13827

The Institution of StructuralEngineers

worksafe consultant SSIP

ADVANCED CERTIFICATION ISO 9001:2015

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CONTENTS

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Name of Project	**Stroud Library, Lansdown, Stroud**
Contract No.	**13827**
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1.0 – Executive Summary

Rowntree Partnership have been appointed on behalf of the client, Gloucestershire County Council, to undertake a condition survey of the RAAC concrete at Stroud Library, Lansdown, Stroud.

RAAC planks have been identified at roof level over part of the building footprint. This report provides a condition survey of the planks with recommendations for their continued use within the building.

Many plank defects have been identified including cracks, post drilled holes, water ingress, steel brackets installed and efflorescence and delamination of the soffit. All these defects have the potential to undermine the structural integrity of the planks.

The defects within the planks have been carefully logged with photographic evidence. Each plank has been given a risk rating with a summary on next steps to be taken.

The purpose of this report is to provide an opinion on the RAAC planks that were readily accessible and visible at the time of inspection, and is limited to those defects that may affect the stability of the planks. Whilst we have used all reasonable skill and care in preparing this report, it should be appreciated that we cannot offer any guarantee that the planks will be free from future defects or that existing ones will not suffer from further deterioration.

This report has been prepared on behalf of and for the exclusive use of Rowntree Partnership's client, and is subject to and issued in connection with the provisions of the agreement between Rowntree Partnership and its client. Rowntree Partnership accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

2.0 – Introduction

Rowntree Partnership have been appointed on behalf of the client, Gloucestershire County Council, to undertake a condition survey of the RAAC concrete at Stroud Library, Lansdown, Stroud.

The property is located on Lansdown in Stroud to the North of Stroud Parish Church as shown within the red box on the satellite image below.

The library building consists of an amalgamation of different buildings, all constructed using different methods at different times.

An initial visit was made to the property on 31st January 2024 whereby RAAC concrete was identified to the flat roof construction across part of the building footprint. Subsequently all suspended ceilings in this area were removed to allow a detailed inspection on 14th February 2024. Sketch SK-01 within Appendix D shows the different areas of the building and highlights the areas where RAAC concrete has been identified.

In the area where RAAC has been discovered, the two-storey building has been constructed with reinforced concrete columns at ground floor with a reinforced concrete first floor slab. First floor columns are assumed to be concrete encased steel columns fixed down to the floor slab below. Steel roof beams span between the columns and support the RAAC planks.

In February 2022, the Institution of Structural Engineers published a document entitled 'Reinforced Autoclaved Aerated Concrete (RAAC) Panels Investigation and Assessment'. This document provides a list of key defects within RAAC panels which are shown on the table below.

Performance Defects	Manufacturing Defects	Construction Defects
• High in-service deflections • Cracking and spalling in the soffit of panels • Corrosion of reinforcement • Deterioration in condition • Panel distress caused by overloading • Panels acting independently with limited load sharing	• Misplaced transverse reinforcement • Insufficient anchorage of longitudinal steel • Voidage around reinforcement • Incorrect cover to tension steel	• Cutting of panels post manufacture • Short bearing lengths • Missing reinforcement e.g. linking dowel anchorage • Structurally damaging builders work

This document also lists the following items as being required as part of the survey scope of works when RAAC has been identified within a building:

- Measurement of deflections.
- Recording of cracks and defects.
- Recording evidence of water leaks.
- Hammer tap testing of signs of debonding concrete.
- Recordings of panels cut after manufacture.
- Recording of any alteration or penetration through panels after construction.
- Recording of plank end bearing length

Unfortunately, it was not possible to record the end bearing length of the planks during the visit. All other items within the above list have been carefully reviewed within this RAAC assessment.

The deflections have been measured by taking floor to ceiling dimensions at the ends and middle of each plank to determine an overall vertical deflection at the middle of the plank. It should be noted that this assumes that the first floor below is exactly level across the length of the plank – which it may not be. Hammer tap testing was undertaken to the underside of all planks. All other items from the above list have been visually recorded.

In April 2023, The Institution of Structural Engineers released a further document entitled 'Reinforced Autoclaved Aerated Concrete (RAAC) Investigation and Assessment – Further Guidance. This document identified risk factors associated with RAAC planks which are noted below.

- End bearing – The original design codes in the 1950-60's (CP114 – Reinforced Concrete in Buildings, and CP116 Structural Use of Precast Concrete), recommended a minimum end bearing of only 45mm for roof panels and 60mm for floor panels. In practice, construction tolerances could have resulted in reduced bearing lengths. To anchor the longitudinal reinforcement, RAAC panels require transverse reinforcement over the bearing support. If this is not present, the performance of the planks is substantially impacted. For this reason, a minimum as built bearing length of 75mm is considered to be necessary.
- Anchorage reinforcement – Where transverse reinforcement is absent, the longitudinal bars will have significantly reduced tensile capacity and there is an increased risk of failure at the support. Intrusive survey techniques are required to determine this and as a result, have not been undertaken as part of this survey.

- Cut panels and trimmers – Cut panels can be created from the manufacturing process where longer panels have been cut down to shorter panels or for planned building services penetrations. These are often supported by steel hangers supported on adjacent panels with narrow bearings. Therefore, cut panels supported on hangers present inadequate bearing conditions and poorly anchored longitudinal reinforcement.
- Cracking – Cracking and spalling can be a visible indicator of excessive deflections, water ingress, mechanical damage or reinforcement corrosion. Cracking close to the supports (within 500mm) is of significant concern because it could be representative of shear cracking.
- Builders works / building modifications – Builders works that were not part of the original construction can result in panels being cut or drilled for new services. In some instances, small diameter core holes may result in longitudinal or transverse reinforcement being cut or damaged. It can also cause mechanical damage to the panels which will weaken them presenting a heightened risk of failure.
- Water ingress – prolonged water ingress can saturate RAAC panels giving risk to a potential increase in panel weight. It can also adversely affect material strength and lead to unseen corrosion to the reinforcement. Corrosion can lead to spalling of the surrounding RAAC panel. It may also affect the bond between the RAAC and the embedded reinforcement which could cause a loss of panel capacity. Water penetration is normally evident through visual inspection. It can be noted where a panel is showing signs of staining, salt crystallisation (efflorescence) or corrosion/spalling.
- Deflection measurements – RAAC panels that are exhibiting high deflections may increase the risk of water ponding and increases in loading. It may also affect bearing stresses. Both factors are potential failure risks. The deflection of panels should be recorded, and the data used to classify the deflection of each panel as follows:
    - Deflection equal to panel span/100 or lower.
    - Deflection between panel span/100 and span/200
    - Deflection between panel span/200 and span/250
    - Deflection equal to panel span/250 or greater.
    - Differential deflections exceeding 20mm between adjacent panels is considered significant.
- Adverse changes in loading – Poor roof drainage can result in the build-up of water on flat roofs which can be further exacerbated by vegetation build-up. These situations can result in prolonged periods of additional loading to the panels. Any areas where the use has changed from the original design or where new finishes have been applied and are supported off the planks can also have the same effect.

The same IStructE document recommends that following the structural survey of the RAAC, a RAG (Red, Amber, Green) risk rating approach is followed as shown in the table below.

Assessment category	Risk category	
Red	Critical risk	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. Combined with awareness campaign for occupants including exclusion zones.
	High risk	Requires remedial action as soon as possible. Combined with awareness campaign for occupants, which may include exclusion zones, signage, loading restrictions and the need to report changes of condition, eg, water leaks, debris, change in loading, etc.
Amber	Medium risk	Requires inspection and assessment on a regular basis, eg, annually. Combined with awareness campaign for occupants, which may include signage, loading restrictions and the need to report changes of condition, eg, water leaks, debris, etc.
Green	Low risk	Requires inspection and assessment occasionally, say three year period depending on condition. Combined with awareness campaign for occupants, which may include signage, loading restrictions and the need to report changes of condition, eg, water leaks, debris, etc.

Table 1 – Risk categories

The potential impact of the above risk factors will be reviewed in detail for the planks in Section 3.0 – Observations.

3.0 – Observations

During the site visit, each plank was surveyed to determine midspan deflections, undertake hammer tests to check for loose concrete and inspect for defects in the planks.

The log of these inspections is within Appendix B of the report. This log provides a colour coded rating for deflection along with a RAG risk rating which should be read in conjunction with the Table 1 within the previous section of this report.

With reference to the risk factors noted within the previous section of this report, the following observations can be made:

- End bearing – It was not possible to measure the bearing of the planks. The steel roof support beams were measured as 165mm wide. Provided the planks have been constructed with a full shared bearing on the steel beams, it is possible that the currently recommended 75mm bearing length is met across most of the building.
- Anchorage reinforcement – It was not possible to undertake surveys to determine extent of anchorage or tension reinforcement. However, long horizontal cracks close to the bearing, a visual indicator of this defect, were not present during the inspection.
- Cut panels and trimmers – Many of the panels were cut short to accommodate circa 1200mm square rooflights. It was not clear how these smaller panels were supported but it is assumed that the short panels were supported on the steelwork to the rooflight, which in turn was supported on the full-length planks on either side of the rooflight. There is also evidence of brackets to the underside of the planks. These brackets are slightly recessed into the underside of the planks so that they are flush with the underside of the planks. They do not appear to be located near openings and the reason for their presence is not clear.
- Cracking – Widespread cracking was not present. There are however instances of small cracks to the sides and edges of the planks which would suggest an overstressing of the planks in these areas.
- Builders works / building modifications – Several planks have circular holes cored through for assumed previous light fittings. In one instance, the underside of the plank has collapsed along a line between the two cores. The new light fittings are held within the suspended ceiling, rendering the holes in the planks open and redundant. Hessian was bonded to the underside of the planks. This, combined with the redundant holes for assumed previous for light fittings, would suggest that the soffit of planks was once exposed as the finished surface. In other locations, small diameter pipes are present through the slabs at bearing locations.
- Water ingress – There are many indicators of damp ingress to the planks. These are typically located around rooflights and roof edges – areas considered more susceptible to moisture ingress. In one location, timber panelling below the planks has warped due to moisture. Efflorescence is also present to the soffit of many planks, predominantly around the perimeter of the building. This would suggest water leaching through the planks and leaving a salty residue on the soffit.
- Deflection measurements – Plank deflection varies widely across the building. Differential measurements of up to 30mm have been taken for an individual plank between the plank soffit and the first-floor structure below. Provided the floor is level as a datum, this 30mm deflection is within the planks. The plank deflections have been grouped into 4 categories within the table in Appendix B of this report. No deflections fall into the worst-case category of deflection equal to span/100 or lower as noted previously within this report. Differential deflections between adjacent planks are not visually evident without taking measurements, suggesting that differential deflection is not a concern. Upon looking down on the flat roof structure from above, there was little

evidence of water ponding on the roof. The visits undertaken followed a period of rainfall where ponding would have been expected should the planks be deflecting excessively.

- Adverse changes in loading – As noted in the above 'Builders works' section, it is assumed that the suspended ceiling and insulation has been added after the original construction of the building. This is a load increase on the planks from the original construction, but it is not known whether the ceiling load would have been allowed for within the original design. It is not known whether the roof finishes have been changed since the original construction.
- Other noted defects – many of the planks showed signs of scarring on the underside. This is a non-structural defect that does not compromise the structural integrity of the planks.

All defects noted above were widespread across the roof structure.

Refer to the Log of Plank Inspection Notes within Appendix B and the corresponding Plank Reference Plan sketch number 13827-SK-02 within Appendix D for a detailed account of the defects around the building.

4.0 – Recommendations and Conclusions

The condition of the RAAC planks across the roof varies. Some planks will require more urgent attention that others as noted within the RAG assessment in the final column of the table within Appendix B.

Around 12% of planks are categorised as ‘Red’ and will require urgent attention prior to the building being occupied again. Should the planks be kept in situ, suitable new support measures will need to be designed and installed to adequately support these planks. This could take the form of timber joists and boarding to act as a ‘crash deck’ should be plank fail. The remit of this report does not include for the preparation of remedial repair details.

Around 20% of the planks are categorised as ‘Amber’ and will require regular annual inspections to check that they do not degrade further. The remaining planks are categorised as ‘Green’ and do not pose a high risk in their current condition. These planks will require inspections every 2-3 years. These inspection timescales are noted within Table 1 of the Institution of Structural Engineers publication ‘Reinforced Autoclaved Aerated Concrete (RAAC) Investigation and Assessment – Further Guidance.

Many of the planks can be monitored on an annual or biannual basis. This would require the soffits to be exposed during each inspection.

Inspection carried out by, and report prepared by Wayne Bracher BEng MSc CEng MIStructE.

Appendix A - Clarification of Scope

Scope Clarification Items

- The inspection and reporting does not include for any dimensional surveys or sizing of structural elements.
- We have not included any arrangements and implementation of desk study and SI investigation to assess the existing ground conditions in terms of geotechnical and mineral.
- Desk study and intrusive investigation to assess any contaminated ground conditions and environmental impact assessment are also excluded.
- We have not included the inspection of the underground foul and surface water drainage system under the footprint of the building up to the public sewers. We have not allowed for any surveys in connection with public sewers, land drainage, inspection chambers, interceptors, etc within or outside the site boundary.
- We have excluded inspections of hand railing, balustrades and any architectural metalwork or glasswork, architectural finishes, wall claddings and proprietary ceilings.
- Testing and the measurement of deterioration caused by dampness, rot and infestation to structural timber requiring the involvement of a specialist have been excluded, although we have allowed for identifying effected areas where visible and of structural importance.
- The condition of damp proof courses/membranes together with the testing for dampness in masonry has been excluded although we have allowed for identifying damp effected areas where visibly evident and of structural importance.
- We have excluded from the inspection the condition of roof finishes but if any leaks are identified within the building fabric that could effect the structural integrity of the building these will be reported.
- We have excluded the identification of asbestos or asbestos containing materials (ACM's) which would be the responsibility of others.
- We have not included for the design and preparation of engineering details associated with any remedial proposals. We assume cost estimated or quantity surveying duties associated with the remedial works will be undertaken by others.

Appendix B – Log of Plank Inspection Notes

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13827 - Stroud Library, Lansdown - RAAC Concrete Survey - Log of Plank Inspection Notes

Deflection Rating Key			
Deflection equal to span/100 or lower		Deflection between span/200 and span/250	
Deflection between span/100 and span/200		Deflection equal to span/250 of greater	

Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
1	3350	3000	2990	2996	10	335	Crack at end 2. Delamination and efflorescence at both ends	1, 2	Red
2	3350	3000	2980	3001	21	160			Green
3	3350	Unable to measure due to light fitting covering large majority of plank in centre					Old light fitting fixed to soffit		Amber
4	SHORT	Deflection not measured							Green
5	SHORT	Deflection not measured							Green
6	3350	2995	2987	2987	8	419			Green
7	3350	Unable to measure due to light fitting covering large majority of plank in centre					Old light fitting fixed to soffit		Amber
8	3350	2998	2981	2996	17	197			Green
9	SHORT	Deflection not measured							Green
10	SHORT	Deflection not measured							Green
11	3350	Unable to measure due to light fitting covering large majority of plank in centre							Green
12	3350	3014	2992	3000	22	152	Bracket at end 1	6, 7, 8	Amber
13	SHORT	Deflection not measured							Green
14	SHORT	Deflection not measured							Green
15	SHORT	Deflection not measured					Crack end 2	3, 4	Red
16	SHORT	Deflection not measured							Green
17	3650	3002	2995	2995	7	521	Delamination and efflorescence end 1, Bracket end 2	15	Amber
18	3650	2991	2990	3003	13	281			Green
19	3650	Unable to measure due to light fitting covering large majority of plank in centre							Green
20	SHORT	Deflection not measured							Green
21	SHORT	Deflection not measured					Scarring	5	Green
22	3650	2983	2967	2996	29	126	Cracks end 2	12, 13, 14	Red
23	3650	Unable to measure due to light fitting covering large majority of plank in centre							Green
24	3650	2985	2975	2997	22	166			Green

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Deflection between span/100 and span/200		Deflection equal to span/250 of greater	

Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
25	SHORT	Deflection not measured							Green
26	SHORT	Deflection not measured							Green
27	3650	Unable to measure due to light fitting covering large majority of plank in centre					Scarring end 2	10	Green
28	3650	2994	2989	2994	5	730	Bracket end 2	9	Amber
29	SHORT	Deflection not measured							Green
30	SHORT	Deflection not measured							Green
31	SHORT	Deflection not measured							Green
32	SHORT	Deflection not measured					Crack end 2	11	Red
33	3646	Deflection not measured					Cracks at 700-800mm centres along edge, Delamination/efflorescence of soffit end 1, Crack end 2	19, 20, 22	Red
34	3646	3004	2986	2991	18	203			Green
35	3646	Unable to measure due to light fitting covering large majority of plank in centre							Green
36	3646	2993	2977	2993	16	228			Green
37	3646	2989	2975	2989	14	260			Green
38	3646	2991	2974	2991	17	214	Crack end 2	21	Red
39	3646	Unable to measure due to light fitting covering large majority of plank in centre							Green
40	3646	2992	2980	2996	16	228			Green
41	SHORT	Deflection not measured							Green
42	SHORT	Deflection not measured							Green
43	3646	Unable to measure due to light fitting covering large majority of plank in centre					Possible water stain end 1, delamination/efflorescence end 2	16, 17, 18	Amber
44	3646	2996	2992	2996	4	912			Green
45	SHORT	Deflection not measured							Green
46	SHORT	Deflection not measured							Green
47	3654	2988	2983	2994	11	332	Rust stain end 2, efflorescence end 2	31	Red

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Deflection between span/100 and span/200		Deflection equal to span/250 of greater	

Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
48	3654	2997	2977	2990	20	183	Efflorescence end 2	31	red
49	3654	Unable to measure due to light fitting covering large majority of plank in centre							Green
50	3654	2988	2973	2993	20	183	Scarring end 2	32	Green
51	3654	2986	2972	2996	24	152			Green
52	3654	2987	2970	2995	25	146			Green
53	3654	Unable to measure due to light fitting covering large majority of plank in centre					Scarring end 1	23	Green
54	3654	2991	2982	2985	9	406	Delamination/efflorescence to side at end 2	30	Amber
55	SHORT	Deflection not measured							Green
56	SHORT	Deflection not measured							Green
57	3654	Unable to measure due to light fitting covering large majority of plank in centre					Damp by light fitting, delamination/efflorescence end 1, crack end 1, delamination/efflorescence end 2	24, 25, 26, 27	Red
58	3654	2995	2990	2990	5	731	Delamination/efflorescence end 2, bracket end 2	28	Red
59	SHORT	Deflection not measured							Green
60	SHORT	Deflection not measured					Crack end 2	29	Red
61	2182	2434	2433	2436	Plank Sloped - not flat		Bracket	34	Amber
62	2182	2436	2430	2438	Plank Sloped - not flat				Green
63	SHORT	Deflection not measured							Green
64	SHORT	Deflection not measured							Green
65	SHORT	Deflection not measured					Light fitting through plank	35	Amber
66	SHORT	Deflection not measured					Service hole	35	Amber
67	2182	2457	2431	2441	Plank Sloped - not flat				Green
68	2182	2449	2429	2418	Plank Sloped - not flat				Green
69	2182	2454	2430	2423	Plank Sloped - not flat				Green
70	2182	2439	2429	2421	Plank Sloped - not flat				Green
71	SHORT	Deflection not measured							Green

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Deflection between span/100 and span/200		Deflection equal to span/250 of greater	

Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
72	SHORT	Deflection not measured							Green
73	SHORT	Deflection not measured					Service hole	36	Amber
74	SHORT	Deflection not measured					Service hole	36	Amber
75	2182	2447	2433	2423	Plank Sloped - not flat				Green
76	2182	2441	2438	2423	Plank Sloped - not flat				Green
77	2182	2452	2434	2424	Plank Sloped - not flat				Green
78	2182	2455	2425	2422	Plank Sloped - not flat				Green
79	2182	2440	2428	2422	Plank Sloped - not flat				Green
80	2182	2441	2428	2424	Plank Sloped - not flat				Green
81	2182	2440	2433	2436	Plank Sloped - not flat				Green
82	2182	2437	2435	2434	Plank Sloped - not flat		Bracket end 1	33	Amber
83	3300	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	38	Amber
84	SHORT	Deflection not measured							Green
85	SHORT	Deflection not measured							Green
86	3300	2989	2976	2985	13	254	Crack end 1	39	Red
87	3300	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	40	Amber
88	SHORT	Deflection not measured							Green
89	SHORT	Deflection not measured							Green
90	SHORT	Deflection not measured					Exposed steelwork at irregular centres	41, 42	Amber
91	SHORT	Deflection not measured							Green
92	SHORT	Deflection not measured					Service hole	43	Amber
93	SHORT	Deflection not measured					Service hole	43	Amber
94	SHORT	Deflection not measured							Green
95	SHORT	Deflection not measured					Raised scarring	44	Green

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Deflection between span/100 and span/200		Deflection equal to span/250 of greater	

Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
96	3652	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	45	Amber
97	SHORT	Deflection not measured							Green
98	SHORT	Deflection not measured							Green
99	3652	2980	2980	2988	8	457			Green
100	3652	2977	2975	2986	11	332	Service holes x 2, Crack end 2	46, 52	Red
101	SHORT	Deflection not measured							Green
102	SHORT	Deflection not measured							Green
103	3652	2979	2971	2982	11	332			Green
104	3652	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	47	Amber
105	SHORT	Deflection not measured							Green
106	SHORT	Deflection not measured							Green
107	3652	2983	2984	2994	10	365			Green
108	3652	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	48	Amber
109	SHORT	Deflection not measured					Exposed fixing	49	Amber
110	SHORT	Deflection not measured							Green
111	3652	3002	2983	2991	19	192			Green
112	3652	Unable to measure due to light fitting covering large majority of plank in centre					Service hole x 1, elongated/collapsed service hole x 1	50	Red
113	3652	3000	2996	2996	4	913	Bracket end 1	51	Amber
114	SHORT	Deflection not measured							Green
115	SHORT	Deflection not measured							Green
116	SHORT	Deflection not measured							Green
117	SHORT	Deflection not measured							Green
118	SHORT	Deflection not measured							Green
119	SHORT	Deflection not measured							Green

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Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
120	SHORT	Deflection not measured							Green
121	SHORT	Deflection not measured							Green
122	3647	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	53	Amber
123	SHORT	Deflection not measured							Green
124	SHORT	Deflection not measured							Green
125	3647	2984	2974	2984	10	365			Green
126	3647	2986	2968	2985	18	203	Service holes x 2, damp patch	54	Amber
127	SHORT	Deflection not measured							Green
128	SHORT	Deflection not measured							Green
129	3647	2983	2972	2986	14	261			Green
130	3647	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	55	Amber
131	SHORT	Deflection not measured							Green
132	SHORT	Deflection not measured							Green
133	3647	2994	2986	3000	14	261			Green
134	3647	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	56	Amber
135	SHORT	Deflection not measured							Green
136	SHORT	Deflection not measured							Green
137	3647	2992	2986	2995	9	405			Green
138	3647	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	57	Amber
139	3647	2997	2997	3001	4	912	Crack end 1	58	Red
140	SHORT	Deflection not measured							Green
141	SHORT	Deflection not measured							Green
142	SHORT	Deflection not measured							Green
143	SHORT	Deflection not measured							Green

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Deflection Rating Key			
Deflection equal to span/100 or lower		Deflection between span/200 and span/250	
Deflection between span/100 and span/200		Deflection equal to span/250 of greater	

Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
144	SHORT	Deflection not measured							Green
145	SHORT	Deflection not measured							Green
146	SHORT	Deflection not measured							Green
147	SHORT	Deflection not measured							Green
148	3287	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	59	Amber
149	SHORT	Deflection not measured							Green
150	SHORT	Deflection not measured							Green
151	3287	2989	2984	2994	10	329			Green
152	3287	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	60	Amber
153	SHORT	Deflection not measured							Green
154	SHORT	Deflection not measured							Green
155	3287	2985	2984	2991	7	470	Exposed fixing	65	Amber
156	3287	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	61	Amber
157	SHORT	Deflection not measured							Green
158	SHORT	Deflection not measured							Green
159	3287	2997	2983	2992	14	235			Green
160	3287	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	62	Amber
161	SHORT	Deflection not measured							Green
162	SHORT	Deflection not measured							Green
163	3287	2996	2984	2998	14	235			Green
164	3287	Unable to measure due to light fitting covering large majority of plank in centre					Service holes x 2	63	Amber
165	3287	3000	2994	3000	6	548	Bracket end 2, Efflorescence end 2	64	Red
166	SHORT	Deflection not measured							Green
167	SHORT	Deflection not measured							Green

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Deflection Rating Key			
Deflection equal to span/100 or lower		Deflection between span/200 and span/250	
Deflection between span/100 and span/200		Deflection equal to span/250 of greater	

Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
168	SHORT	Deflection not measured							Green
169	SHORT	Deflection not measured							Green
170	SHORT	Deflection not measured							Green
171	SHORT	Deflection not measured							Green
172	SHORT	Deflection not measured							Green
173	SHORT	Deflection not measured							Green
174	3664	2995	2994	2995	1	3664	Efflorescence end 1, Crack end 2	67, 76	Red
175	3664	2993	2990	2997	7	523	Bracket & hole end 1, efflorescence both ends	83, 85	Red
176	3664	2988	2982	2995	13	282	Service hole	66	Amber
177	SHORT	Deflection not measured							Green
178	SHORT	Deflection not measured							Green
179	3664	2985	2977	2986	9	407			Green
180	3664	2988	2986	2989	3	1221	Service hole x 2	68	Amber
181	3664	2987	2979	2988	9	407			Green
182	SHORT	Deflection not measured							Green
183	SHORT	Deflection not measured							Green
184	3664	2987	2976	2988	12	305	Delamination and water staining	69	Red
185	3664	2992	2979	2991	13	282	Delamination and water staining	70	Red
186	3664	2991	2976	2990	15	244	Service hole x 2	71	Amber
187	3664	2988	2982	2994	12	305			Green
188	3664	2995	2989	2993	6	611	Broken edge end 1	72	Amber
189	3664	2997	2989	2989	8	458	Service hole x 2	73	Amber
190	SHORT	Deflection not measured					Hole at bearing end 2	74	Amber

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Deflection Rating Key			
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Deflection between span/100 and span/200		Deflection equal to span/250 of greater	

Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
191	SHORT	Deflection not measured					Hole at bearing end 1	75	Amber
192	SHORT	Deflection not measured							Green
193	SHORT	Deflection not measured							Green
194	SHORT	Deflection not measured							Green
195	SHORT	Deflection not measured							Green
196	SHORT	Deflection not measured							Green
197	SHORT	Deflection not measured							Green
198	3664	2992	2984	2991	8	458	Hole at bearing end 2	78	Amber
199	3664	2993	2991	2993	2	1832	Service hole x 2, hole at bearing end 2	77, 79	Amber
200	3664	2991	2978	3000	22	167	Crack end 2	80	Red
201	3664	2990	2989	2992	3	1221			Green
202	3664	2994	2988	2991	6	611			Green
203	3664	2994	2983	2990	11	333			Green
204	3664	2992	2979	2996	17	216	Service hole x 2, crack end 2	81, 82	Red
205	SHORT	Deflection not measured							Green
206	SHORT	Deflection not measured							Green
207	3664	2985	2975	2995	20	183	Water staining	86	Amber
208	3664	2983	2975	3001	26	141	Service hole	87	Amber
209	3664	2986	2982	3000	18	204	Efflorescence both ends	83, 85	Red
210	SHORT	Deflection not measured							Green
211	SHORT	Deflection not measured							Green
212	3384	3001	2987	2987	14	242	Scarring end 1, crack end 1	87	Red
213	3384	2997	2982	2987	15	226	Service hole	96	Amber
214	SHORT	Deflection not measured							Green
215	SHORT	Deflection not measured							Green

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Deflection between span/100 and span/200		Deflection equal to span/250 of greater	

Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
216	3384	2986	2980	2995	15	226	Scarring end 1	93	Green
217	3384	2986	2985	2997	12	282	Scarring end 1, service holes x 2	93, 94	Amber
218	3384	2989	2981	2992	11	308	Scarring end 1	92	Green
219	3384	2992	2976	2988	16	212	Scarring end 1	92	Green
220	3384	2990	2978	2991	13	260	Crack end 1	91	Red
221	3384	2988	2983	2988	5	677	Scarring end 2	97	Green
222	3384	2986	2984	2992	8	423	Service hole x 2, scarring	89, 90	Amber
223	3384	2990	2977	2989	13	260	Scarring	88, 89	Green
224	3384	2992	2984	2991	8	423	Scarring	88, 89	Green
225	3384	2992	2979	2988	13	260	Scarring	88	Green
226	3384	2991	2979	2993	14	242	Service hole x 2	95	Amber
227	3384	2988	2985	2990	5	677			Green
228	SHORT	Deflection not measured							Green
229	SHORT	Deflection not measured							Green
230	3384	2992	2990	2992	2	1692			Green
231	3384	2988	2986	2989	3	1128	Warped wood below plank end 2	104	Red
232	3384	2990	2983	2985	7	483	Service hole, water stain end 2 by old collapsed ceiling tile.	98, 103	Red
233	3384	2983	2976	2982	7	483			Green
234	3384	2976	2978	2983	5	677	Crack end 1, water stain end 2	99, 105	Red
235	3384	2986	2978	2986	8	423			Green
236	3384	2992	2979	2990	13	260	Crack end 1, service holes x 2	100, 101	Red
237	3384	3014	2984	2990	30	113	Damage to side at end 2	106	Red
238	3384	3018	3015	3018	3	1128	Delamination/efflorescence end 1	102	Red
239	3384	Area not surveyed due to suspended ceilings not being removed in locked room prior to visit							TBC
240	3384								TBC
241	3384								TBC

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Deflection Rating Key			
Deflection equal to span/100 or lower		Deflection between span/200 and span/250	
Deflection between span/100 and span/200		Deflection equal to span/250 of greater	

Plank No.	Plank Span (mm)	Deflection Checks (floor to ceiling heights)					Visible Defects / Penetrations / Cuts	Photos	RAG Risk Rating
		End 1	Midspan	End 2	Max deflection	Span over			
242	3384								TBC
243	3384								TBC
244	SHORT	Deflection not measured							Green
245	SHORT	Deflection not measured							Green
246	SHORT	Deflection not measured							Green
247	SHORT	Deflection not measured							Green
248	SHORT	Deflection not measured							Green
249	SHORT	Deflection not measured							Green
250	SHORT	Deflection not measured							Green
251	SHORT	Deflection not measured							Green
252	SHORT	Deflection not measured							Green
253	SHORT	Deflection not measured							Green
254	SHORT	Deflection not measured							Green
255	SHORT	Deflection not measured							Green
256	SHORT	Deflection not measured							Green
257	SHORT	Deflection not measured							Green
258	SHORT	Deflection not measured							Green
259	SHORT	Deflection not measured							Green

Appendix C – RAAC Concrete Defect Photos

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DATE: MARCH 2024
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DESCRIPTION: RAAC CONCRETE DEFECTS PHOTOS (SHEET 1 OF 8)

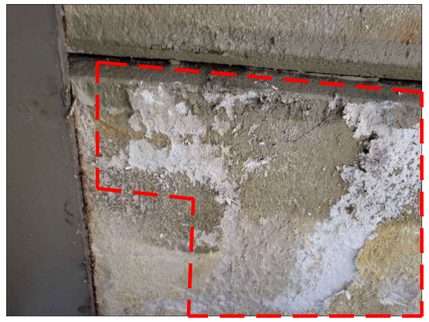

PHOTO 1 - PLANK No. 1
CRACKS & DELAMINATION/EFFLORESCENCE AT END 2

PHOTO 2 - PLANK No. 1
DELAMINATION/EFFLORESCENCE AT ENDS 1 & 2

PHOTO 3 - PLANK No. 15
CRACK AT END 2

PHOTO 4 - PLANK No. 15
CRACK AT END 2

PHOTO 5 - PLANK No. 21
SCARRING AT END 1

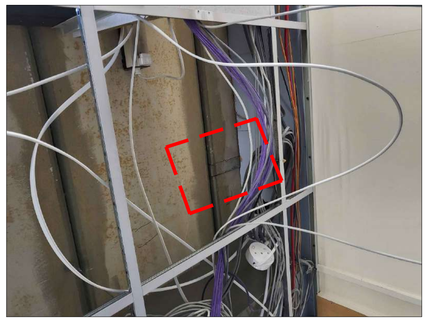

PHOTO 6 - PLANK No. 12
BRACKET AT END 1

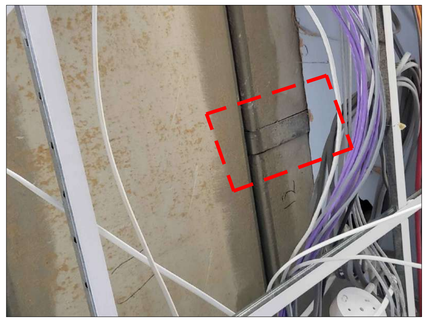

PHOTO 7 - PLANK No. 12
BRACKET AT END 1

PHOTO 8 - PLANK No. 12
BRACKET AT END 1

PHOTO 9 - PLANK No. 28
BRACKET AT END 2

PHOTO 10 - PLANK No. 27
SCARRING AT END 2

PHOTO 11 - PLANK No. 32
CRACK AT END 2

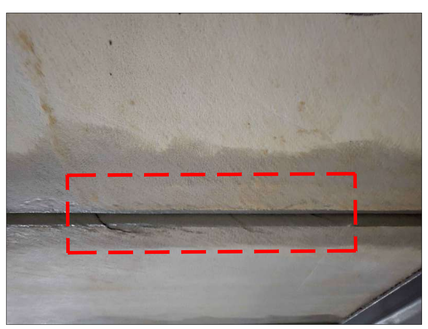

PHOTO 12 - PLANK No. 22
CRACKS AT END 2

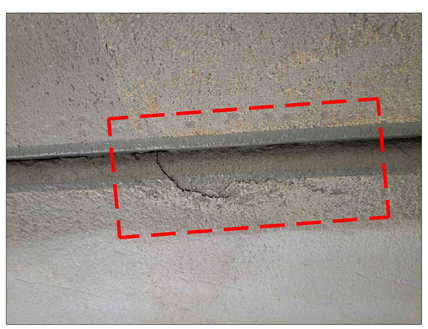

PHOTO 13 - PLANK No. 22
CRACKS AT END 2

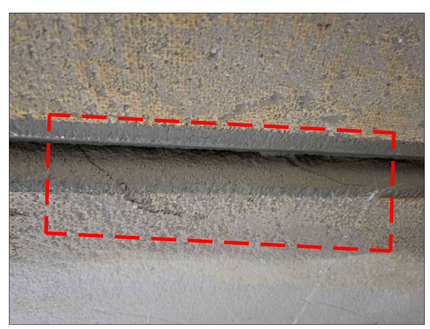

PHOTO 14 - PLANK No. 22
CRACKS AT END 2

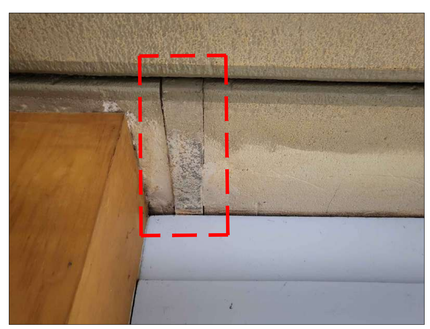

PHOTO 15 - PLANK No. 17
BRACKET AT END 2

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DESCRIPTION: RAAC CONCRETE DEFECTS PHOTOS (SHEET 2 OF 8)

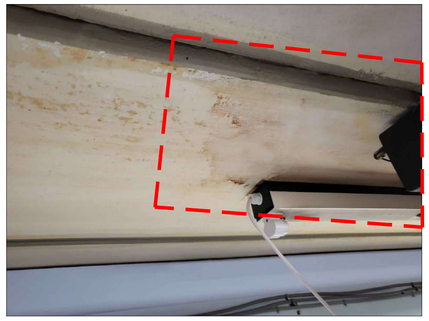

PHOTO 16 - PLANK No. 43
POSSIBLE WATER STAINS AT END 1

PHOTO 17 - PLANK No. 43
POSSIBLE WATER STAINS AT END 1

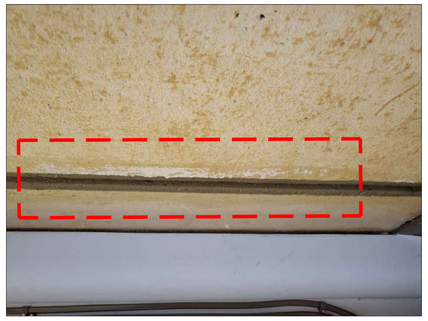

PHOTO 18 - PLANK No. 43
DELAMINATION/EFFLORESCENCE AT END 2

PHOTO 19 - PLANK No. 33
CRACK AT END 2

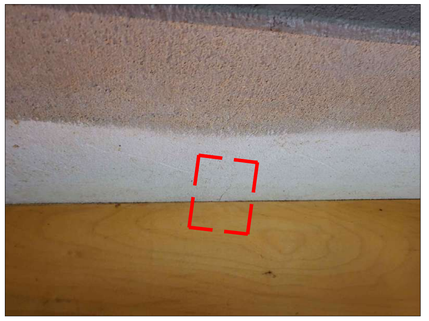

PHOTO 20 - PLANK No. 33
CRACK @ 700-800mm CTRS ALONG EDGE

PHOTO 21 - PLANK No. 38
CRACK AT END 2

PHOTO 22 - PLANK No. 33
EFFLORESCENCE AT END 1

PHOTO 23 - PLANK No. 53
SCARRING AT END 1

PHOTO 24 - PLANK No. 57
DAMP BY LIGHT
CRACK AT END 1

PHOTO 25 - PLANK No. 57
DAMP BY LIGHT

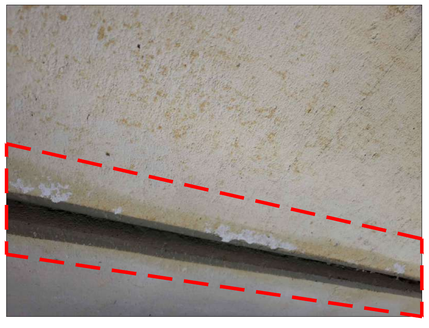

PHOTO 26 - PLANK No. 57
DELAMINATION/EFFLORESCENCE AT END 1

PHOTO 27 - PLANK No. 57
DELAMINATION/EFFLORESCENCE AT END 2

PHOTO 28 - PLANK No. 58
DELAMINATION/EFFLORESCENCE AT END 2
BRACKET AT END 2

PHOTO 29 - PLANK No. 60
CRACK AT END 2

PHOTO 30 - PLANK No. 54
SIDE DELAMINATION/EFFLORESCENCE AT END 2

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PHOTO 31 - PLANK No. 47 & 48
RUST STAIN
EFFLORESCENCE AT END 2

PHOTO 32 - PLANK No. 50
SCARRING AT END 2

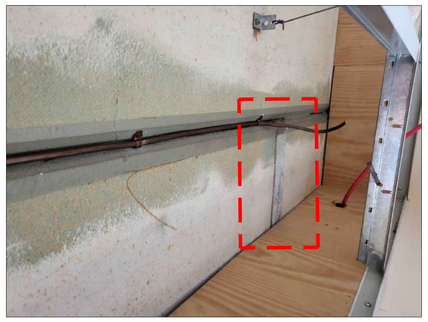

PHOTO 33 - PLANK No. 82
BRACKET AT END 1

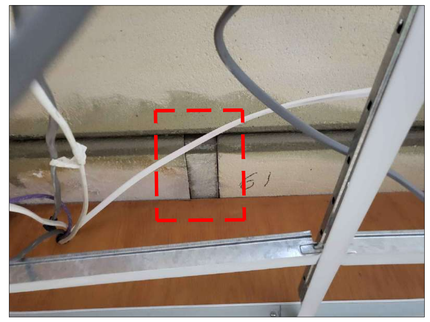

PHOTO 34 - PLANK No. 61
BRACKET

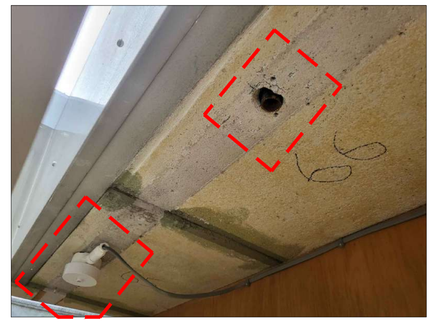

PHOTO 35 - PLANK No. 65 & 66
LIGHT FITTING
SERVICE HOLE

PHOTO 36 - PLANK No. 73 & 74
SERVICE HOLES

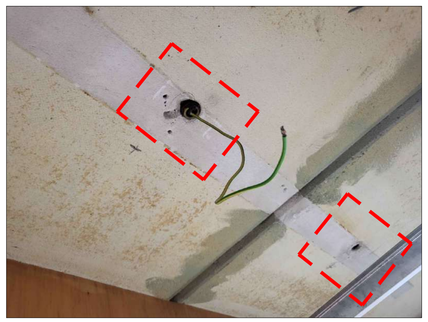

PHOTO 37 - PLANK No. 79 & 80
SERVICE HOLES

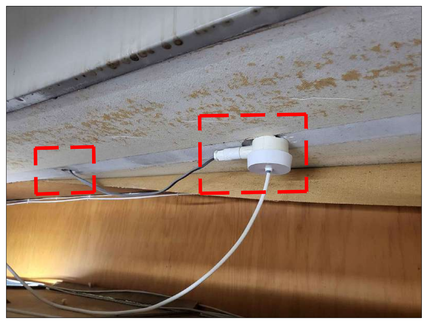

PHOTO 38 - PLANK No. 83
2No. SERVICE HOLES

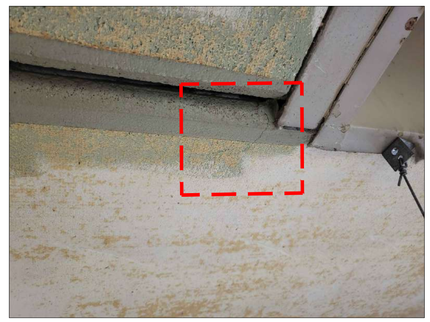

PHOTO 39 - PLANK No. 86
CRACK AT END 1

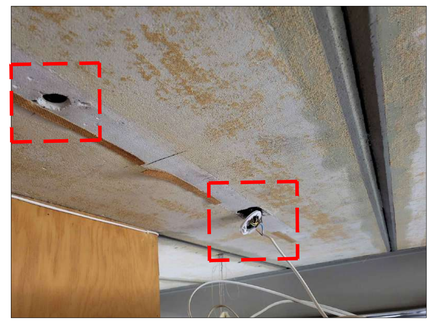

PHOTO 40 - PLANK No. 87
2No. SERVICE HOLES

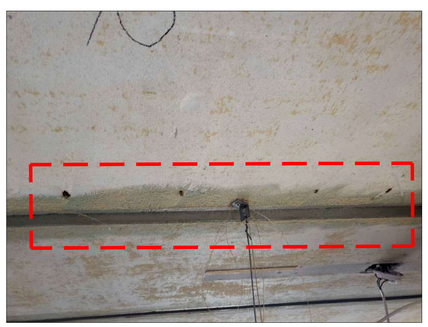

PHOTO 41 - PLANK No. 90
EXPOSED STEEL AT IRREGULAR CENTRES

PHOTO 42 - PLANK No. 90
EXPOSED STEEL AT IRREGULAR CENTRES

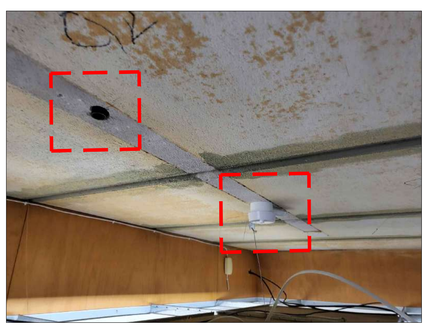

PHOTO 43 - PLANK No. 92 & 93
SERVICE HOLES

PHOTO 44 - PLANK No. 95
RAISED SCARRING

PHOTO 45 - PLANK No. 96
2No. SERVICE HOLES

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SKETCH No. SK-06 REV. P1
DATE: MARCH 2024
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DESCRIPTION: RAAC CONCRETE DEFECTS PHOTOS (SHEET 4 OF 8)

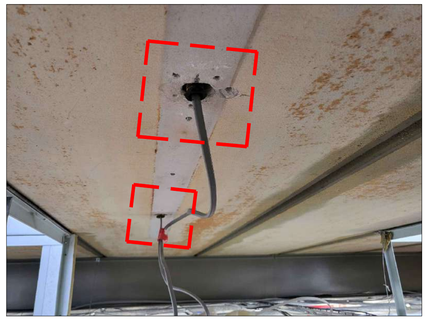

PHOTO 46 - PLANK No. 100
2No. SERVICE HOLES

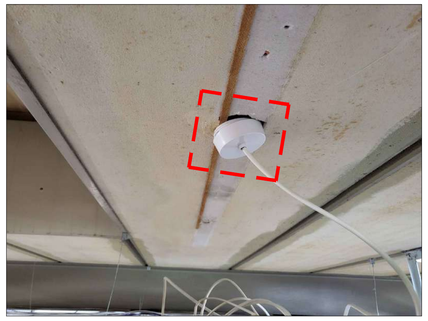

PHOTO 47 - PLANK No. 104
2No. SERVICE HOLES

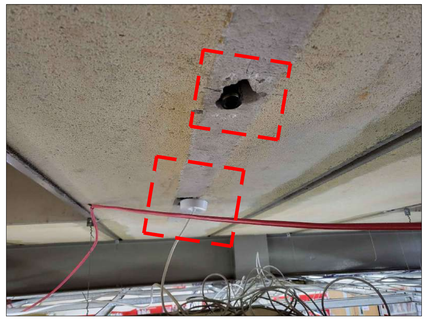

PHOTO 48 - PLANK No. 108
2No. SERVICE HOLES

PHOTO 49 - PLANK No. 109
EXPOSED FIXING

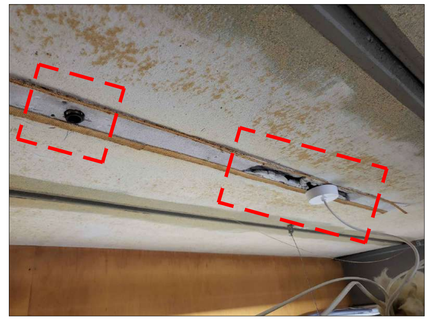

PHOTO 50 - PLANK No. 112
1No. SMALL HOLE
1No. LONG HOLE

PHOTO 51 - PLANK No. 113
BRACKET AT END 1

PHOTO 52 - PLANK No. 100
2No. HOLES
CRACK AT ENDS 1 & 2

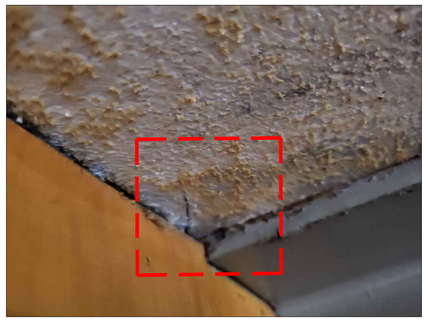

PHOTO 53 - PLANK No. 122
CRACK AT END 1

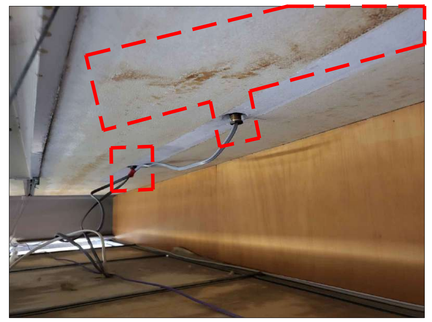

PHOTO 54 - PLANK No. 126
2No. SERVICE HOLES
DAMP PATCH

PHOTO 55 - PLANK No. 130
2No. SERVICE HOLES

PHOTO 56 - PLANK No. 134
2No. SERVIE HOLES

PHOTO 57 - PLANK No. 138
2No. SERVICE HOLES

PHOTO 58 - PLANK No. 139
CRACK AT END 1

PHOTO 59 - PLANK No. 148
2No. SERVICE HOLES

PHOTO 60 - PLANK No. 152
2No. SERVICE HOLES

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SKETCH No. SK-07 REV. P1
DATE: MARCH 2024
DRAWN BY: DC CHECKED BY: WB

DESCRIPTION: RAAC CONCRETE DEFECTS PHOTOS (SHEET 5 OF 8)

PHOTO 61 - PLANK No. 156
2No. SERVICE HOLES

PHOTO 62 - PLANK No. 160
2No. SERVICE HOLES

PHOTO 63 - PLANK No. 164
2No. SERVICE HOLES

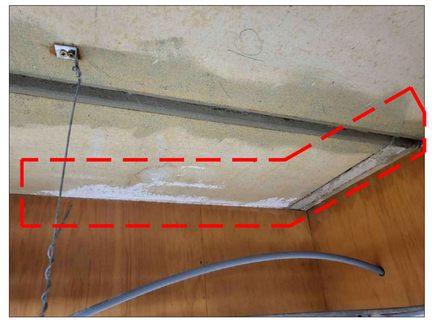

PHOTO 64 - PLANK No. 165
BRACKET AT END 2
EFFLORESCENCE AT END 2

PHOTO 65 - PLANK No. 155
EXPOSED FIXINGS

PHOTO 66 - PLANK No. 176
HOLE

PHOTO 67 - PLANK No. 174
EFFLORESCENCE AT END 1

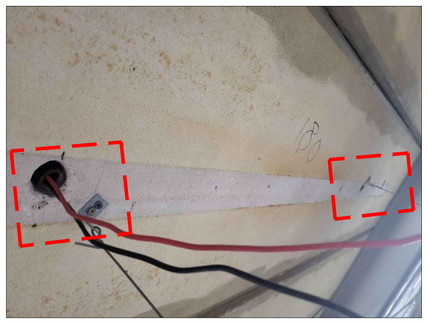

PHOTO 68 - PLANK No. 180
2No. SERVICE HOLES

PHOTO 69 - PLANK No. 183
DELAMINATION
WATER STAIN

PHOTO 70 - PLANK No. 184
DELAMINATION
WATER STAIN

PHOTO 71 - PLANK No. 185
2No. SERVICE HOLES

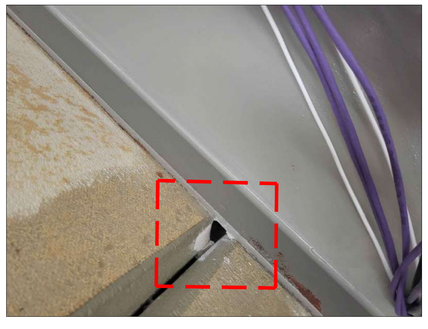

PHOTO 72 - PLANK No. 188
BROKEN EDGE AT END 1

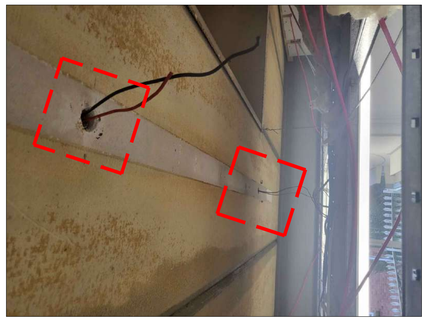

PHOTO 73 - PLANK No. 189
2No. SERVICE HOLES

PHOTO 74 - PLANK No. 190
1No. HOLE AT BEARING

PHOTO 75 - PLANK No. 191
HOLE AT END 1

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CONTRACT REF. 13827
SKETCH No. SK-08 REV. P1
DATE: MARCH 2024
DRAWN BY: DC CHECKED BY: WB
DESCRIPTION: RAAC CONCRETE DEFECTS PHOTOS (SHEET 6 OF 8)

PHOTO 76 - PLANK No. 174
CRACK AT END 2

PHOTO 77 - PLANK No. 200
2No. SERVICE HOLES

PHOTO 78 - PLANK No. 198
HOLE AT BEARING END 2

PHOTO 79 - PLANK No. 200
HOLE AT BEARING END 2

PHOTO 80 - PLANK No. 201
CRACK AT END 2

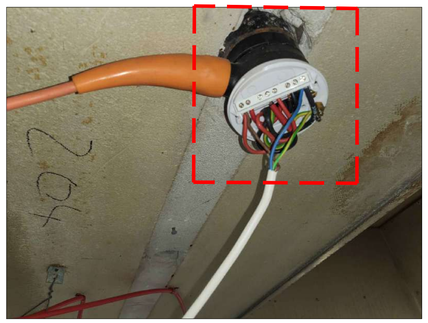

PHOTO 81 - PLANK No. 204
2No. SERVICE HOLES

PHOTO 82 - PLANK No. 204
CRACK AT END 2

PHOTO 83 - PLANK No. 209 & 175
BRACKET & HOLE AT END 1
EFFLORESCENCE AT BOTH ENDS

PHOTO 84 - PLANK No. 208
SERVICE HOLE

PHOTO 85 - PLANK No. 175 & 209
EFFLORESCENCE AT BOTH ENDS

PHOTO 86 - PLANK No. 207
WATER STAIN

PHOTO 87 - PLANK No. 212
SCAR AT END 1
CRACK AT END 1

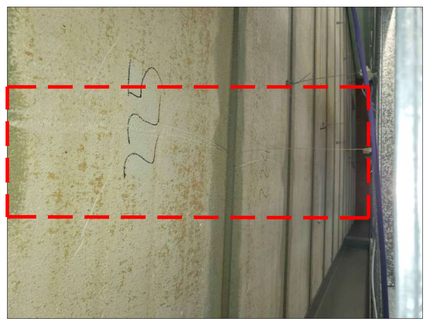

PHOTO 88 - PLANK No. 223, 224 & 225
SCAR

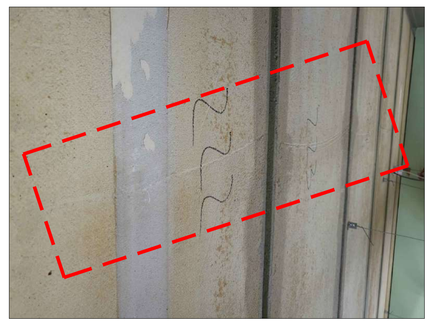

PHOTO 89 - PLANK No. 222, 223 & 224
SCAR

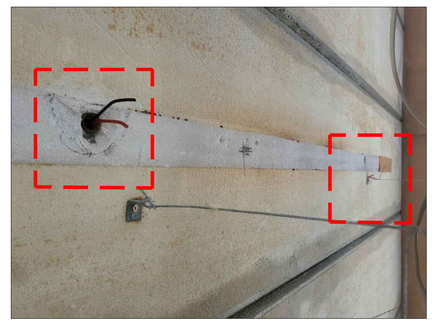

PHOTO 90 - PLANK No. 222
2No. SERVICE HOLES

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SKETCH No. SK-09
REV. P1

DATE: MARCH 2024
DRAWN BY: DC
CHECKED BY: WB

DESCRIPTION: RAAC CONCRETE DEFECTS PHOTOS (SHEET 7 OF 8)

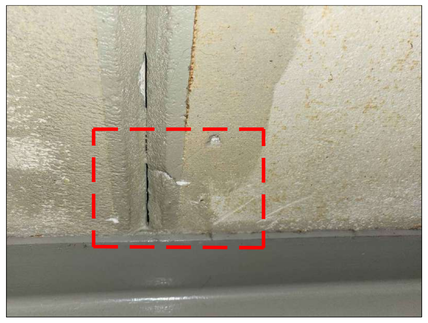

PHOTO 91 - PLANK No. 220
CRACK AT END 1

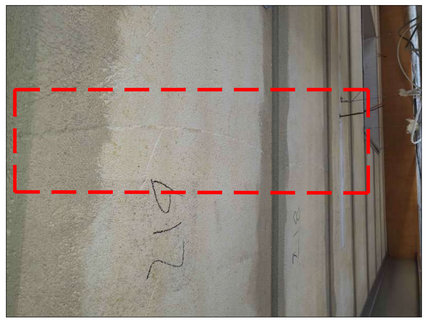

PHOTO 92 - PLANK No. 218 & 219
SCAR AT END 1

PHOTO 93 - PLANK No. 216 & 217
SCAR AT END 1

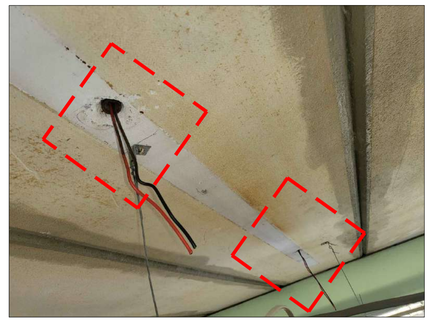

PHOTO 94 - PLANK No. 217
2No. SERVICE HOLES

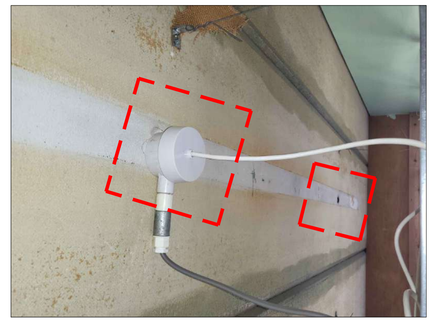

PHOTO 95 - PLANK No. 226
2No. SERVICE HOLES

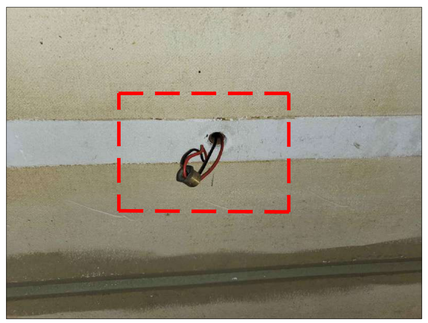

PHOTO 96 - PLANK No. 213
1No. SERVICE HOLE

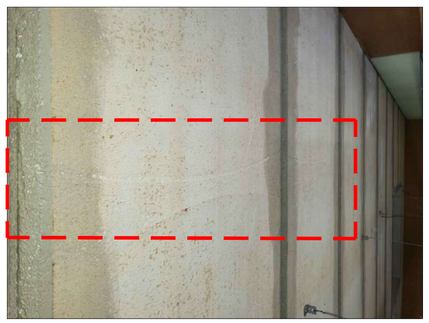

PHOTO 97 - PLANK No. 221
SCAR AT END 2

PHOTO 98 - PLANK No. 232
1No. HOLE

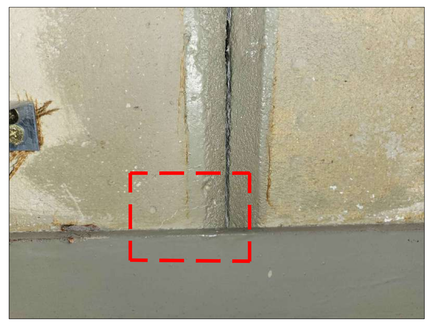

PHOTO 99 - PLANK No. 234
CRACK AT END 1

PHOTO 100 - PLANK No. 236
CRACK AT END 1

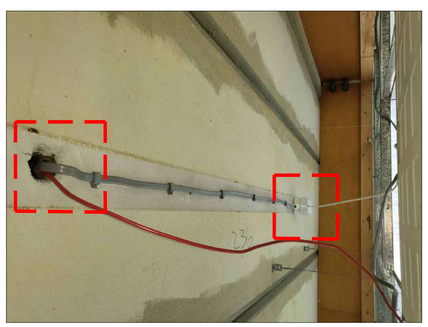

PHOTO 101 - PLANK No. 236
2No. SERVICE HOLES

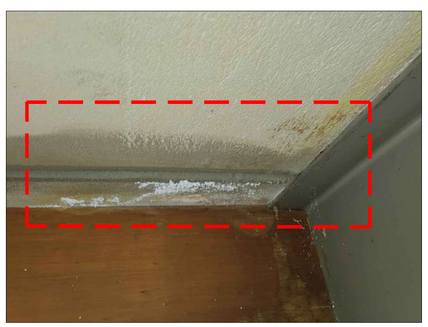

PHOTO 102 - PLANK No. 238
DELAMINATION/EFFLORESCENCE AT END 1

PHOTO 103 - PLANK No. 232
WATER STAIN AT END 2 BY OLD COLLAPSED CEILING TILE

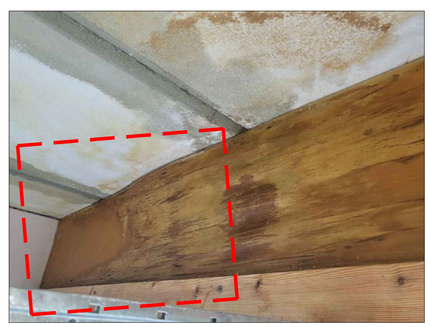

PHOTO 104 - PLANK No. 231
WARPED WOOD AT END 2

PHOTO 105 - PLANK No. 234
WATER STAIN AT END 2

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CONTRACT REF. 13827

SKETCH No. SK-10

REV. P1

DATE: MARCH 2024

DRAWN BY: DC

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DESCRIPTION: RAAC CONCRETE DEFECTS PHOTOS (SHEET 8 OF 8)

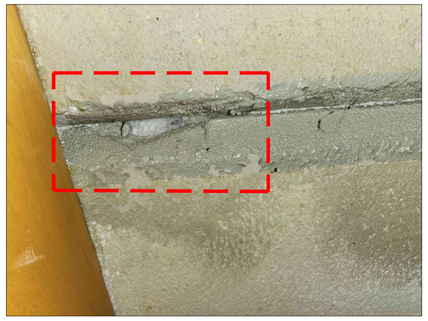
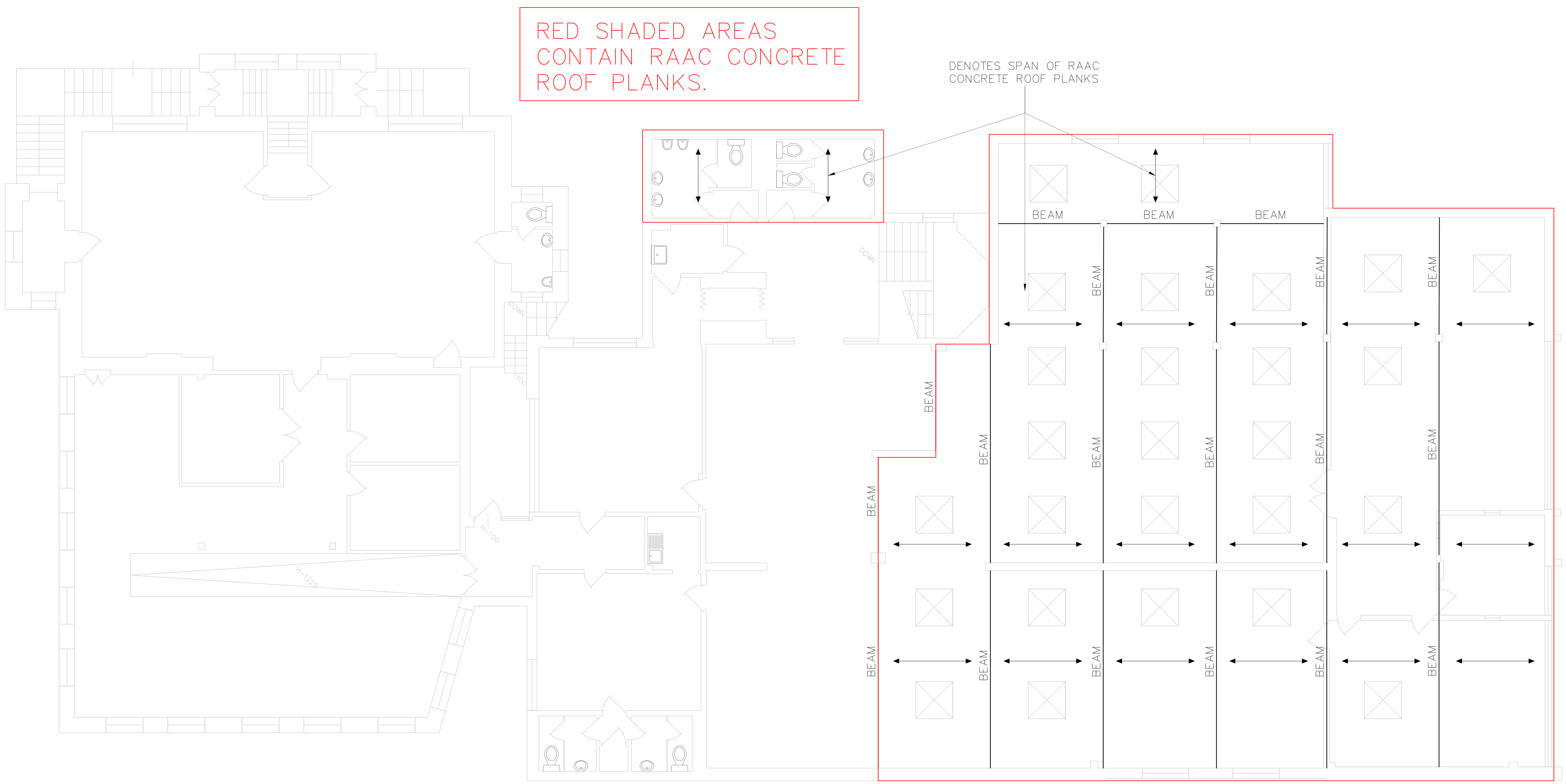


PHOTO 106 - PLANK No. 237

SIDE DAMAGE AT END 2

Appendix D – Floor Plans and Plank Reference Plans



CDM RESIDUAL RISKS

THERE ARE NO RESIDUAL RISKS THAT A COMPETENT CONTRACTOR SHOULD NOT BE ABLE TO EFFECTIVELY MANAGE

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The Institution of StructuralEngineers

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GLOUCESTER, GL2 2AQ
TEL (01452) 883859
email: info@rowntree.co.uk

ARCHITECT
N/A

CLIENT
GLOUCESTERSHIRE COUNTY COUNCIL

DESCRIPTION
FIRST FLOOR PLAN SHOWING EXTENT OF RAAC PLANKS TO ROOF STRUCTURE

CONTRACT
STROUD LIBRARY
LANSDOWN
STROUD

DRAWING STATUS		REINF. SCHEDULE NOS.	
PRELIMINARY			
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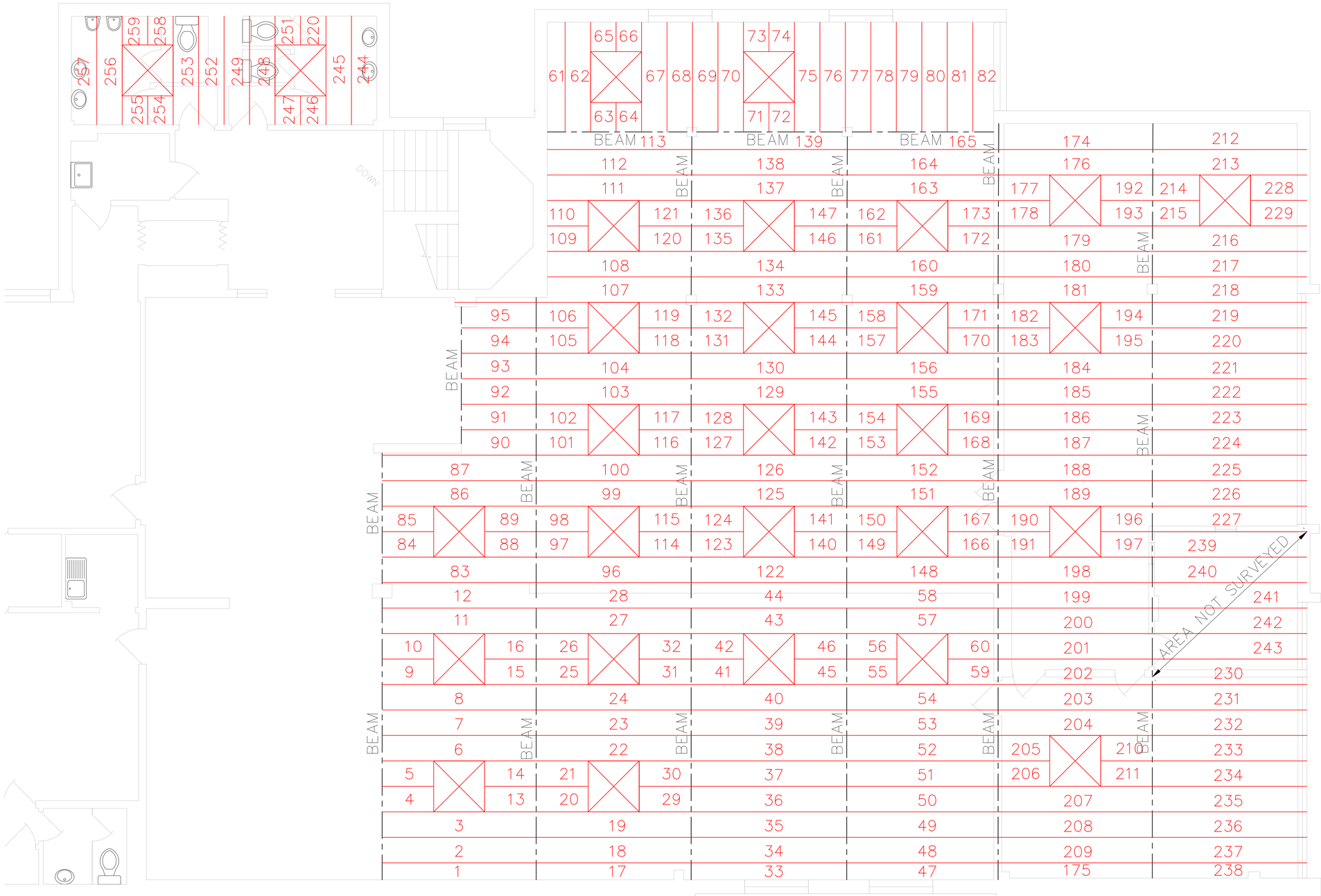
AS SHOWN	½ SHOWN	WB	DAW
DATE	CONTRACT REF.	DWG. NO.	REV.
MAR '24	13827	SK-01	P1



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ISSUE FOR REPORT	P1	WB	15/03/24

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ARCHITECT

N/A

CLIENT

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DESCRIPTION

FIRST FLOOR PLAN SHOWING RAAC PLANK REFERENCES

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STROUD

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AS SHOWN	½ SHOWN	WB	DAW
DATE	CONTRACT REF.	DWG. NO.	REV.
MAR '24	13827	SK–02	P1