·EDINBVRGH·
THE CITY OF EDINBURGH COUNCIL

The Council has undertaken a number of structural surveys of the main building in Currie High School in 2017, in response to a leak in the home economics department. The results of those surveys are included in this document. To summarise, this document includes:

The first survey, undertaken by Will Rudd Davidson. This survey concludes:

- That the building is currently considered structurally safe;
- The original parts of the building are in excess of their probable lifespan of 50 years;
- That the identified issues are likely to have been present since construction; and
- That a timescale be set out for transitioning the school to new premises.

The second document, by Charles Darley Associates, formed part of the Will Rudd Davidson report.

The third document provides a second opinion requested by the Council, undertaken by David Narro Associates. This report concludes:

- The defects do not show major deterioration of the floor structure and do not require urgent action;
- At slightly over 50 years old, the building may be considered to have exceeded its design life span;
- The structure may be expected to have a reasonable future lifespan.

Peter Watton,
Head of Property and Facilities Management

CM/SC/E10312

22nd May 2017

43 York Place
Edinburgh EH1 3HP
T: 0131 557 5255
E: edinburgh@ruddconsult.com
www.ruddconsult.com

The City of Edinburgh Council
Waverley Court
4 East Market Street
Edinburgh
EH8 8BG

For the attention of Mr Murdo MacLeod

Dear Sirs,

Currie High School
Structural Appraisal – Reinforced Concrete Floors

Introduction

Further to a preliminary report on a crack within the Home Economics block in 2013, WRD were invited to re-attend the school to refresh the recommendations, on the condition of the structural floors.

Description

Currie High School Comprises 2 multi-storey Reinforced Concrete Framed buildings with other reinforced concrete framed link and assembly blocks and a reinforced concrete framed swimming pool block. There are a more modern steel framed gym hall and library facilities. The majority of the school is of the reinforced concrete constructed circa 1964 – 1965.

Observations

Intrusive investigative works were carried out on the return visit and a Charles Darley Associates report was commissioned into the cracking which was apparent in the existing floor slabs at all levels at the west end of the economics block, which were exposed as part of the investigation. The Charles Darley report should be read in conjunction with this one.

Concerns had originally been raised with regard to a longitudinal crack found due to a spilt fluid making its way down to the classroom below through the crack in the structural floor.

There was also an awareness of a greater than usual sag in the original suspended floors in the building.

The intrusive investigations revealed that the distribution steel in the top of the slab (3mm diameter bars at 150 centres) is at least half of what is considered to be a minimum and also confirmed that the sag in the floors as a defect.

Cont/d.

Currie High School
Home Economics Block

The alternative parts of the school were identified and are summarised as follows:-

- Original multistorey classroom construction
- Original large span construction
- Modern additions

Conclusions

- The approximate age of the original parts of the reinforced concrete buildings is 50 years and therefore these are in excess of their probable 50 year intended design life.

- The newer recent additions, ie the Library and sports hall areas are not of the same construction and do not exhibit the defects identified in this report.

- The areas identified as original large span construction should be treated with caution, in particular the swimming pool area which can also be affected by chlorides from the pool water.

- The classroom buildings suffer from excessive sag in their floors, which has likely been present since construction.

- In conjunction with the sagging defect, the slabs are cracked with both a randomised cracking pattern but also a wider longitudinal crack issue. These cracks appear to be related to the sagging of the floors linked to the recent discovery of the light distribution mesh that was exposed in the slabs. Anecdotal evidence suggests, born out by our further walkround inspection that all the areas identified as original were constructed to the same methodology and all exhibit the same sag, and it is surmised contain the longitudinal cracking.

- We would agree with Charles Darley Report that conjectures that the temporarily supporting falsework might have been removed too early during construction so that the concrete was loaded before it was mature and this has caused the issue that is prevalent within all the classrooms of the original school.

- The buildings do not have a level of distribution steel within their slab to mitigate against the effects of the random crazed cracking and longitudinal cracking apparent in the floors. This means that any approach to try to and repair by epoxying may be compromised by crack relocation to a new area.

- Any investigative or remedial work is additionally hampered by what appears to be a significant amount of existing asbestos which has been identified within the existing original buildings in the Asbestos register.

Cont/d.

Currie High School
Home Economics Block

- It is understood that the City of Edinburgh Council periodically reviews their Estate based on many factors and it is understood that such a review is currently underway.

- Other serviceability issues such as the degree of air permeability / fire separation between the floors should be considered in the review.

- Any such proposal to rectify the defects currently present in the schools fabric should be carefully thought out, for example the remedial levelling off the floor is not recommended as the weight of levelling compound is likely to deflect the slab further and exacerbate the problem.

- The building is currently considered structurally safe, however is compromised by the issues laid out in this report.

Recommendations

- It is recommended that the review of the building currently being undertaken, is informed by the technical matters uncovered recently by the undertaking of intrusive structural works and that a timescale be set out against this for transitioning the school to suitable premises, unaffected by the legacy issues surrounding the schools original buildings.

- Annual inspections, typically during the summer holidays, should be carried out to monitor any deterioration during this end of life phase.

- It is recommended that fire consultants be formally appointed to advise and report on issues of fire permeability between existing fire compartments in the short term. Any remedial works that are suggested should only be implemented in conjunction with advice from a structural engineer with detailed knowledge of the building.

- It is recommended that a detailed topographical survey should be carried out on an annual basis to monitor any potential future movement. It is envisaged that these are carried out in conjunction with the annual structural inspection.

- It is recommended that further intrusive investigations are carried out to the swimming pool over the summer period.

Cont/d.

The City of Edinburgh Council

22nd May 2017

Currie High School
Home Economics Block

Important Notes

This report is based on a visual, non-disruptive, walk round inspection, and viewed externally from ground level only. Intrusive investigation only took place as set out in the Charles Darley Report. Access was not gained to the external roof area, roof void or solum void.

No advice is given or implied regarding the presence or otherwise of any asbestos in any shape or form within the property. Areas of Asbestos and ACM are suspected, and the Client is advised to follow Health and Safety Executive guidelines.

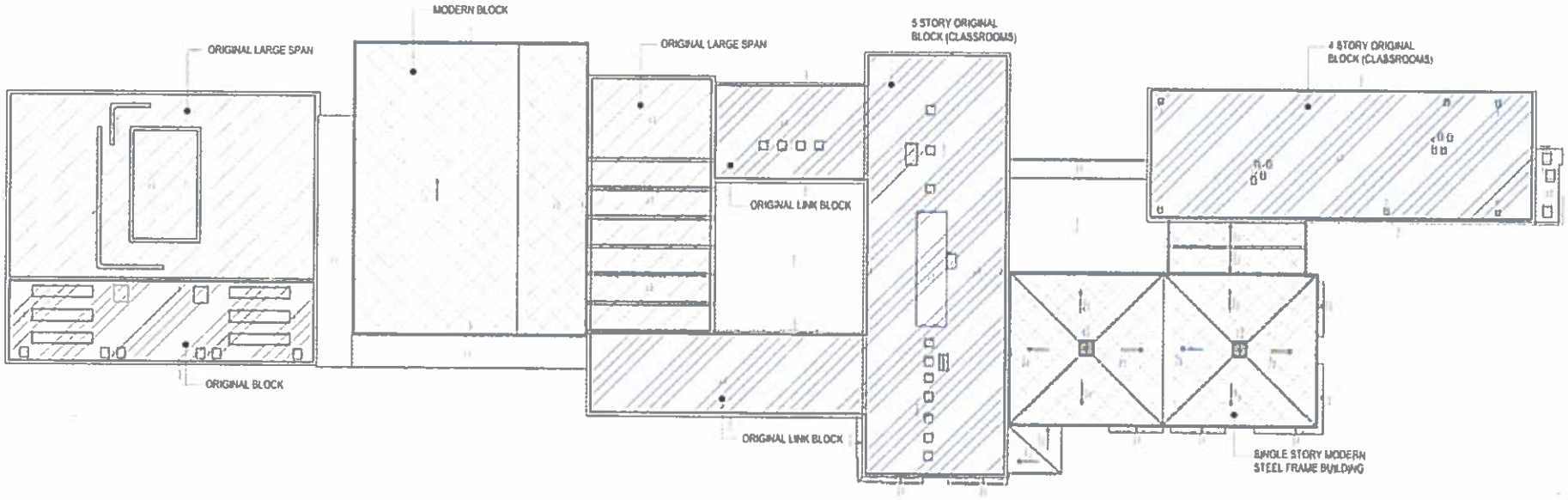
No detailed inspection of any woodwork or other parts of the structure which are unexposed or inaccessible has been carried out and we are therefore unable to report that any such part of the property is free from defect

No investigations or calculative checks were carried out as to the strength of individual structural members nor was any site investigation works in respect of foundations or drainage undertaken.

We trust this is sufficient for your present purposes, however please do not hesitate to contact us should you have any queries.

Yours faithfully,

Chris Milne
Director
for Will Rudd Davidson Ltd



CURRIE HIGH SCHOOL SCHEMATIC

CURRIE HIGH SCHOOL AERIAL VIEW

GENERAL NOTES

1. DO NOT SCALE FROM THIS DRAWING - IF IN DOUBT CONTACT PROJECT ENGINEER

Will Rudd

CLIENT
CITY OF EDINBURGH COUNCIL

PROJECT TITLE
CURRIE HS
CURRIE
EDINBURGH

DRG TITLE:
CURRIE HS BUILDING PLAN

STATUS: INFORMATION

DRAWN BY: CMa	DATE DRAWN: 22.05.17
CHECKED BY: CM	DATE CHECKED: 22.05.17
SCALES: NTS	SHEET SIZE: A1

PROJECT No: E10312

DRAWING No:	DISC.	TYPE	CAT	No	REV
	S	L	(00)	001	

CHARLES
DARLEY
ASSOCIATES

REPORT ON INSPECTION AND TESTING OF REINFORCED CONCRETE FLOOR SLABS AT **CURRIE HIGH SCHOOL, EDINBURGH.**

CHARLES DARLEY AND ASSOCIATES LTD
REGISTERED IN SCOTLAND 150570
33 CAMPBELL STREET, HELENSBURGH G84 8XZ
TELEPHONE : 01436 673805 FAX : 01436 674109
E-mail: charles@charlesdarley.com

Contents

CHARLES
DARLEY
ASSOCIATES

10th January 2017. Job No: 98/16.

Will Rudd Davidson,
43 York Place,
Edinburgh, EH1 3HP.

For the attention of Chris Milne Esq.,

Report on Inspection and Testing of Reinforced Concrete Floor Slabs at
Currie High School, Edinburgh.

1. INTRODUCTION

In accordance with your instructions, we have inspected and tested concrete floor slabs at the west end of the north east block of Currie High School. The work on site was done on the 26th November 2016 by a team led by our Dr. J.C. Darley. This report details our findings.

Opinions and interpretations expressed herein are outwith the scope of our UKAS accreditation.
We confirm that in preparing this report we have exercised all reasonable skill and care.

2. INSPECTION AND SITE TESTING

2.1 Inspection

The suspended floor slabs which were examined exhibit noticeable sag. This is clearly visible, for example, in the angles between the tops of tables. The sag appeared not to be replicated in the profiles of false ceilings which were hung from the soffits of slabs.

There were many cracks in the soffits of the slabs. The widest cracks (5mm or more) were in the direction of the span. Floor coverings were not lifted so that it was not determined whether or not cracks extended to the top surface.

2.2 Concrete Cover to Reinforcement

Measurements were made of position and depth of concrete cover to reinforcement in accordance with BS1881:Part 204: 1988. The test details were as follows:-

a)	Date of test.	26th November 2016.
b)	Component tested.	Floor slabs.
c)	Details of concrete in test area.	See Appendix A.
d)	Location of test areas.	See Appendix A.

CHARLES DARLEY AND ASSOCIATES LTD
REGISTERED IN SCOTLAND 150570
33 CAMPBELL STREET, HELENSBURGH G84 8XZ
TELEPHONE : 01436 673805 FAX : 01436 674109
E-mail: charles@charlesdarley.com

e)	Make of covermeter.	Elcometer 331.
f)	Accuracy of covermeter.	In laboratory conditions +/- 2mm or +/- 5%, whichever is greater. On site +/- 5mm or +/- 15%, whichever is greater, or cover not exceeding 100mm.
g)	Details of calibration.	Instrument checked in-situ. Laboratory calibrated 26/08/16.
h)	Measured cover.	See Appendix A.
i)	Arrangement of reinforcement.	See Appendix A.

2.3 Removal of Concrete Cover (Not UKAS Accredited)

Small areas of cover concrete were cut away from the soffits of the floor slabs within each of the test areas. The size, type and condition of reinforcement was recorded. The findings can be found in Appendix A. Photographs in Appendix C. The concrete cover was replaced using Nufins Nucem HB.

3. LABORATORY ANALYSIS

A sample of concrete was collected from Area 2 and sent to Quartz Scientific of Watford for analysis for chloride content, cement content and cement type (HAC or Portland). Results are shown in Appendix B.

4. DISCUSSION AND OPINION

The suspended slabs exhibited substantial sagging distortion. It is likely the sagging has been present for a long time, perhaps since construction. Similarly, the appearance of cracks is consistent with their being long standing. The widest cracks were in the direction of span, so that they are not attributable to normal flexural stresses. Reinforcement was found to have only superficial corrosion such as might have been present since construction. Expansive corrosion can, therefore, be ruled out as a cause of cracking.

The concrete was tested for cement type (HAC or Portland) using the rapid chemical test described in BRE IS 15/74. The result was positive, so that further chemical analysis was done. The concrete has an increased aluminium oxide content however it is considerably lower than would be expected in a concrete made with high alumina cement.

The cement content of the concrete was found from analysis to be 11.7%. This is a little lower than might be expected in normal structural concrete. 14% is more usual.

Chloride content was found to be 0.06% by weight of cement, which is negligible.

The cracking is consistent with the root cause being plastic and drying shrinkage of the concrete. Large drying shrinkage would also give rise to sagging. Shrinkage at the bottom of the structure is restrained by the main reinforcement so that the top tends to shrink more. The degree of sagging is so great that there may well be another contributory cause. Falsework might have been removed too early during construction so that concrete was loaded before it was mature.

The indication of the inspection and testing is that cracks and sagging have been present for some time. They give rise to an issue of serviceability. It is unlikely there is structural distress requiring urgent attention.

J. C. Darley
For Charles Darley & Associates Ltd.

APPENDIX A

IN-SITU SAMPLING AND TESTING

In-Situ Sampling & Testing

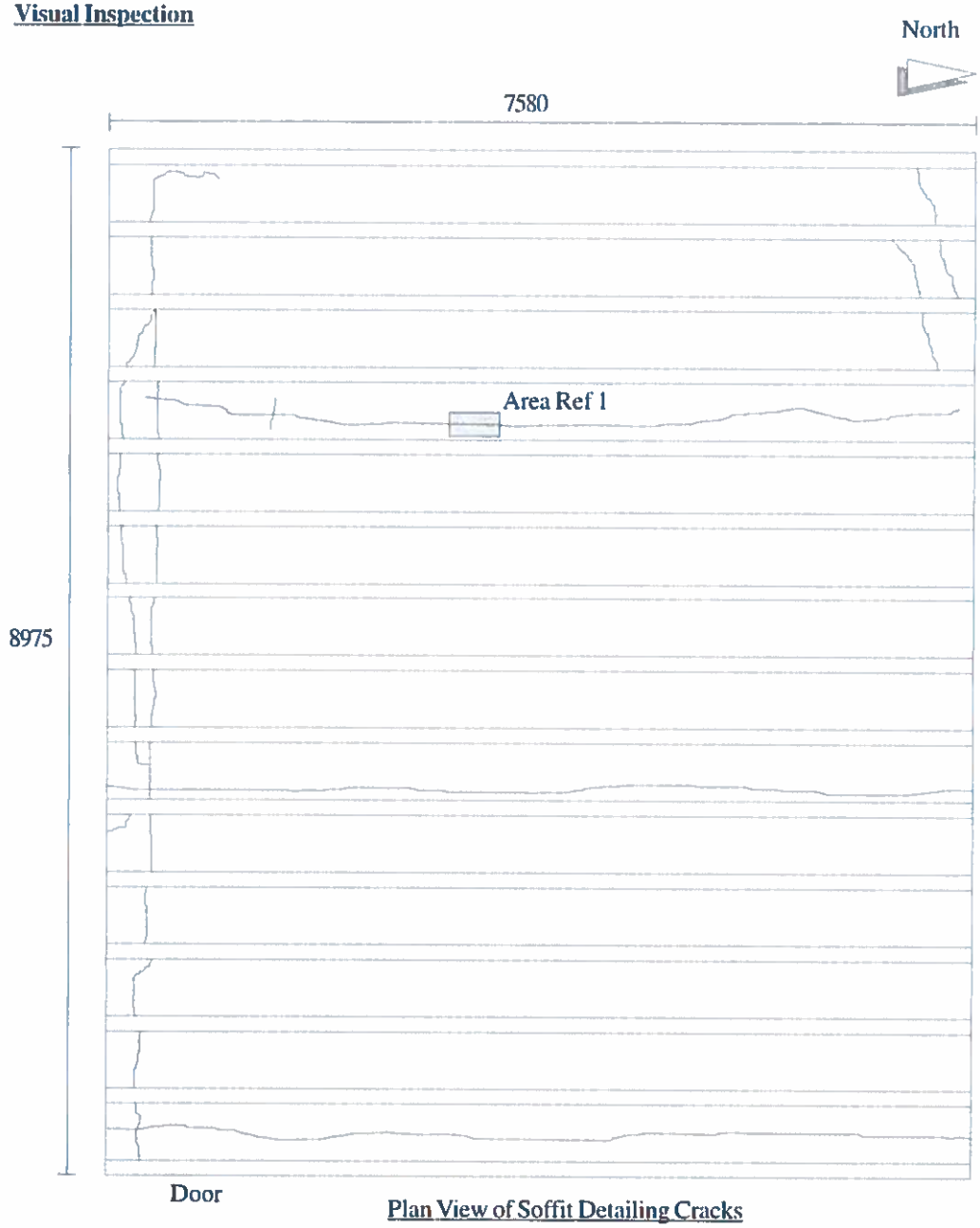
Area Ref.: 1. **Job No.:** 98/16. **Structure Name:** Currie High School, Edinburgh.

Test Area Details

Area Size:	See below.
Element Inspected:	Floor Slab.
Surfaces Inspected:	Soffit.
Date Of Test:	26th November 2016.

Location
Soffit of the 1st floor slab, Room CDT1.

Visual Inspection



Plan View of Soffit Detailing Cracks

Visual Inspection;
A crack 5mm wide was visible adjacent to the west face of the 5th rib from the east side. This crack extends over the full width of the room. It was noted to be narrower towards the ends. Smaller cracks, up to 1.5mm wide were noted in the centre of the 1st and 11th troughs also spanning width of room. See plates 1 to 9.

Note
All measurements in millimetres.

Covermeter Survey and Concrete Sampling

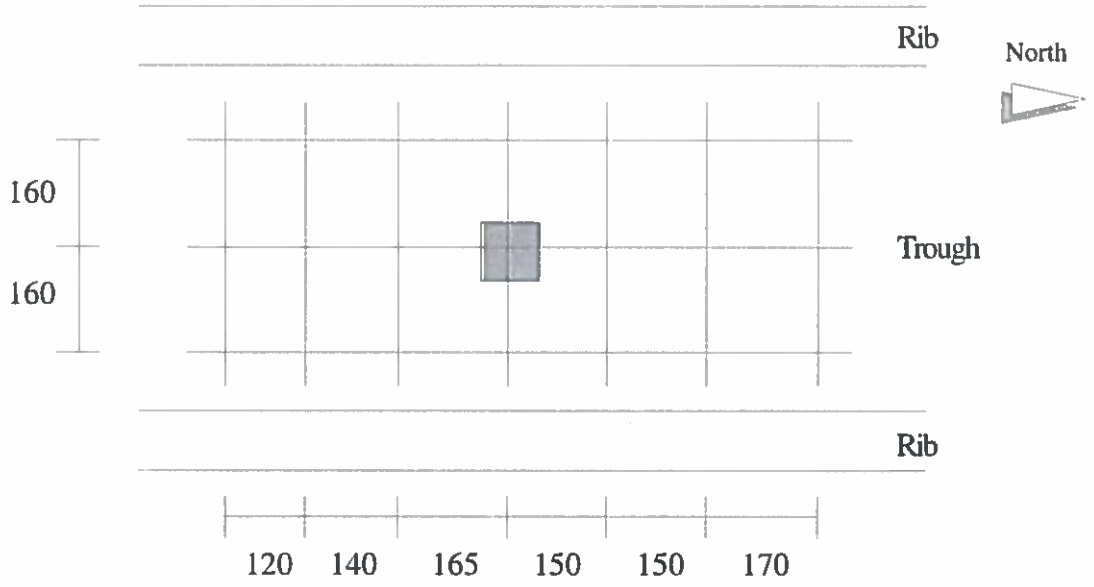
Area Ref.: 1. **Job No.:** 98/16. **Structure Name:** Currie High School, Edinburgh.

Test Area Details

Area Size:	See below.
Element Inspected:	Floor Slab.
Surfaces Inspected:	Soffit.
Date Of Test:	26th November 2016.

Location
Soffit of the 1st floor slab, Room CDT1.

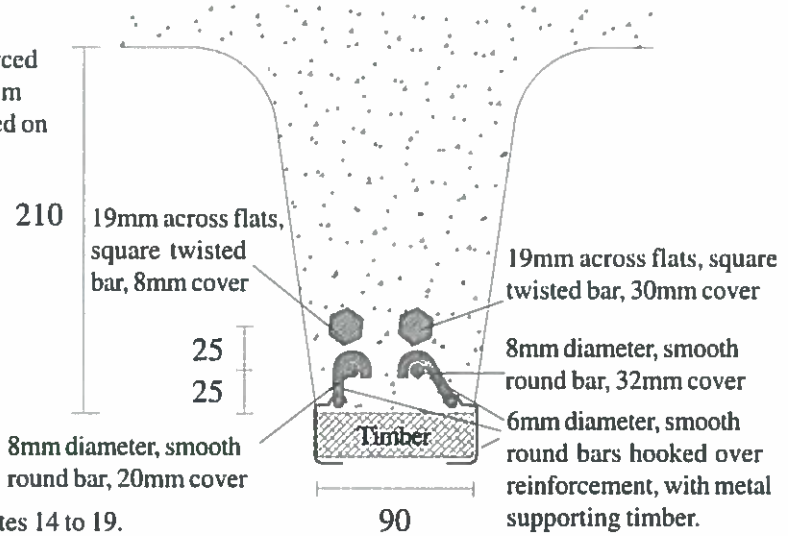
Details of Reinforcement;



Part Plan Detailing Layout of Reinforcement to Soffit of Floor Slab

Details of Breakout
3mm diameter smooth round bars in both directions exhibiting surface corrosion. 12mm concrete cover. See plates 10 to 13.

Details of Floor Make-up
Above the trough the reinforced slab was between 75 and 80mm thick with a 50mm thick screed on top



See plates 14 to 19.

Section Through Rib Detailing Layout of Reinforcement

Note
All measurements in millimetres.

In-Situ Sampling & Testing

Area Ref.: 2. **Job No.:** 98/16. **Structure Name:** Currie High School, Edinburgh.

Test Area Details

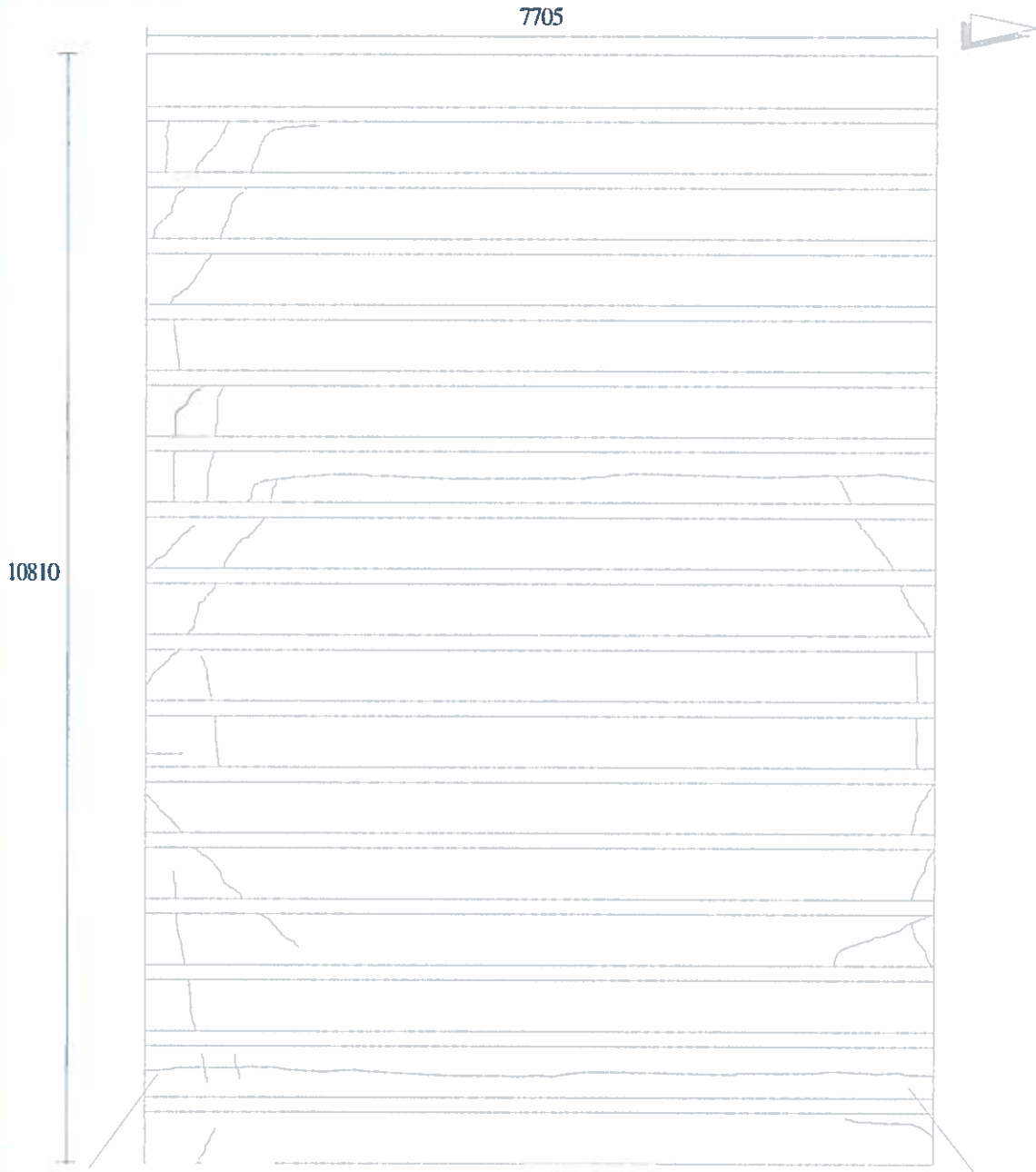
Area Size:	See below.
Element Inspected:	Floor Slab.
Surfaces Inspected:	Soffit.
Date Of Test:	26th November 2016.

Location

Soffit of the 2nd floor slab. Home Economics class above CDT1.

Visual Inspection

North



Joint / crack is continuous into next classroom

Plan View of Soffit Detailing Cracks

Reinforcement is continuous through joint / crack

See plates 20 to 32.

Note

All measurements in millimetres.

Covermeter Survey and Concrete Sampling

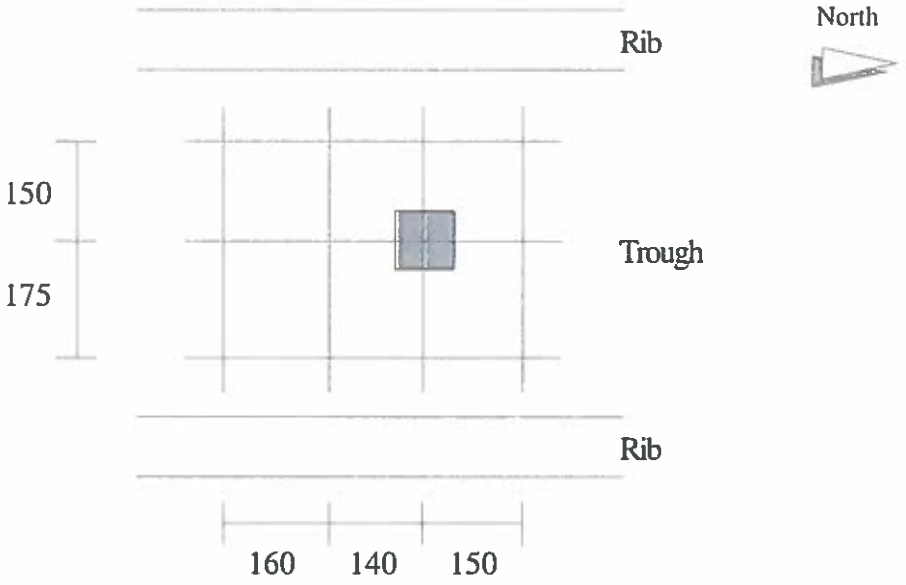
Area Ref.: 2. **Job No.:** 98/16. **Structure Name:** Currie High School, Edinburgh.

Test Area Details

Area Size:	See below.
Element Inspected:	Floor Slab.
Surfaces Inspected:	Soffit.
Date Of Test:	26th November 2016.

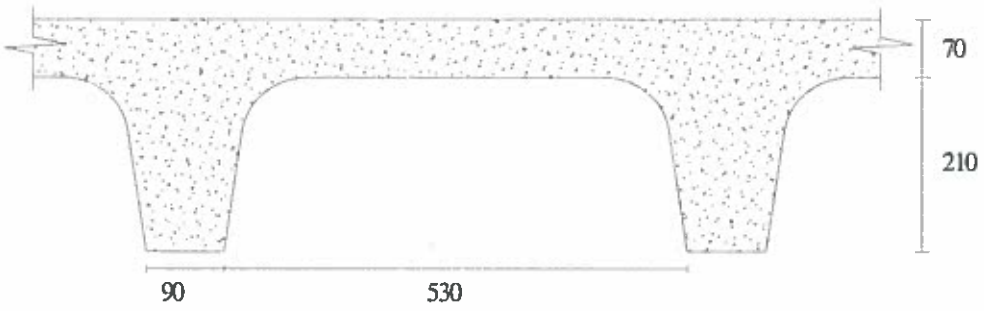
Location
Soffit of the 2nd floor slab. Home Economics class above CDT1.

Details of Reinforcement;



Part Plan Detailing Layout of Reinforcement to Soffit of Floor Slab

Details of Breakout
3mm diameter smooth round bars in both directions exhibiting surface corrosion. 9mm concrete cover. See plate 33.



Cross Section Through Floor Slab

Details of Breakout
Reinforcement detail to the bottom of the rib is as detailed in Area 1. See plates 34 and 35.

Note
All measurements in millimetres.

Covermeter Survey and Concrete Sampling

Area Ref.: 3. **Job No.:** 98/16. **Structure Name:** Currie High School, Edinburgh.

Test Area Details

Area Size:	See below.
Element Inspected:	Floor Slab.
Surfaces Inspected:	Soffit.
Date Of Test:	26th November 2016.

Location

Soffit of the 2nd floor slab. 2nd classroom east of test area 2.

Visual Inspection & Details of Reinforcement:

All dimensions and details of reinforcement are as described in Area 2.
The span was 6400mm. See plates 36 to 39.

Note

All measurements in millimetres.

Covermeter Survey and Concrete Sampling

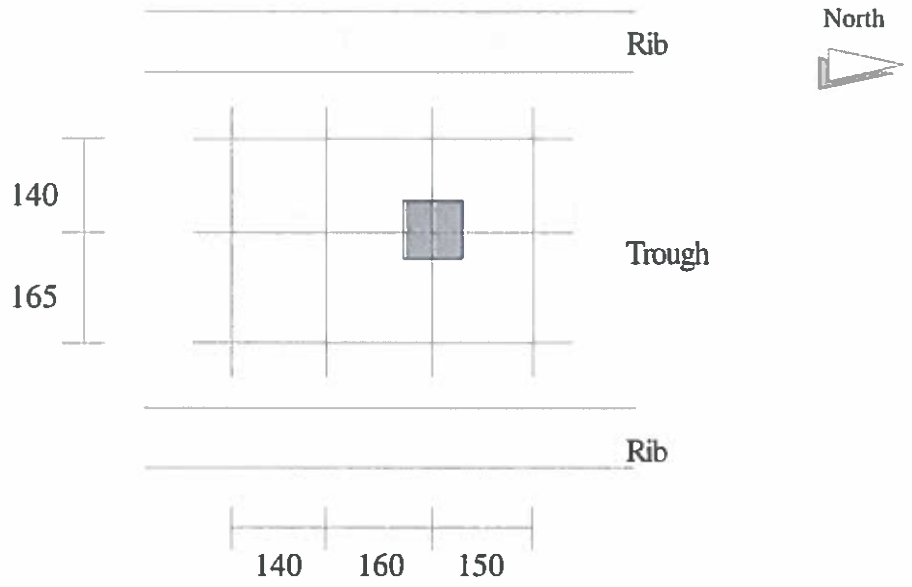
Area Ref.: 4. **Job No.:** 98/16. **Structure Name:** Currie High School, Edinburgh.

Test Area Details

Area Size:	See below.
Element Inspected:	Floor Slab.
Surfaces Inspected:	Soffit.
Date Of Test:	26th November 2016.

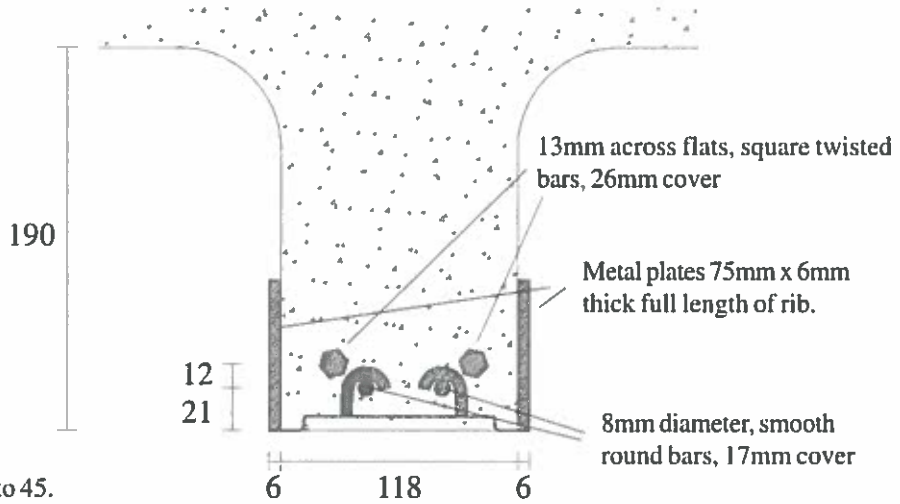
Location
Soffit of the 1st floor slab. 1st classroom east of test area 1.

Details of Reinforcement;



Part Plan Detailing Layout of Reinforcement to Soffit of Floor Slab

Details of Breakout
3mm diameter smooth round bars in both directions exhibiting surface corrosion. 12mm concrete cover. See plates 40 and 41.



See plates 40, 42 to 45.

Section Through Rib Detailing Layout of Reinforcement

The span was 6600mm.
The spacing between the ribs was 500mm.

Note
All measurements in millimetres.

APPENDIX B

LABORATORY ANALYSIS

Quartz Scientific

7G Dukes Yard, Shakespeare Industrial Estate, Watford WD24 5AL
Tel: 01923 213983 Fax: 01923 247732
e-mail: mail@quartz-scientific.co.uk www.quartz-scientific.co.uk

Charles Darley Associates
33 Campbell Road
Helensburgh
G48 8XZ

10 January 2017
CD/13329 Rev. 01/isj

CERTIFICATE of ANALYSIS

Currie High School

Cement/high alumina cement content of concrete sample

Sample ref.:	16284	OPC	HAC
Client's ref.:	-		
Date received:	5 December 2016		
Mass received (g) :	215		
Type of sample:	concrete lump		
Date of analysis:	14 to 21 December 2016		
Determined values			
Soluble silica (%)	2.8	20.2	4
Calcium oxide (%)	8.6	64.5	40
Chloride (%)	0.01		
Presence of high alumina cement*	positive*		
Aluminium oxide (%)	1.1	5.4	40
Calculated values			
Cement content (%)			
ex silica	11.7		
ex lime	13.4		
preferred/mean value %	11.7		
Aggregate content (%)			
ex silica	85.6		
ex lime	83.5		
preferred/mean value	85.6		
Aggregate/cement ratio			
ex silica	7.3		
ex lime	6.2		
preferred/mean value	7.3		

Sample ref.:	16284	OPC	HAC
Client's ref.:	-		
Chloride (% by mass of cement)	**0.06**		
Silica/alumina ratio	2.5	3.7	0.1
Calcium oxide/alumina ratio	7.8	11.9	1.0

Based the chemical analysis the concrete has an increase aluminium oxide content however it is considerably lower than would be expected in a concrete made with high alumina cement.

The cement contents were determined in accordance with B.S. 1881:Part 124:1988. The silica content was determined by atomic absorption spectrophotometric method.
Assumptions used for the cement and aggregate content calculations:

Silica content of cement	=	20.2 %
Soluble silica content of aggregate	=	0.5 %
Calcium oxide content of cement	=	64.5 %

‡Rapid chemical test for the possible presence of HAC - BRE IS 15/74.

Revised report to clarify the BRE test result.

End of report

Iren S. Jasko MSc EurChem CSci CChem FRSC
Technical Manager

APPENDIX C

PHOTOGRAPHS

Plate 1. **Area 1, Soffit of Slab**
General View Exhibiting Cracking

Plate 2. **Area 1, Soffit of Slab**
General View Exhibiting Cracking

Plate 3. **Area 1, Soffit of Slab**
General View Exhibiting Cracking

Plate 4. **Area 1, Soffit of Slab**
General View Exhibiting Cracking

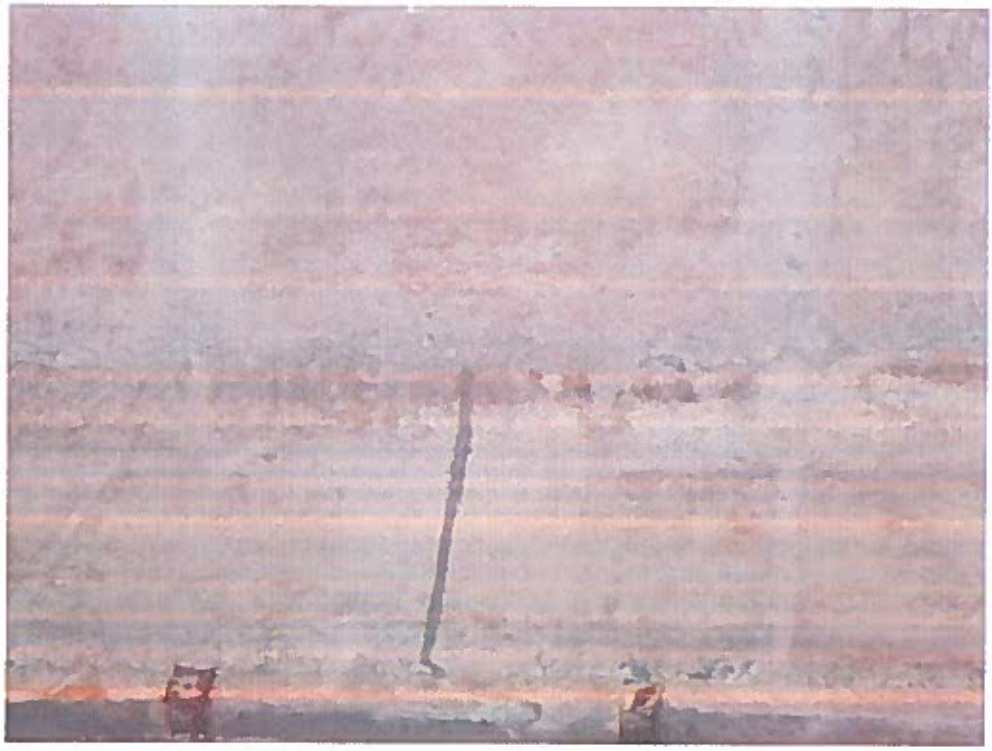


Plate 5. **Area 1, Soffit of Slab**
General View Exhibiting Cracking

Plate 6. **Area 1, Soffit of Slab**
Close Up of Crack

Plate 7. **Area 1, Soffit of Slab**
Close Up of Crack

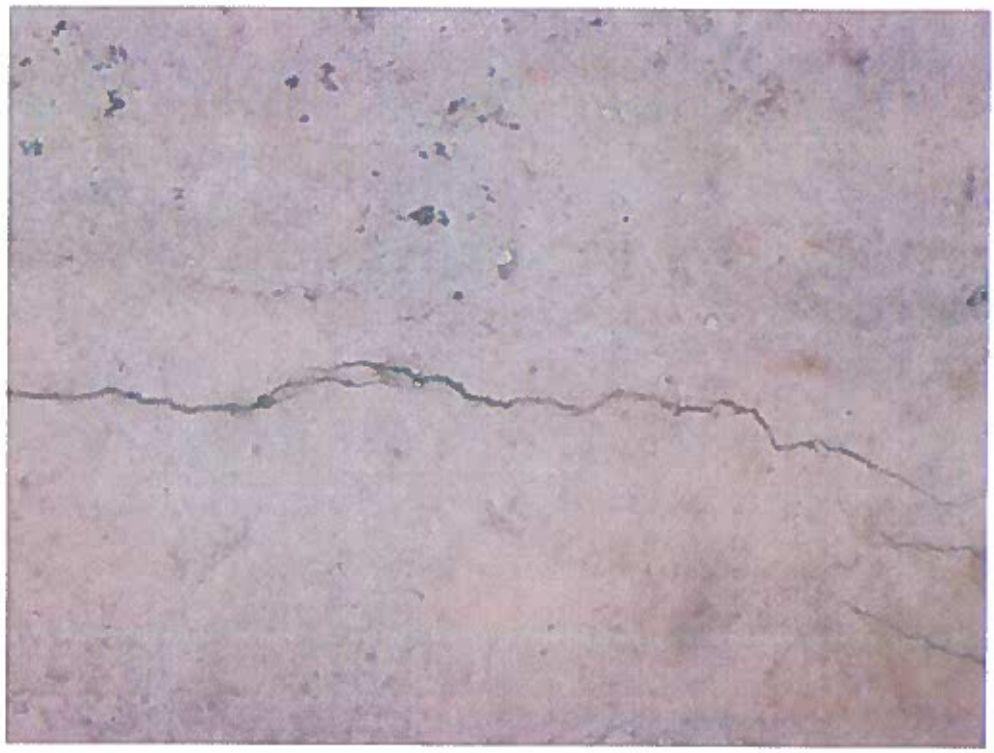


Plate 8. **Area 1, Soffit of Slab**
Close Up of Crack

Plate 9. **Area 1, Soffit of Slab**
Close Up of Crack

Plate 10. **Area 1, Soffit of Slab**
Layout of Embedded Reinforcement

Plate 11. **Area 1, Soffit of Slab**
Layout of Embedded Reinforcement

Plate 12. **Area 1, Soffit of Slab**
Concrete Cover Removed to Expose Reinforcement

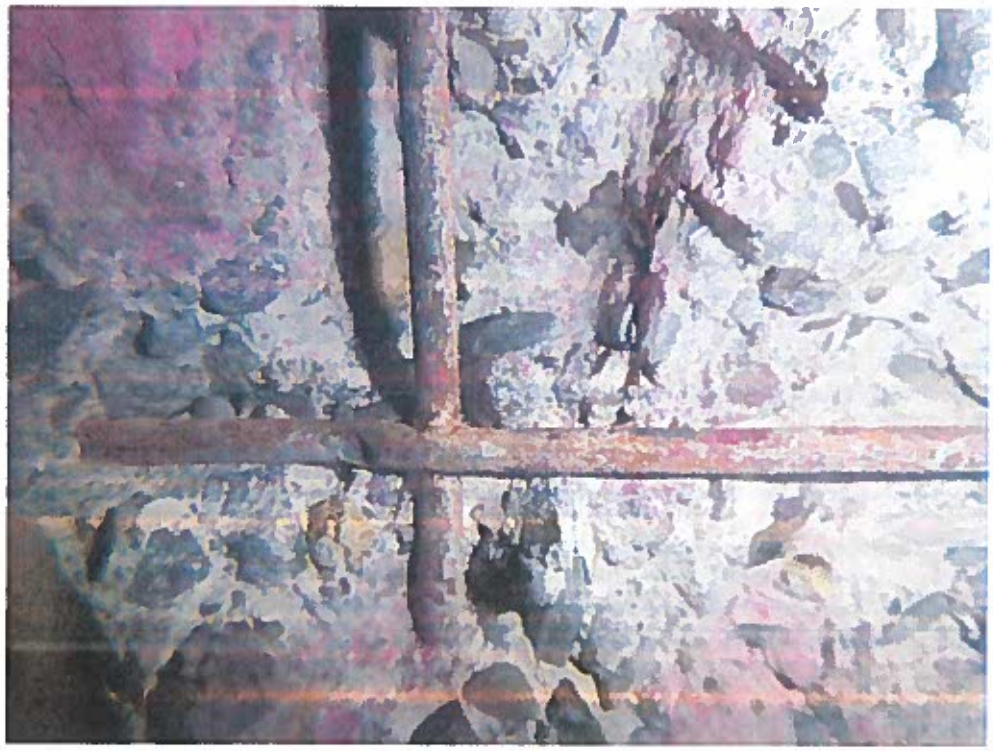


Plate 13. **Area 1, Soffit of Slab**
Concrete Cover Removed to Expose Reinforcement

Plate 14. **Area 1, Rib**
Details of Reinforcement

Plate 15. **Area 1, Rib**
Details of Reinforcement

Plate 16. **Area 1, Rib**
Concrete Cover Removed to Expose Reinforcement

Plate 17. **Area 1, Rib**
Concrete Cover Removed to Expose Reinforcement

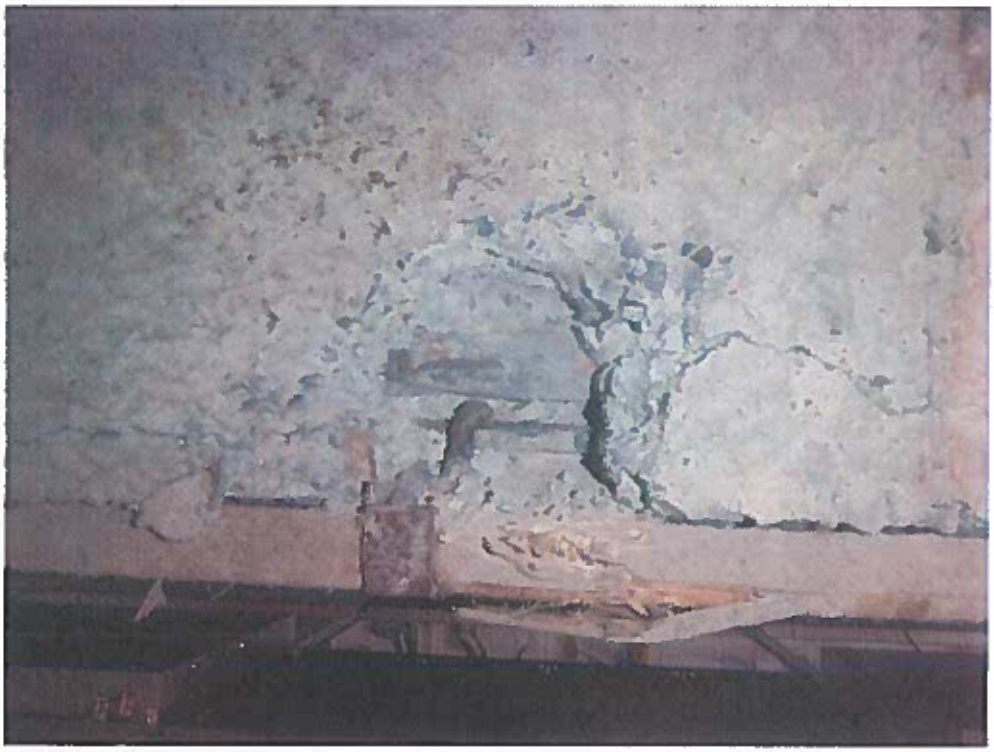


Plate 18. **Area 1, Rib**
Concrete Cover Removed to Expose Reinforcement

Plate 19. **Area 1, Rib**
Concrete Cover Removed to Expose Reinforcement

Plate 20. **Area 2, Soffit of Slab**
General View Exhibiting Cracking

Plate 21. **Area 2, Soffit of Slab**
General View Exhibiting Cracking

Plate 22. **Area 2, Soffit of Slab**
General View Exhibiting Cracking

Plate 23. **Area 2, Soffit of Slab**
General View Exhibiting Cracking

Plate 24. **Area 2, Soffit of Slab**
General View Exhibiting Cracking

Plate 25. **Area 2, Soffit of Slab**
Large Area of Spalled Concrete Due to
Service Access and Adjacent Crack

Plate 26. **Area 2, Soffit of Slab**
Large Area of Spalled Concrete Due to
Service Access and Adjacent Crack

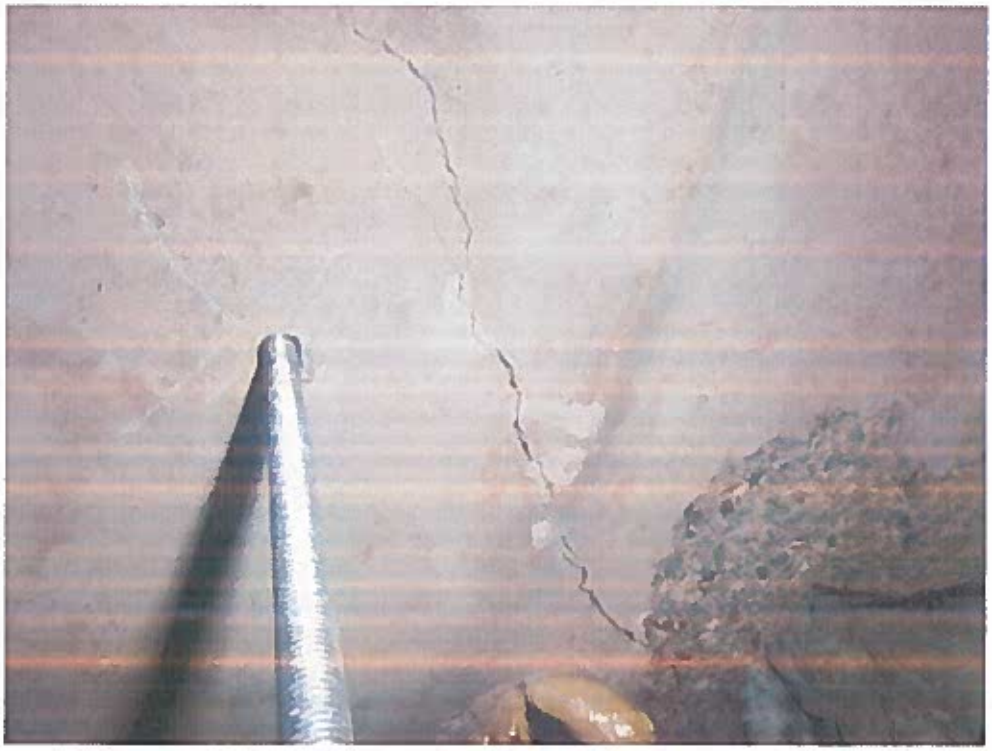


Plate 27. **Area 2, Soffit of Slab**
Large Area of Spalled Concrete Due to
Service Access and Adjacent Crack

Plate 28. **Area 2, Soffit of Slab**
Close Up of Crack

Plate 29. **Area 2, Soffit of Slab**
Close Up of Crack

Plate 30. **Area 2, Soffit of Slab**
Close Up of Crack

Plate 31. **Area 2, Soffit of Slab**
Close Up of Crack

Plate 32. **Area 2, Soffit of Slab**
Concrete Cover Removed to Expose Reinforcement
Across Joint / Crack

Plate 33. **Area 2, Soffit of Slab**
Concrete Cover Removed to Expose Reinforcement

Plate 34. **Area 2, Rib**
Concrete Cover Removed to Expose Reinforcement

Plate 35. **Area 2, Rib**
Concrete Cover Removed to Expose Reinforcement

Plate 36. **Area 3, Soffit of Slab**
General View Exhibiting Cracking

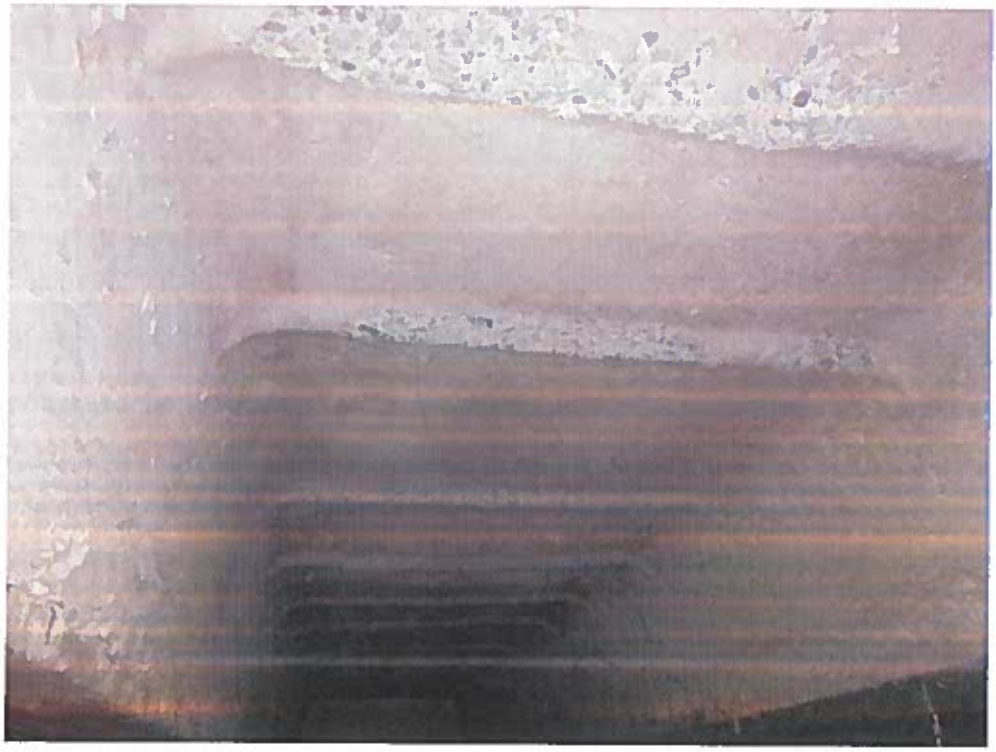


Plate 37. **Area 3, Soffit of Slab**
General View Exhibiting Cracking

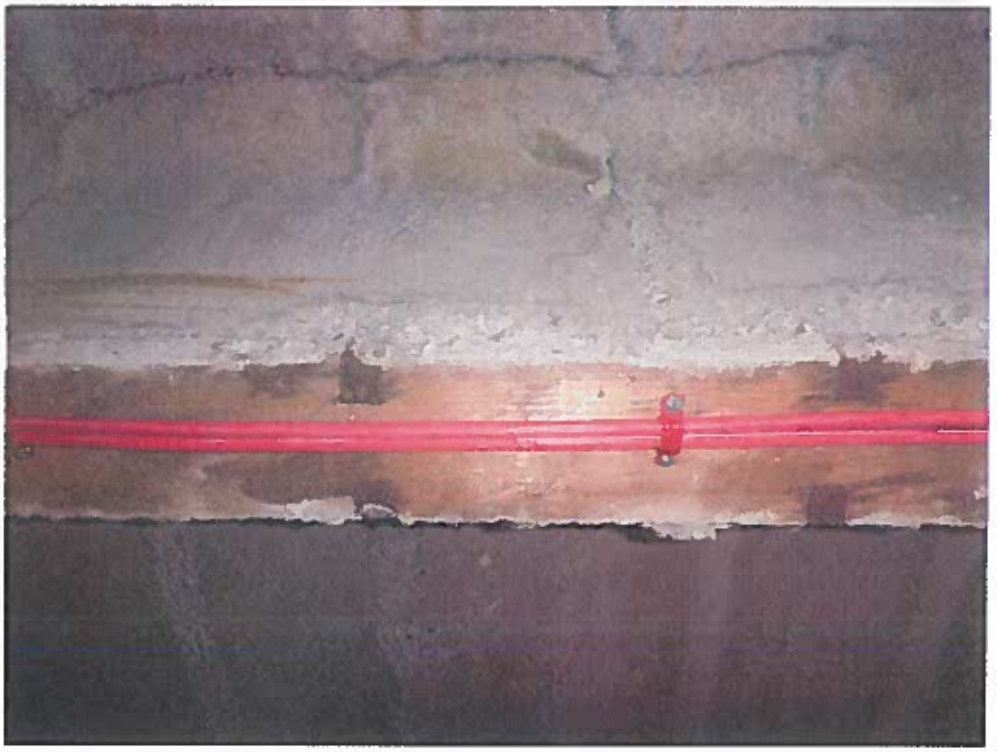


Plate 38. **Area 3, Soffit of Slab**
Close Up of Crack

Plate 39. **Area 3, Soffit of Slab**
Close Up of Crack

Plate 40. **Area 4, Soffit of Slab**
General View

Plate 41. **Area 4, Soffit of Slab**
Concrete Cover Removed to Expose Reinforcement

Plate 42. **Area 4, Rib**
Metal Plate Along Vertical Face of Rib

Plate 43. **Area 4, Rib**
Details of Reinforcement

Plate 44. **Area 4, Rib**
Concrete Cover Removed to Expose Reinforcement

Plate 45. **Area 4, Rib**
Concrete Cover Removed to Expose Reinforcement

City of Edinburgh Council
Property and Facilities Management

Currie Community High School

Technical Block

Floor Report

November 2017

David Narro Associates
Consulting Structural & Civil Engineers
34-36 Argyle Place
Edinburgh
EH9 1JT

Tel: 0131 229 5553
Fax: 0131 229 5090
Email: mail@davidnarro.co.uk
Web: www.davidnarro.co.uk

Job No. 17.0741

CONTENTS

Report prepared by

Lesley Donald

Lesley Donald
B.Sc Hons
for David Narro Associates

1.0 Introduction

1.1 The City of Edinburgh Council commissioned David Narro Associates to report on the condition of the reinforced concrete floors at all levels in the technical block of Currie Community High School. A fluid spillage on the second floor that affected the level below had shown that there were floor cracks present.

1.2 The reporting requirements are to:

a) Assess the condition of the floors;
b) Recommend future actions including remedial works;
c) Assess the future lifespan of the building.

2.0 Inspection Details and Records

2.1 An initial inspection was carried out on 18 August 2017. The technical block was inspected visually externally from ground level and internally, accessing most of the rooms on all levels. Suspended ceiling tiles were removed locally in three areas under the 2nd floor near the area of the reported leak to view the concrete floor. No other areas of the school were inspected.

2.2 After the initial inspection we advised that record drawings would be beneficial if available, and that a more extensive inspection with assistance for ceiling tile removal was required. The inspection was arranged with council framework contractor in attendance on 15 September 2017.

2.3 The inspection areas are shown in the sketch plans in Appendix A. These covered every space on first floor to show 2nd floor structure, all available spaces on ground floor to show first floor structure, all available spaces at basement level to show ground floor and two locations at 2nd floor to show roof structure. Observations and ground and basement levels were limited by presence of plastered ceilings in some areas. Openings to view the roof were selective only to confirm he structure type, as there was no indication of any issues with the roof.

2.4 No physical investigations were carried out as to the strength of individual structural members.

2.5 On the first visit limited overall measurements were made in the building. Structural member sizes were measured where accessible.

2.6 The only record drawings available at the time of the initial inspection were A4 copies taken from the asbestos register held on site. Prior to the second inspection a full electronic copy of the asbestos register was supplied, including clearer larger scale re-drawn plans of the school. These were used for the sketch inspection records in Appendix A.

2.7 Only the technical block is described in detail for the purposes of this report. The description is based on the available drawings and the survey inspections. It is noted that the small-scale plans in the asbestos register may have been based on scans of original record drawings. However, it is not known if the original drawings are available.

3.0 Building Description

3.1 General layout and development

Currie Community High School is located at the north end of Dolphin Avenue. The long axis of the school building group is oriented in an approximately east / west direction. The main entrance is on the south side. Moving from west to east, the building group contains the swimming pool, the gymnasium, the assembly hall with link blocks round an internal courtyard, the 4-storey main teaching block, the library and linking areas, and the 3-storey technical block. The original school buildings are reinforced concrete framed, constructed circa 1964 - 1965. The gymnasium and library areas are later infill of steel framed construction. The ground level slopes downwards in a south to north direction, giving additional partial basement storeys at the north side of the main and technical blocks.

3.2 Technical block overall structure and layout

The flat roofed block is approximately 47 m x 16 m in plan with the long axis aligned in an east / west direction. The building is concrete framed with insitu reinforced concrete beams and columns. The external cladding at upper levels on the north and south elevations is exposed aggregate concrete panels with concrete mullions projecting beyond the cladding line. At the lowest level on each side (ground level to the south and basement level to the north) there is facing brick infill. There are three window bays with timber framed windows in each section between the external column positions at all levels. The east and west gables are clad in storey height exposed aggregate panels. The internal walls are non- loadbearing brick partitions, with some later additions of block or stud partitions.

The main column lines are at approximately 5.5 m centres along the building, length with variations at stairwells. Stairwells are located on the south side near the west end and on the north side near the east end. A lift shaft adjoins the easterly stairwell. The plan layout is similar on 1st and 2nd floor levels with classrooms on each side of a central corridor over the middle two thirds of the block. Columns are located on the external walls and along each side of the corridor wall. The internal column pattern differs at the ends of the block where there are two classrooms in the full width of the building with no corridor. A central internal column occurs in the end rooms. The plan layout is similar at ground floor level, but with a different arrangement of rooms. The basement level occurs on the full length only over the north side of the main corridor line. The basement level floor and the south side of the ground floor appear to be concrete ground bearing slab.

3.3 Technical block suspended floor details

Main beams run along the length of the building on the external elevations and along the corridor wall lines, with a single internal beam locally at the ends. Cross beams tie the column heads. Where observed, the beams were 300 mm wide and 330 mm depth below the ribs. However, there are likely to be variations in the beam sizes throughout the building. The insitu concrete floor spans over the main concrete beams. It is of inverted concrete trough profile with 100 mm wide ribs at 610 mm centres. In most locations the depth from the bottom of the rib to highest point of the trough was measured at 200 mm. Some varying dimensions were noted in the roof structure, which had both smaller and larger trough depths.

4.0 Technical Block Condition

4.1 General structural condition

There are no obvious defects apparent in the concrete columns. The columns, with plaster finishes where internally exposed, are project from corridor walls and occur as isolated columns in a few locations. They are also visible externally at the lowest floor level on each of the north and south elevations. No obvious defects were seen in concrete beams. However, these were viewed only in very restricted locations. The external cladding appears to be in acceptable condition. Internal non-loadbearing walls appear to be in sound condition.

4.2 Floor condition – Cracking and concrete defects

The sketches in Appendix A show the location of observed defects based on sample locations in most available rooms. Fine longitudinal cracking parallel to the north / south span direction of the trough flooring occurs in several areas. The crack line is generally near the centre of the high part of the trough. Some areas display what appears to be cracks across the troughs. There are local minor defects of damaged concrete around service penetrations and a few associated diagonal cracks. Small diameter reinforcement is visible locally at a few damaged areas at the top of the troughs. The few floor cracks visible on the south side of the ground floor are more likely to be at joints in the ground bearing slab.

4.3 Floor condition – Slopes

The floors display slopes of varying degree in locations shown in the sketches in Appendix B. The floor slopes are most noticeable on the first floor, and to a lesser extent on the 2nd floor. They are also noticeable on the north side of the ground floor, particularly at the east end. The general direction of slope in the suspended floors is downwards from the centre of the building towards the north and south elevations. At the east end of the block where there is no central corridor, there is typically also a slight slope downwards to the east gable. This effect is not obvious at the west end. In this area the slopes towards the north and south elevations level out at approximately the middle of the end rooms on 1st floor. The corresponding area on the 2nd floor was not clearly seen.

5.0 Discussion

5.1 Floor construction

This type of concrete trough floor structure was used until about the end of the 1960s, when pre-stressed concrete units such as Bison became more economical. There were various manufacturers of the proprietary trough forms over which the insitu concrete floor was cast. The depth of concrete over the top of the high point of the formers in these type of systems is not usually great. It is likely to be in the range 75 mm to 100 mm. The main ribs are expected to contain bar reinforcement in the bottom, and mesh reinforcement in the upper floor deck area.

5.2 Defects as noted by school staff

The floor slopes are noticeable to the untrained eye. However, it was not clear when these had occurred or whether they had occurred over a short space of time. The general view appeared to be that they were recent, without being able to put a definite time against that. The issue that prompted the condition of this report was a plumbing leak in a second-floor sink in the south west end room that flowed down the first-floor room division wall. Tracing the leak had shown cracking in the floor at this area.

5.3 Floor cracks

The fine longitudinal cracks are in the thin slab area that spans the short distance across the ribs. Shrinkage or carbonation of the concrete are possible reasons for the cracking. In my opinion these are not of major structural significance. What appears to be cracks across the trough profile in a few areas may in fact be junctions of the trough forms that may have slipped during casting. Other areas of damage and exposure of reinforcement are generally related to service penetrations, and are minor in nature. There is no sign of significant corrosion of reinforcement where exposed.

5.4 Floor slopes

There is no obvious explanation to account for the floor slopes. The slopes direction tends to suggest settlement of the edge beams relative to the internal beams or deflection of the edge beams. The edge beam was not clearly seen in any location to confirm its size and condition. At ground floor level in the northeast corner room the start of slope appears distinctive. From the layout drawings, it appears likely that the beam under has a longer span than typical.

5.4 Settlement

Slight settlement towards the end of the construction period is common, as the ground adjusts to the new load from the building. However, this does not tie in with the possibly more recent appearance of floor slopes. There is no evidence of movement on the elevations, though is it possible that cladding could have been levelled to take up slight movement that had occurred before it was installed. If any ground movement has taken place since, causing local sinking of columns and beams, it has not been sufficient to damage the cladding.

6.0 Conclusions

6.1 In my opinion the observed defects do not show major deterioration of the floor structure and do not require urgent action.

6.2 Since there are no obvious reasons to account for the defects, some further investigation, including some limited concrete testing is recommended. This should concentrate on the edge beams. Work could most conveniently be carried out during the February or Easter school holidays in 2018.

6.3 At slightly over 50 years old, the building may be considered to have exceeded its design life span. However, in my opinion, and subject to a more detailed review after the further investigation noted, the structure may be expected to have a reasonable future lifespan.

7.0 Recommendations

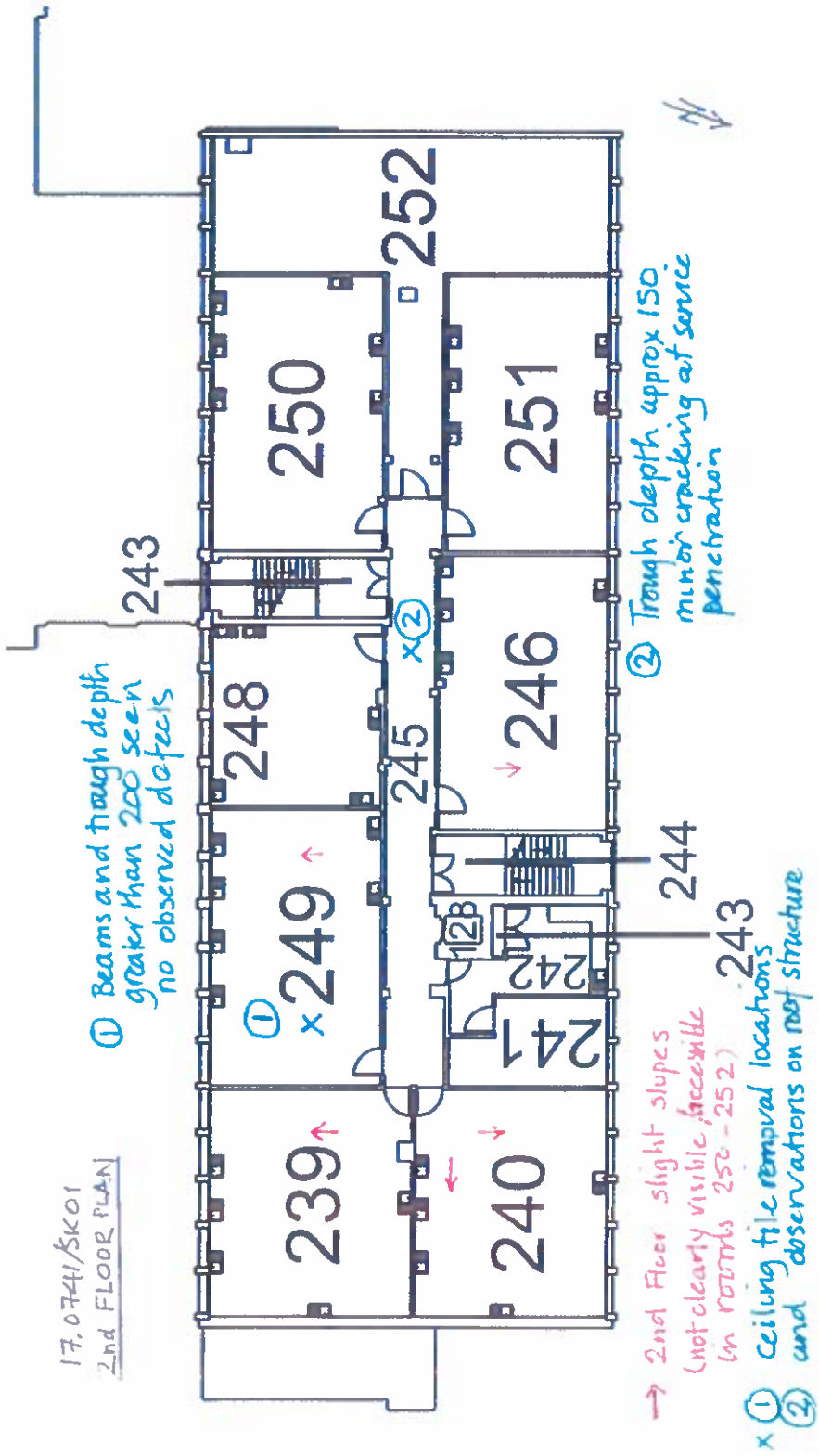
7.1 Carry out a further opening-up exercise for visual inspection, concentrating on edge beams to determine sizes and spans. This should also include cutting small openings in plaster ceilings where present as well as ceiling tile removal to allow a reasonable sample of beam locations.

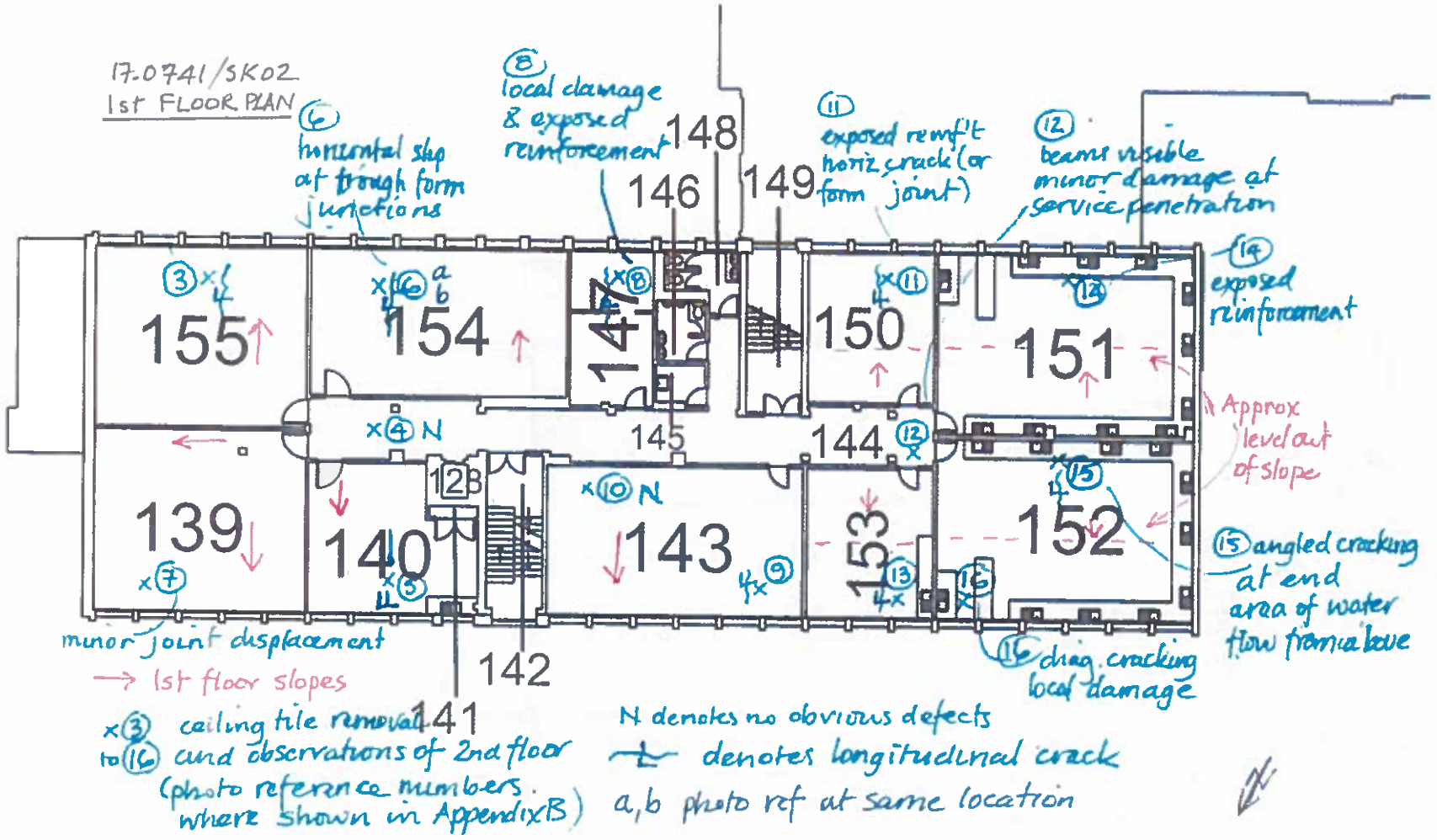
7.2 Engage a concrete testing specialist such as Stanger or Charles Darley Associates to carry out tests for concrete carbonation and take small samples to determine concrete strength and composition, and carry out a selective covermeter survey to determine bar sizes and location. The exact nature of the survey and testing would be discussed in detail with the specialist.

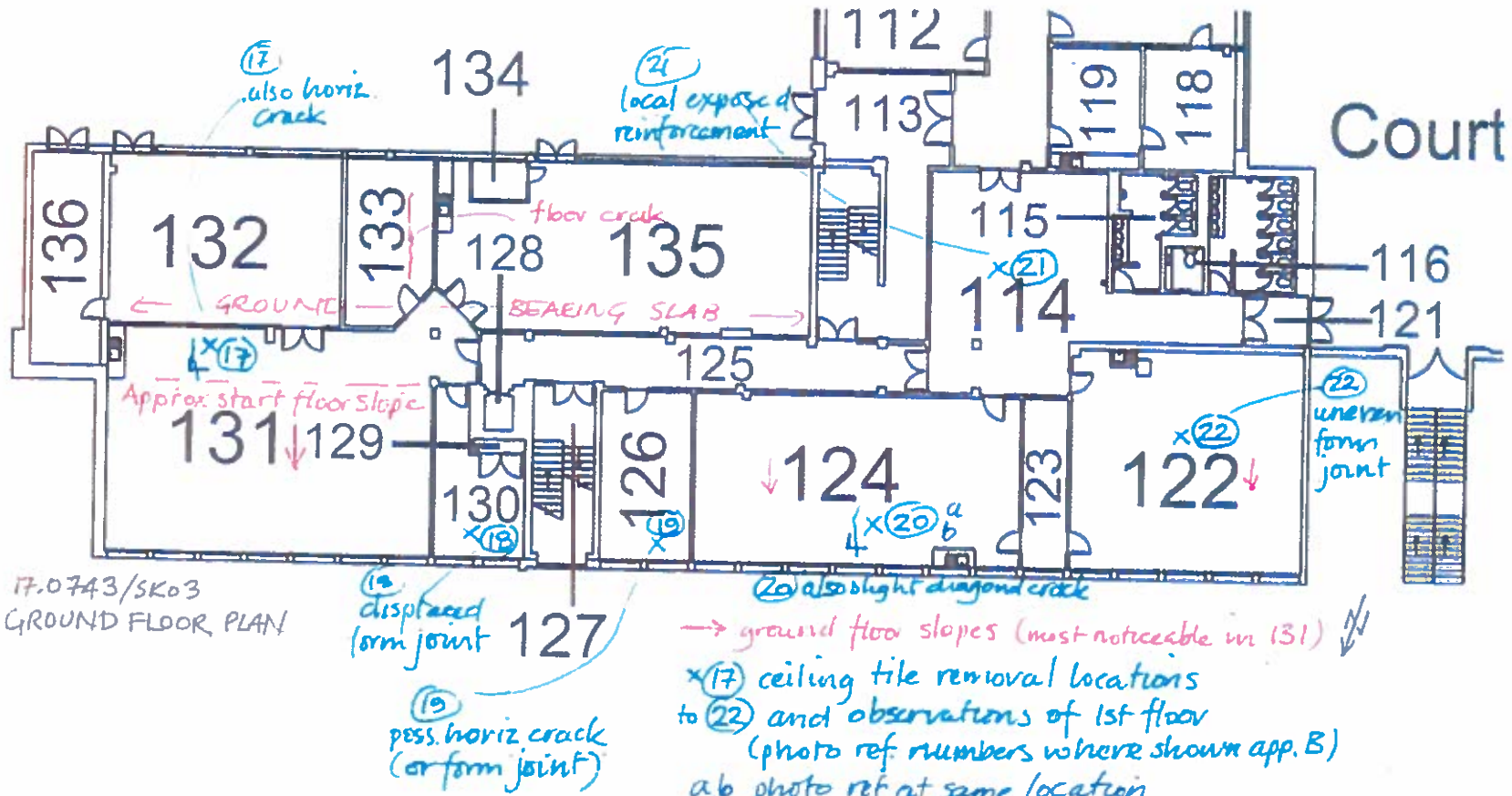
7.3 If the investigation is carried out in February, depending on the findings, it may be possible to specify and arrange for any necessary repairs to be carried out in the Easter or Summer holidays.

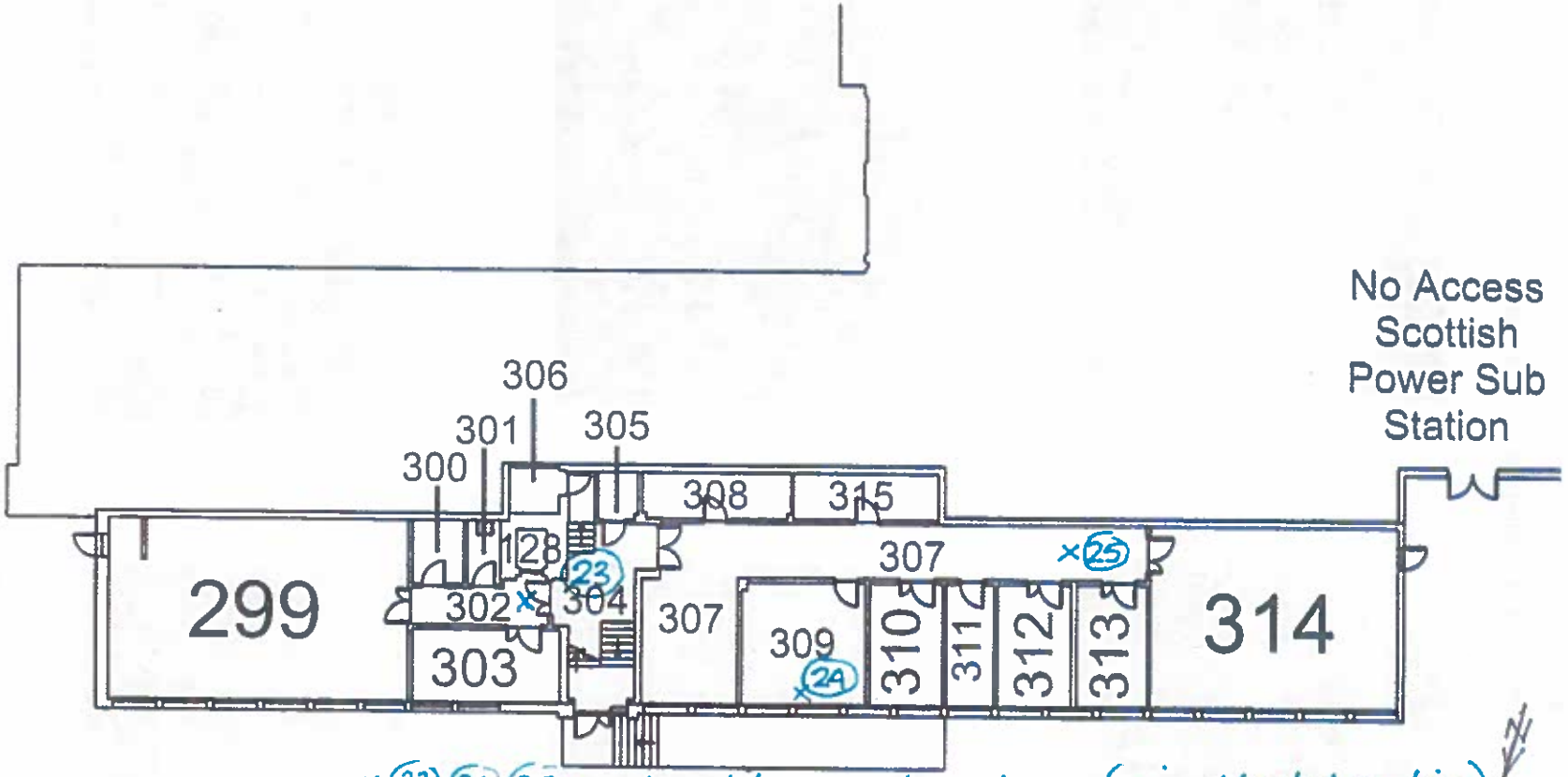
Appendix A

Sketch Details




17.0741/SK02
1st FLOOR PLAN
(6) horizontal slip at trough form junctions
(8) local damage & exposed reinforcement
(11) exposed reinf't horiz crack (or form joint)
(12) beams visible minor damage at service penetration
(14) exposed reinforcement
Approx level out of slope
(15) angled cracking at end area of water flow from above
(16) diag. cracking local damage
minor joint displacement → 1st floor slopes
x(3) to (16) ceiling tile removal and observations of 2nd floor (photo reference numbers where shown in Appendix B)
N denotes no obvious defects
denotes longitudinal crack
a,b photo ref at same location
155
154
147
148
146
149
150
151
145
144
139
140
128
143
153
152
142
141


134
(17) also horiz crack
(21) local exposed reinforcement
112
113
119
118
Court
136
132
133
128
135
floor crack
115
116
121
114
GROUND
BEARING SLAB
125
Approx start floor slope
131
129
130
126
124
123
122
(22) uneven form joint
17.0743/SK03
GROUND FLOOR PLAN
(18) displaced form joint
127
(19) poss. horiz crack (or form joint)
(20) also slight diagonal crack
→ ground floor slopes (most noticeable in 131)
(17) ceiling tile removal locations to (22) and observations of 1st floor (photo ref. numbers where shown app. B)
a,b photo ref at same location



17.0741/SK04
BASEMENT
LEVEL 1 PLAN

× (23), (24), (25) ceiling tile removal locations (limited by plaster ceilings)
no obvious defects in ground floor over
No floor observations - ground bearing slab throughout

Photographic Appendix B

Ceiling opening views – for location refer to Sketches 01 to 04 in Appendix A

1

3

5

6a

6b

7

8a

8b

9

11

12a

12b

13

14

15a

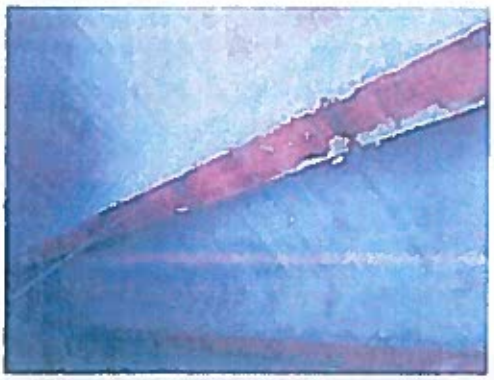
15b

16a

16b

17

18



19

20a

20b

21

External views

South elevation

Southeast corner

Northeast corner

North elevation