



Roads Department

Consultancy Unit - Structures Section

Structural Survey Report

Lochside Leisure Centre, Forfar

09 July 1998



General Report

Department of the Interior

Washington, D.C.

June 15, 1964

Mr. [Name]

Enclosed for you are [Number] copies of [Title]

Very truly yours,

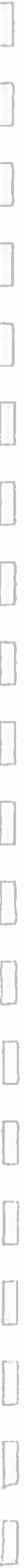
[Signature]

ANGUS COUNCIL ROADS DEPARTMENT CONSULTANCY UNIT
STRUCTURAL SURVEY REPORT
LOCHSIDE LEISURE CENTRE, FORFAR
09 JULY 1998



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2.0 INTRODUCTION

2.1 Background to Report

This report was requested by Mr. W. Duff (Property Services Department), the report was written by Mr. D. Davidson (Roads Department).

This report is the third report written by this department since the formation of Angus Council Unitary Authority.

The first report was written by C Strachan (17/03/98) and requested by I Lingard (Property Services Department). This report dealt specifically with the "North Elevation Wall" (Wall 2 Drg. No. AC520/818/001).

The second report was requested by E Mann (Property Services Department) and written by D Davidson (14/10/97) and reported upon the condition of various sections of the building outlined by the building users and maintenance inspectors as requiring investigation.

This third report augments the two previous reports, and will cover the following points

- To determine as far as possible any previous structural maintenance to the structure.
- To report upon the present condition of the areas of the building highlighted as suffering from distress.
- To draw conclusions from the above.
- To recommend remedial works, and monitoring if required for the above areas.
- To recommend further investigations to determine further areas under distress which may require attention.



3.0 STRUCTURAL MAINTENANCE SUMMARY

3.1 Dates and Events

Date	Event	Notes	Source
22/07/77	Copy of Letter from GRM Kennedy (contact unclear - ref JR/ES) to WH Brown Construction Ltd. Dundee	Refers to outstanding defects still to be attended to. Completion date may have been 11/02/77. Defective Door Closures Copy of correspondence not in file. Was this a result of poor workmanship or due to differential settlement ? Staff House References made to cracked areas of roughcast - was this a result of poor workmanship or due to settlement?.	ADC C/W Archive Files - General up to 1991.
23/03/84	Copy of Letter from GRM Kennedy (Edinburgh) to GRM Kennedy (Aberdeen). Enclosed report	4 no. A4 sheets of crack positions - all to be grouted - some reference to columns being built out of plumb. <i>"It cannot be guaranteed that further cracking will not take place but we would expect this if any to be to a lesser degree"</i>	ADC C/W Archive Files Crack Monitoring 1984/85 - Corrs.
03/04/84	Letter from GRM Kennedy & Partners (Aberdeen) to ADC Department of Technical Services.	Enclosing detailed report and drawings (drawings not found in ADC C/W Archive Files). <i>"...It is the Engineer's opinion that the cracks are essentially 'cosmetic' problems due to differential settlement, and are not a cause for any concern over the structural stability of any part of the centre"</i>	ADC C/W Archive Files Crack Monitoring 1984/85 - Corrs.
24/05/84	Letter from GRM Kennedy & Partners, Engineer to ADC Department of Technical Services	"Metal Pin" tell tales to be installed in disco area, sports hall store, drama hall store. ADC fitting tell tales in-house.	ADC C/W Archive Files Crack Monitoring 1984/85 - Corrs.
24/05/84	Copy of letter to J. Wilson (Edinburgh) from GRM Kennedy & Partners Aberdeen Office.	More tell tales to be fitted Asking for detailed information on the strengthening of the column in the boat store. Why was this strengthening required ?	ADC C/W Archive Files Crack Monitoring 1984/85 - Corrs.



07/06/84	Letter from J. Wilson (GRM Kennedy & Partners, Engineer) to ADC Department of Technical Services	<i>"the structural stability of the column within the 'boatstore' at the rear of the Centre is entirely sound"</i> Why was the strength of this column in question ?	ADC C/W Archive Files Crack Monitoring 1984/85 - Corrs.
10/06/84	Crack Monitoring Begins	Report on Crack Monitoring 10/06/84 - 22/05/85 ADC meeting with GRM Kennedy to discuss cracking and install gauges to cracked structural walls and floorslab. Gauges to be monitored weekly for 3-4 month period. GRM Kennedy to then advise on necessary repairs. Note, no mention was made of this by GRM Kennedy representatives during the meeting with AC staff in January 1998	ADC C/W Archive Files Crack Monitoring 1984/85 - Notes / Results
18/06/84	Note from 100	Crack in floor to Coffee Bar " <i>across slab</i> " adjoining sports hall window " <i>of a fairly recent nature</i> " - gauge(s) installed.	ADC C/W Archive Files Crack Monitoring 1984/85 - Notes / Results
26/06/84	Copy of letter from J. Wilson (Edinburgh) to R Parker (Aberdeen) (both GRM Kennedy & Partners)	Crack movements described as minor - slab cracks described as "consistent with ground movement" - grout repairs to cracks recommended.	ADC C/W Archive Files Crack Monitoring 1984/85 - Corrs.
29/06/84	Letter from J. Wilson (GRM Kennedy & Partners, Engineer) to Mr Guthrie (ADC Department of Technical Services)	Detailing resin treatments for the crack infilling, confirming no such work is to be undertaken until " <i>all are satisfied that movement is no longer occurring</i> "	ADC C/W Archive Files Crack Monitoring 1984/85 - Corrs.
09/07/84	Note from 100	"Slight movement" noted to crack " <i>across slab</i> " adjoining sports hall window.	ADC C/W Archive Files Crack Monitoring 1984/85 - Notes / Results
16/07/84	Note from 100	Crack monitoring confirms that cracks in "certain areas" open and close periodically - dependant upon weather conditions.	ADC C/W Archive Files Crack Monitoring 1984/85 - Notes / Results



30/07/84	Note from 100	Coffee bar crack and cracks in sports hall store closing.	ADC C/W Archive Files Crack Monitoring 1984/85 - Notes / Results
3/9/84	Note from 100	"Movement" to all cracks after weekend of wet weather.	ADC C/W Archive Files Crack Monitoring 1984/85 - Notes / Results
11/09/84	Note from 100	Meeting with Mr. J. Wilson of GRM Kennedys - weather conditions to be noted between readings.	ADC C/W Archive Files Crack Monitoring 1984/85 - Notes / Results
13/09/84	Draft letter from ADC Director of Technical services (Mr. Miller) to J. Wilson (GRM Kennedy & Partners, Engineer)	Enclosed crack monitoring readings for past three months.	ADC C/W Archive Files Crack Monitoring 1984/85 - Corrs.
POST 21/1/84		<i>"TELL TALES UPPER FLOOR - Coffee Bar Adjoining Recreation Area"</i> <i>"Tell tales removed during bar construction & filling with lightweight grout - no indication of movement (approx. 6 weeks after filling)."</i> Bar construction & grout filling - what area was grouted and why ?	ADC C/W Archive Files Crack Monitoring 1984/85 - Notes / Results
22/3/85		Little or no movement since 11/09/84 - comments made that all the movement seems to take place during the dry months of the year.	ADC C/W Archive Files Crack Monitoring 1984/85 - Corrs.
09/12/85	Letter of award from ADC to WF Barker	<i>"Forming Store in Drama Studio"</i> Installation of timber partition to drama studio.	ADC C/W Archive Files - General up to 1991.
22/05/86	Crack Monitoring Ceases		ADC C/W Archive Files Crack Monitoring 1984/85 - Notes / Results



22/05/86	Quote to re-rivet and seal 4 no. Joints to flue Chimney by	Earliest indication of movement in chimney .	ADC C/W Archive Files - General up to 1991.
01/12/86	Letter of award from ADC to W.J. Furse & Company	<p><i>"Repairs to Steel Insulated Chimney"</i></p> <p>£574.00</p> <p>Evidence of collars having been fitted around ducts connecting chimney to building - cracks under collars may have been caused by wind movement or differential settlement.</p> <p>Attached letter from Furse Steeplejacks states that unclad or unlined steel chimneys should be ultrasonically tested every year, and clad / lined steel chimneys to be tested every three years.</p>	ADC C/W Archive Files - General up to 1991.
28/11/91	Report from Hampton Timber Specialists	Replace doorposts and tiles in showers - due to water ingress causing rot and infestation of beetles - indicates tiles possibly cracked for a very long period.	ADC C/W Archive Files - Phase 2 - Refurbs.
21/03/94	ADC letter of award to G&B Building & Civil Engineers	<p>Football Changing Rooms</p> <p>£55,009.09 exc. VAT</p> <p>What works were carried out? -</p>	ADC C/W Archive Files - General 1992 -
10/94	Floor Treatment to Sports Hall Store	<p>ADC drawings indicating addition of 50mm screed to sports hall store areas.</p> <p>This has not been put in place.</p>	ADC C/W Archive Files "Repair to L/C Storefloor"
16/12/94	Remedial Works to Sports Hall Store AI 02, 03, 04	<p>02 Cut ramp to allow for addtl. screed</p> <p>04 Installation of 4000 x 300mm mesh fabric over crack in floor.</p> <p>03 Repair to brickwork to LHS of fire exit - remove clean and re-build.</p> <p>No evidence of AI 02, 04 being actioned.</p>	ADC C/W Archive Files "Repair to L/C Storefloor"
11/01/95	Practical Completion Certificate for Remedial Works to Store Floors		ADC C/W Archive Files "Repair to L/C Storefloor"

3.2 Comments On The Structural Maintenance History of The Building

It is clear from the ADC archives that cracking within the building has been a problem since 23 March 1984 when the buildings designers (GRM Kennedy) were engaged by ADC to undertake a structural survey. Previous to this, defective door closures in the main building and cracking to the staff house harling were problems highlighted in the list of outstanding defects to be attended to during the contractor's maintenance period (22/07/77). The cause of these defects is uncertain at this time, it is possible that differential settlement could have been a cause.

The letter accompanying the structural survey report dated 3 April 1984 states that the cracks are not structural (ie: "cosmetic"). It is unclear as to whether the cracks in the GP room slab and sports hall store walls were in evidence at this time.



A crack monitoring system was then set up upon GRM Kennedys recommendation to record the crack width movements in the following five positions from the period 10 June 1984 to 22 May 1985.

- GP Room / Drama Studio partition wall (1st floor)
- Coffee Bar adjoining recreation area (1st floor)
- Sports hall store - either side of door 58 - ground floor (2 no.)
- Viewing Lounge (now canteen) - ground floor slab.

See 4.3 and A10.

It is unclear why the above measure was taken if the cracks were viewed as being "cosmetic" in April 1984.

In May of 1985 correspondence relates that the stability of a column within the boatstore became the subject of discussion. It is unclear why this topic arose, all columns within the boatstore will be inspected as part of the next crack monitoring survey.

In June of 1984 a letter from GRM Kennedy recommends resin treatments from crack infilling - no resin treated cracks have been found to date in the building.

In May of 1986 repairs to the chimney connections were required, this may have been due to wind vibrations loosening rivets, or differential settlement between the chimney / building foundations. The chimney should be given a comprehensive inspection by qualified steeplejacks on a regular basis.

In November 1991 cracked tiles in the showers were reported as causing timber rot / beetle infestation due to long term water ingress. Again this may have been due to differential settlement causing the tiles to crack.

4.0 EXISTING CONDITION OF THE STRUCTURE

4.1 General

The building is situated adjacent to Forfar Loch. The surrounding area consists of residential, rural, wooded, and farmland areas sloping gently to the loch. Local knowledge tells us that site is reputed to have been a marshland area which was infilled with domestic / light industrial refuse. The access road to and from the building crosses over the landfilled area. The road can be seen to undulate in various places, this is especially evident at the exit road junction with Craig O'Loch Road. This is representative of the fill exhibiting subsidence due to traffic loadings, especially prevalent at the point where the soft landfill meets the natural soil under static traffic loads.

The building's Architect and Structural Engineer (GRM Kennedy) were contacted prior to this report being written. This was required in order to gain insight into the history, present form and condition of the building. Several original drawings were passed on by GRM Kennedys and copies are now held by both Property Services and this Department. The Structural Engineer responsible for the design of the building stated verbally that vibro-replacement piles were used on a continuous basis to a depth of approximately 5-6m underneath all foundations.

Vibro - replacement piles were reported as being put in place outwith the current building limits so as to allow expansion of the squash courts. A shallow excavation in this area has revealed the presence of type 1 fill or similar material, confirming the piles position on plan.



4.2 Ground Investigation

A borehole ground investigation was carried out on 3 March 1998 in order to provide data by which new foundations to the sports hall store could be designed. The borehole logs show a layer of refuse landfill some 3m in thickness, approximately 1-1.5m below ground level (A1).

It is therefore reasonable to assume that if the vibro-replacement piles are 6m deep, then only the bottom 2-2.5m of pile will be resisted by soil passive pressure (see conclusions).

The above investigation showed that there was evidence of hydrocarbons present within the landfill, therefore any works to be carried out within the ground should highlight this as a hazard in the pre-tender health and safety plan.

See 5.1 for conclusions on the vibro-replacement piles.

4.3 Crack Monitoring

Crack monitoring was carried out from 11/06/84 to 22/05/85, at the suggestion of GRM Kennedys. The accuracy of the crack monitoring appears to be 0.5mm (A2). This would suggest a method of measurement other than using a vernier rule. The readings show that the cracks generally closed by 0.5 to 2.5mm during the period of July to September 1984.

“Avongard” stainless steel monitoring discs, and tell-tale crack measurement gauges were installed on 17 February 1998 by Angus Council, and the first readings taken. The positioning of the gauges was arrived at after consultation with the appropriate Building Research Establishment (BRE) Guides (Ref. A11-1,2,3).

Readings were taken at two week intervals for the first month, and the cracks were confirmed as exhibiting negligible movement, the readings were then taken at monthly intervals.

The readings to date from the Angus Council crack monitoring gauges can be found in Appendix A3. These readings show that during the period 17/02/98 to 7/07/98, the cracks have generally decreased in width by approximately 0.1 - 0.2mm.

See 5.2 for conclusions on the crack monitoring readings to date.

4.4 Sports Hall Stores

The structural partition wall between the sports hall store and polygym has suffered differential settlement / subsidence along the length of its foundation. This has resulted in the end of the wall abutting pushing the head of the rear exterior wall of the sports hall store out by 30mm approx. (see also last report). As a result of the movement to the foundation, the wall has suffered shear cracking to the end abutting onto the rear sports hall wall.

4.5 General Purpose (GP) Room / Canteen Area

The GP room (Plate 1) is situated on the first floor above the canteen area. The floor consist of 1.1m wide precast units spanning between 3 no. steel beams. A member of the building user's staff alerted the survey team to a crack in the floor situated within the GP Room store cupboard. (See Plates 2 and 3).

The GP room floor was noted as having a visible fall to the outer glazed wall.

A structural survey of the floorslabs in this area was then carried out to determine the condition of the beams and slabs in this area. A plan of the GP room area can be found in Appendix A6. _



4.5.1 Steel Beams

The 1st floor consists of 150mm precast slabs + 50mm screed spanning from 565 x 230 steel beams (beams 1 & 2) situated as per drawing CP2.3.181/001 (A6).

The steel beams are unusual in that they are not of universal section (ie: different depth, width, flange and web thicknesses to BS standards). Their section is unusual in that the top flange is thinner than the lower flange, suggesting they are ideally suited to a composite action between beam and slab.

The web of Beam 1 (A6) has been burnt out to accommodate 2 no. service ducts some 150mm in diameter close to the sports hall wall bearing. The web of Beam 1 (A6) has also been burnt out to accommodate 4 no. service ducts some 100mm in diameter close to the plant room wall bearing (see 5.5 for conclusions and recommendations).

Beam 2 exhibits a fall of some 56mm over its length towards the sports hall wall bearing. The beam 1 bearing on the sports hall wall is also low by some 61mm relative to the rest of the floor. Therefore it can be surmised that the sports hall wall has settled approximately 55-60mm relative to the GP room floor slab (see 5.5 for conclusions and recommendations).

4.5.2 Precast Slabs

See 5.5 for conclusions and recommendations on cracks found to date.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Structural Maintenance History

The columns within the boatstore require inspection in order to confirm their stability as being intact. This is required as correspondence from the ADC archives indicates that the stability of a column within the boatstore was in question at one time.

The chimney connection to the building has been re-riveted and plated, it is possible that this may have been due to differential settlement. The chimney and its connection to the main building should be inspected upon a regular basis by qualified steeplejacks. This is especially important above landfill sites where subsidence is possible.

The 1984/85 GRM Kennedy structural survey concluded that the cracking was not a structural problem. The subsequent crack monitoring readings showed crack movements between 1 - 2.5mm during the latter summer months of 1984. See 5.3 for conclusions and recommendations regarding crack monitoring.

5.2 Vibro-Replacement Stone Column Piles

The borehole logs revealed that the landfill lies in a lense some 3m thick, approximately 1-1.5m below ground. The soil below the landfill consist of loose - medium firm, fine, SAND (A1). The stone columns placed using the vibro-replacement technique were reported as being 5-6m in depth. This would imply that only the bottom 2-2.5m of the stone piles are restrained by the passive pressure of surrounding natural fill.

5.2.1 Differential Settlement

Stone column piles used within granular soils rely upon the surrounding soil's passive pressure to restrain them once under load. It is common practice today to use this vibro-replacement technique in



landfill sites (as related by verbal advice from two specialist engineers in this area). However 25 years ago when the stone piles were put in place, the technique of vibro-replacement was in its infancy within the UK, and the practice of bottom-feeding the stone into the bore was not yet developed. Boring into loose silts & fills without the ability to feed stone from the bottom of the bore, may well have led to landfill debris collapsing into a number of bores as the rig was retracted. This could have resulted in the stone columns having “layers” of fill / silt within their section, thus resulting in “soft” columns. These columns would have settled differentially to the stiffer columns, thereby possibly causing cracking in the building due to differential settlement shortly after loading was applied.

5.2.2 Subsidence

Stone columns are restrained by the fill/soil around them, they act to increase the horizontal stress within the soil section thereby “stiffening” the soil mass as a whole in the vicinity of the piles. As stated above it is common practice today to use vibro-replacement techniques in landfill. However, if the stone columns contained bio-degradable landfill within their section due to not using bottom feeding techniques; it is possible that the stone columns could shorten as the bio-degradable components of the fill within the columns decay. The restraint to the piles would also be decreased as these components decay allowing the piles to “barrel” out and further shortening them. It is therefore possible that the stone columns have shortened in some areas due to the decay of bio-degradable components within the stone column section.

5.3 Crack Monitoring

The results from the ADC archives indicate that the cracks in the building generally close during the summer months. The readings taken to date by Angus Council show that the cracks are closing marginally as the summer months progress.

The cracks monitored by Angus Council are all situated between 0-4m from ground level and are likely to be due to differential settlement and/or subsidence of the building foundations. The fact that they are closing suggests the building is rising as the summer approaches. Therefore assuming that the readings taken by ADC reflect a general yearly trend; the cracks in the building are opening during the Autumn months as the building rises, and closing during the Spring months as it falls. In the Spring the water table would normally fall, and in the Autumn the water table would normally rise. The general yearly relationship between the rise and fall of the building and the water table may be as follows:

<u>Yearly Period</u>	<u>Crack Readings</u>	<u>Building Foundations</u>	<u>Water Table</u>
Spring	Closing	Rising	Falling
Autumn	Opening	Falling	Rising

Under drained conditions (summer); the fill will transmit loads by contact between particles. As the water table rises (autumn), the voids in the fill are filled with water, and the loads are distributed by both interparticle forces and pore water pressure. The only way that normal fill can compress under fully saturated conditions would be if the pore water could flow out of the voids, ie: water table drops.

Therefore this poses the question - why does the building lower as the water table rises?.

In order to answer the above I would recommend that the cracks are monitored monthly for a period of two years. This would confirm or otherwise any yearly trends, and highlight any parts of the building which are moving excessively.



The crack readings could then be interpreted by a specialist foundation / geotechnical consultant to determine what further movements are likely in very dry or wet years, and to recommend preventative measures to minimise structural damage during these periods if required.

The advice of a specialist foundation / geotechnical consultant should also be employed presently so as to determine whether the installation of a piezo tube in a borehole (to log water table levels) - or any other monitoring measures not requested in this report - will be required in order to draw adequate conclusions after the two year period.

5.4 Sports Hall Stores

5.4.1 Rear Wall to Sports Hall Store

The top 3.5m of wall is cracked and leaning out by 30mm at the head. The top 3.5m of the wall from fire exit to movement joint should be replaced as existing, incorporating mesh bed reinforcement every 450mm vertically. The bed reinforcement will minimise any future cracking. The roof joist adjacent to the wall will require temporary removal to allow replacement of the wall. No precast slabs will require removal as the foundations will be underpinned using piling techniques.

This wall requires piled underpinning along its length to negate any further movement, and support additional loads from the roof support beams to be installed (see 5.4.2). The types of piling arrangements which could be used in this situation are many and varied.

In order to ensure value for money, the piling should be included into the sports hall store remedial works as a design and construct item. This would allow each piling contractor to choose the cheapest solution which could carry the building loads to the silts below the landfill lense. It is envisaged that AC Roads will be required to provide a design certificate for the remedial works to the sports hall store. If this is required then the piling designs should be approved by AC Roads prior to tender evaluation. The winning piling contractor will be required to provide a design certificate for the piling design. A full copy of the "Terratek" ground investigation report should be included with the contract documents for the works in order to allow the piles to be designed accordingly. A pre-tender design check will ensure that all pile lengths included in the quotes are based on realistic values (ie: no under-cutting to win tender, and waiting for re-measure at end of job).

The piling should be designed to the following requirements:

1. All piling systems to allow the transfer of the loads through the landfill layer to below 6m existing ground surface level.
2. No works allowed inside the building (to negate boring through suspended slabs and to minimise building user disruption).
3. No works allowed to inner leaf (supports precast slab).
4. Loading - 35 kN/m ULS loading at 0.45m below ground level.
5. The piles should be sleeved in a de-bonding tube to a depth below the landfill and stone columns (6m). The de-bonding tube will allow the fill/stone around the piles to settle / heave without affecting the load capacity of the piles.
6. The piles should be designed so as to take no account of skin friction until a depth of 6m, the soil characteristics from borehole no. 1 (A1) are to be used to design the piles from 0m to 10m depth.
7. If the piles require to go below a depth of 10m from ground surface, then the worst case values from borehole no. 1 (A1) are to be used to design the piles below 10m depth:

IE: SPT = 6.

See A11 for designers method statement and highlighted hazards.

5.4.2 Partition Wall to Sports Hall Store and Polygym



This wall has suffered cracking due to differential settlement / subsidence. The wall consist of a clay brick single leaf 100mm wide currently supporting roof joists “fingered” together from both sides. The wall should be made non-structural by the installation of 2 no. 203 x 102 x 23 UB (one either side of wall) supported on 300 x 100 x 150 C30 padstones supporting the ends of the existing joists. This will allow the replacement of this wall with a timber partition.

See A4 for designers method statement and highlighted hazards.

5.5 GP Room / Canteen Area

Ref: Appendix A6 - drawing CP2.3.181/001

5.5.1 Steel Beams

Beam 1 requires to be analysed under its permanent condition which may now be different to that envisaged during its design. That is to say the beam should be analysed for shear capacity taking into account the burnt out holes to its web, and for bending taking into account the difference in level along its length. The latter analysis would also be required for Beam 2.

5.5.2 Precast Units

5.5.2.1 Crack A

Crack A is hairline in width and spreads from the steel beam slab support some 825mm into the GP room floor slab. The crack is visible in the slab soffit viewed from service hatch 2. The screed to the first floor slab should be inspected in this area in order to determine if the crack is continuous through the depth of the slab.

5.5.2.2 Cracks B & C

Cracks B and C are visible in the slab soffit as viewed from service hatch 1. Crack B ranges in width from hairline to 2mm at the plant room wall. The cracks are probably due to the slab not being allowed to deflect under load where the kitchen wall returns. The screed to the first floor slab should be inspected in this area in order to determine if the crack is continuous through the depth of the slab.

5.5.2.3 Crack D

Crack D varies from 3-5mm in width and runs longitudinally between two slab units. The crack is in evidence in the screed layer only. One possible explanation for this crack would be the omission of mesh in the screed. This means a concentrated load on one slab would not be transmitted to its neighbours, thereby allowing differential deflection between the units causing a crack between them. The mortar in the screed around the crack should be removed so as to confirm the presence of mesh or otherwise, before further recommendations can be given.

5.5.2.4 Crack E

Crack E is 3-5mm in width (hard to assess width due to repairs). The repairs carried out to the crack took the form of a mortar grout. It is envisaged that a non-shrink mortar would have been used for this repair, if this is the case the crack has grown since the repair was carried out by some 3-5mm. The crack cannot be observed at soffit level (in the plant room). This suggests tensile action at the top of the slab only, possibly due to the load from the GP room store partition wall (1st floor) combining with insufficient compressible filler at the top of the plant room partition wall (ground floor). This would provide a intermediate support which the slab would not have been designed for, thereby causing



tensile stress at the top of the slab section near to the support. This combined with a possible omission of mesh to the screed would account for such a crack , see drg 002 (A6).

The length and extent of the crack should be determined by removing all floor coverings in the immediate area, and the screed should be inspected for mesh, before further recommendations can be given.

5.5.3 Concrete Door Lintel

The door lintel marked as cracked on drawing 001 (A6) should be supported by the use of 200 x 200 x 16 RSA bolted to the wall via 4 no. M16 "Rawlbolts" or equivalent approved. The angle should be shimmed tight to the underside of the lintel via steel shims, and non-shrink grout.

5.5.4 Further Survey Required

In order to determine the condition of all the sloping precast units supporting the GP room, a new inspection hatch should be formed in the middle of the hatched area shown on drg. 001 (A6).

5.6 Further Surveying Measures and Structural Surveys.

The above GP room survey brought to light a cracked lintel requiring support, a beam with services running through the web requiring analysis, and several cracks to the precast units requiring further investigation.

In order to determine the position of any further cracking to the building slabs, a level survey of both floors should be undertaken. This would provide a basis by which to estimate where any cracks to the slabs may be. The screed (and soffits if possible) in these areas should then be exposed to determine if the cracks have been subject to cracking as a result of settlement / subsidence. Where significant cracks are found in the screed, the screed should be removed to allow inspection of the slab.



APPENDIX A1 - GROUND INVESTIGATION REPORT



TERRA TEK



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Site Investigation &
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ANGUS COUNCIL
PROPERTY SERVICES
REPORT ON SITE INVESTIGATION
AT FORFAR LEISURE CENTRE



Angus Council
Property Services
9 West High Street
FORFAR
DD8 1BD

April 1998

Registered in Scotland No. 121594

Directors : A. Baxter B.Sc., M. Phil, G. Wilson F.T.C., M.I.Sc.T., A. Tait F.I.A.T., (Managing), Company Secretary : A. Penman

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ANGUS COUNCIL

PROPERTY SERVICES

REPORT ON SITE INVESTIGATION

FOR

PROPOSED DEVELOPMENT

AT

FORFAR LEISURE CENTRE

REF : 3424

INTRODUCTION

Angus Council propose to carry out remedial works to the existing Leisure Centre in the town of Forfar, Angus. The building indicated a degree of distress.

At the request of Angus Council Property Services, Consulting Engineers for the project, a site investigation was carried out to their instructions to provide information on the ground conditions at the site, and to enable comments to be made on the design of the foundations. All comments are advisory and no responsibility can be taken for specific design proposals not detailed or advised at the time of compilation of this report.

This report is based on information established by observation, boring, sampling and testing. It should be noted that natural strata vary from point to point and groundwater conditions are dependent on seasonal and other factors, while infill materials are subject to an even greater degree of diversity. Whilst an attempt is made in comprehensive reporting to assess the likelihood or extent of such variations at the site, it should be recognised that there may be conditions pertaining which are not disclosed by the investigation.

TOPOGRAPHY AND GEOLOGY OF SITE

The site under consideration was located at Forfar Leisure Centre within the town of Forfar in Angus. The site at the time of the investigation comprised a generally level grassed area adjacent to the existing Leisure Centre. The building indicated signs of distress. It was understood from the Engineer that the site was historically a pond, which had been infilled at some time in the past.

Available published geological information indicates the natural superficial deposits of the area to comprise alluvial deposits.

The underlying solid strata comprise rocks of the Lower Old Red Sandstone series.

SITE WORK

During the period 3rd to 4th March 1998, two boreholes were sunk by cable and tool methods at 150mm diameter at positions indicated by the Engineer and to depths as required by him.

Representative disturbed and undisturbed samples of the soils encountered were taken and dynamic penetration tests carried out as described in the Notes in the Appendix.

Details of the boreholes including daily progress of hole and casing, descriptions of soils encountered, records of sampling and in-situ testing carried out, and observations of groundwater conditions during boring are given in the Borehole Records in the Appendix.

LABORATORY WORK

Geotechnical testing was carried out on selected samples of soils as required by the Engineer and using procedures referred to in the Notes in the Appendix.

The results of these tests are summarised in Table 1, and detailed in the Figures and Tables in the Appendix.

Chemical testing for contaminants was carried out on one soil sample recovered from borehole 1, as required by the Engineer. The sample analysed from the borehole generally represented the fill materials from the suspected landfill layer.

Details of the analytical testing procedures employed are given in the Notes in the Appendix.

The analysis programme comprised of ICRCCL (Interdepartmental Committee on the Redevelopment of Contaminated Land) inorganic contaminants arsenic, cadmium, lead, mercury, chromium, selenium, copper, nickel, zinc, total cyanide, sulphide, sulphate and pH value. Organic contaminants were addressed by phenol and toluene extract determinations (TEM). The samples were also screened for asbestos contamination prior to testing.

The results of these tests and analyses, along with details of visual/olfactory assessment of the materials, are given on Tables 2, 3, 4 and 5 in the Appendix.

GROUND CONDITIONS

The ground conditions encountered at the site to be developed were found to be generally consistent with available published information in that underlying topsoil and approximately 4m of made ground, apparently natural alluvial soils were met to the full depth explored in each case of 10m. Rockhead was not encountered at either of the two borehole positions.

Topsoil of 0.4m in thickness was encountered at each of the borehole positions, underlain in both instances by a brown, sand and gravel and sandy gravel infill to depths of between approximately 0.7m and 1.2m. In the case of borehole 1, a 0.3m thickness of silty clay with gravel and ash was met underlying this granular infill.

Further infill materials were encountered in boreholes 1 and 2 at depths of 1.5m and 0.7m respectively, described as a dark brown, slightly clayey to clayey, silty sand with gravel, paper, plastic, ash, pottery, glass, sandy silt bands, and occasional rubber, extending to depths of between 3.7m and 4.2m. On the basis of in-situ testing carried out within the boreholes these deposits were assessed to be moderately compact.

The underlying apparently natural strata comprised a brown, very silty, fine sand with occasional gravel, extending to the full depth of 10m explored in both cases. On the basis of in-situ standard penetration testing carried out, these deposits were assessed to be generally loose, occasionally medium dense.

Groundwater was struck at 1.7m in borehole 1, while borehole 2 recorded a water level of 3.5m on completion of the boring operations. A borehole however represents a very insensitive standpipe for the limited period for which it remains open. As such the groundwater conditions encountered therein may not be truly representative of the groundwater regime of the area.

COMMENTS ON GROUND CONDITIONS IN RELATION TO PROPOSED WORKS

The investigation has revealed a succession of predominantly granular infill materials to depths of between approximately 3.7m and 4.2m beneath existing ground level, overlying granular alluvial deposits to the final depth of 10m explored in both boreholes. Rockhead was not achieved to this final depth explored.

The made ground was found to be variable in content, with degradable materials such as paper and wood detected. Domestic refuse such as plastic, rubber and glass were also noted, as were ash residue products which can have an adverse effect on foundation concrete. It is not normally considered desirable to found structures on such heterogeneous materials due to the indeterminate magnitude of the resulting settlements. In view of the variable nature of these materials; The apparent lack of control during placement; and the potential for gas to form due to decomposition of organic elements within the horizon, the founding of even light-weight structures on such materials would not be considered desirable.

The underlying, apparently natural granular soils were assessed on the basis of in-situ standard penetration testing to be generally loose, in places medium dense. Preliminary assessment of the allowable bearing capacity for footings of modest dimensions has been estimated to lie in the range of 80 to 100 kN/m² while restricting settlements to less than 25mm. In view of the potential for the relatively near surface water table during the boring operations, the application of correction factors to the in-situ test results would not be considered appropriate.

In view of the foregoing, the reason for the distress noted may be the result of foundations placed within the fill materials, which were found to be highly variable, inconsistent, and capable of degradation. Therefore, remedial works in the form of underpinning into the natural granular soils would appear to be the most straightforward solution, either by mass excavation or some form of piled solution.

In the first instance, excavation to depths of approximately 4m at least would appear necessary, and may not prove economic. In addition, the near-surface water level encountered may necessitate pumping.

The use of piled foundations taken to depth may prove to be the most straightforward solution, possibly in the form of driven piles. The aspect of negative skin friction may require consideration due to degradation of the organic elements within the fill horizon. Ultimately, consultation with piling experts would be necessary for the purpose of pile design.

Any excavations should be protected from deterioration by blinding with lean concrete. Any very soft, loose or organic pockets should be removed prior to construction. Dependent upon depth of excavation, retention and pumping may prove necessary.

CHEMICAL ANALYSIS

Chemical testing for contaminants was carried out on a soil sample recovered from borehole 1 at 2.50m depth, as required by the Engineer. Details of the analytical testing procedures employed are given in the Notes in the Appendix.

The sample was subject to a comprehensive analysis programme which included ICRCCL (Interdepartmental Committee on the Redevelopment of Contaminated Land) inorganic contaminants such as arsenic, cadmium, lead, mercury, selenium, copper, nickel, zinc, total cyanide, sulphide, sulphate and pH value. Organic contaminants were addressed by phenol and toluene extract determinations. The samples were also screened for asbestos contamination prior to testing.

The results of these tests and analyses, along with details of visual/olfactory assessment carried out, are given on Tables 2, 3, 4, and 5 in the Appendix.

In view of the nature of the site under investigation, which is commercial, the soil quality results were assessed for contamination using the ICRCCL guidelines for open space, landscaped areas, buildings and hardcover as well as any uses where plants may be grown. In the case of toluene extractable material (TEM), where no levels are given in ICRCCL 59/83 "Guidance on the Assessment and Redevelopment of Contaminated Land", the results were assessed using HSE Publication HS(G)66: 1991, Appendix 1 - Guidelines for Classification of Contaminated Soils. Sulphate and pH levels were appraised with reference to BRE Digest 363: "Sulphate and Acid Resistance of Concrete in the Ground" (1991).

The specific contaminant guidelines used are included with the results on the Tables in the Appendix.

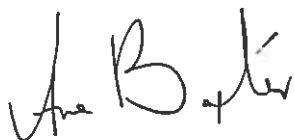
The analytical results obtained from the sample analysed were assessed to be marginal or to comply with the contaminant guidelines adopted for the project and as such the material tested may be considered free of any significant chemical contamination for the purpose of commercial usage. The material tested was also found to be free of any asbestos contamination.

The concentrations of total sulphates present in representative samples of soil and water:soil extract were assessed to lie in Class 1 with reference to BRE Digest 363 (1991) Table 1, "Requirements for well compacted cast in-situ concrete 140mm to 450mm in thickness exposed on all vertical faces to a permeable sulphate soil or fill". Precautions are given therein to ensure the durability of concrete products.


With reference to Table 2 of BRE Digest 363, the pH levels at the positions explored are such that no additional precautions should be required to protect foundation concrete or services from acid attack.

Similarly, with reference to the Specification for Highway Works, Volume 1: Series 600, materials with a water soluble sulphate content exceeding 0.25g/l (expressed as SO₃) should not be placed within 500mm of any metallic items forming part of any permanent works.

Finally, it should be recognised that our comments are based on analysis of a limited number of test samples and as such their may be chemical conditions pertaining which have not been disclosed by the current investigation.



A M BAXTER
BSc M.Phil
GEOLOGIST
For and on behalf of
TERRA TEK LTD



G WILSON
FTC
LABORATORY DIRECTOR

References:

- 1/ BS DD175: Code of Practice for the Identification of Potentially Contaminated Land and its Investigation.
- 2/ ICRCL 59/83: Guidance on the Assessment and Redevelopment of Contaminated Land.
- 3/ BRE Digest 363: Sulphate and Acid Resistance of Concrete in the Ground.
- 4/ HSE Publication HS(G)66:1991, Appendix 1" Guidelines for classification of contaminated soils".
- 5/ Department of Transport Specification for Highway Works, Volume 1.

APPENDIX

NOTES ON FIELD PROCEDURES

Boring

The standard method of boring in soil for ground investigation is known as the light cable percussion method. It uses various tools worked on a wire cable; typically a shell in non cohesive strata such as sands and gravels, and a clay cutter in cohesive soils. Very dense soils, boulders or other hard obstructions are broken up by chiselling and the fragments removed with the shell. Where the ground conditions make it necessary, the borehole is lined with driven steel casing of such sizes that the bottom of the borehole is not less than 125mm diameter.

Rotary Drilling

Rotary drilling is employed to extend the investigation beyond the practical limit of cable percussion boring in hard formations, commonly rock. Core drilling is used to obtain continuous intact samples of the formation and is generally undertaken using double tube swivel type core barrels fitted with tungsten or diamond bits as appropriate to the formation type and hardness. Open hole rotary drilling using tricone rock roller bits is carried out where more limited information is sufficient, strata identification being made from cuttings only. Open hole rotary drilling methods may also be employed for fast penetration of soils where detailed sampling is not required, prior to coring at depth. Air or water flushing medium is normally used with rotary drilling methods.

Sampling

Undisturbed samples of cohesive soils are taken with a 100mm internal diameter open drive sampler 450mm long known as a U100: normally on first encountering a cohesive stratum and subsequently at regular intervals within the stratum. The sampler is driven into the soils by a sliding hammer, recording the number of blows required to drive the sample for 450mm. The blows give an indication of the consistency of the soil, however it should be noted that there is no direct relationship with the results of Standard Penetration Testing. The sample tube is sealed with wax and end caps secured.

A range of more specialised equipment, e.g. piston samplers may be used to obtain high quality undisturbed samples in conditions where conventional sampling is impracticable or unsatisfactory.

Small disturbed samples are taken from the boring tools and in-situ testing equipment at each change in stratum and at regular intervals down the borehole. These are supplemented by large bulk disturbed samples in non cohesive deposits such as sands and gravels.

Samples of groundwater are taken in clean glass jars when sufficient water has collected in a borehole.

In the case of potentially contaminated sites representative disturbed soil and water samples are taken in clean glass jars at appropriate intervals with reference to Clause 6 of DD175 : 1988 "Code of Practice for the Identification of Potentially Contaminated Land and its Investigation"

In-situ Dynamic Penetration Tests

The Standard Penetration Test (SPT) is carried out within granular soils in accordance with BS 1377: Part 9: 1990: Clause 3.3, using a 50mm diameter split-barrel sampler. This is driven 450mm into the soil using a 63.5kg hammer with a 760mm drop, and the penetration resistance is expressed as the number of blows required to obtain 300mm penetration below and initial penetration of 150mm through any disturbed ground at the bottom of the borehole. The number of blows to achieve the standard penetration of 300mm is reported as the 'N' value.

In coarse granular soils the Cone Penetration Test (CPT) is conducted in the same manner as the SPT but using a 50mm diameter 60 degree apex solid cone point in replacement of the split spoon sampler.

Static cone penetration tests are used to provide a continuous record of penetration resistance at varying depths; and plate bearing tests are occasionally appropriate to allow a more accurate estimate to be made of the allowable bearing pressure of shallow cohesionless soils.

In-situ vane tests are carried out in boreholes in accordance with BS 1377: Part 9: 1990: Clause 4.4, or carried out in trial pits and trenches with a direct reading hand vane, give a measure of the in-situ undrained shear strength.

Groundwater Level

Borehole water levels are recorded together with the depths at which seepages or inflows of water are detected and the observations noted on the borehole records. In general these observations do not give a highly accurate indication of the groundwater conditions due to

- (a) The borehole is rarely left standing at the relevant depth for sufficient time to allow the water level to reach equilibrium
- (b) A permeable stratum may have been sealed off by the borehole casing.
- (c) Water may have been added to the borehole during drilling to facilitate progress.

An accurate record of groundwater behaviour may be obtained from standpipes or standpipe piezometers. Where required these are installed in accordance with Appendix 1 of the Specification for Ground Investigation (1993)

In-situ Permeability Testing

This test is carried out in the field generally as a variable head test in accordance with the procedures given in BS 5930:1981 and Ciria Report 113. Prior to commencement of the test the natural groundwater table should be determined and the test carried out within a standpipe or the casing entirely below this depth. The standpipe is then filled to ground level with clean water (falling head test) or the water pumped out (rising head test). The head of water in the borehole is then allowed to equalize with that in the ground, the actual head being measured at intervals of time from the commencement of the test until the head of water in the borehole is not more than 1/5th of the head at the beginning of the test. This data allows the coefficient of permeability to be calculated.

Landfill Gas

Determination and measurement of landfill gases may be made in boreholes, or directly from the ground surface. In the latter case a hole is formed by driving a solid and rigid 25mm diameter steel spike to depths in the range of 1.0m to 1.5m. Gas emissions are analysed using a Portable Neronex Exotox 50 Intrinsic Safe multi-gas analyser.

Where longer term measurement of emissions is required, gas monitoring standpipes are installed in boreholes in accordance with Appendix II of the Specification for Ground Investigation.

NOTES ON LABORATORY PROCEDURES

Samples of soil and rock taken during the site works are examined in the laboratory and assessments of their characteristics used to supplement field observations, and in-situ and laboratory test results, in the preparation of the Borehole Records. Preparation and testing is carried out to the requirements of British or other international Standards where applicable, or otherwise in accordance with good practice. NAMAS accredited tests are indicated thus: (N). All other tests reported or opinions and interpretations expressed herein are outwith the scope of UKAS (NAMAS) accreditation.

TEST	STANDARD
CLASSIFICATION TESTS	
Determination of moisture content (N)	BS 1377: Part 2: 1990, Section 3.2
Determination of liquid limit (N)	BS 1377: Part 2: 1990, Section 4.2 and 4.3
Determination of plastic limit and plasticity index (N)	BS 1377: Part 2: 1990, Section 5
Determination of bulk density (N)	BS 1377: Part 2: 1990, Section 7.2
Determination of particle density	BS 1377: Part 2: 1990, Section 8.2 and 8.3
Sieve analysis by wet or dry sieving (N)	BS 1377: Part 2: 1990, Section 9.2 and 9.3
Sedimentation by hydrometer method (N)	BS 1377: Part 2: 1990, Section 9.5

CHEMICAL TESTS

Determination of organic matter content (N)	BS 1377: Part 3: 1990, Section 3
Determination of mass loss-on-ignition (N)	BS 1377: Part 3: 1990, Section 4
Determination of sulphate content (N)	BS 1377: Part 3: 1990, Section 5
Determination of chloride content (N)	BS 1377: Part 3: 1990, Section 7 (DIHM)
Determination of pH value (N)	BS 1377: Part 3: 1990, Section 9

COMPACTION RELATED TESTS

Determination of dry density/moisture content relationship (N)	BS 1377: Part 4: 1990, Section 3
Determination of moisture condition value (MCV) (N)	SDD Tech Memo SH7/83: SDD Appls Guide No 1 (Rev 1989)
Determination of moisture content/MCV relationship (N)	BS 1377: Part 4: 1990, Section 5.5
Determination of California Bearing Rating (CBR) (N)	BS 1377: Part 4: 1990, Section 7

CONSOLIDATION AND STRENGTH TESTS

Determination of one-dimensional consolidation properties	BS 1377: Part 5: 1990, Section 3
Determination of undrained shear strength in triaxial compression (N)	BS 1377: Part 7: 1990, Section 8 and 9

LABORATORY TESTING (CONTAMINANTS)

An extensive range of test procedures is available for the identification and quantification of levels of contamination in the ground. Selection of the test method and suite of contaminants to be determined is based upon site history, conditions revealed in the course of the investigation, and intended future use. Procedures are described and referenced as appropriate in the text of this report.

LABORATORY TESTING (ROCKS)

The laboratory testing of rock specimens has not reached the degree of standardisation achieved for soils testing. A wide range of test procedures are described in the relevant literature. All these methods are to a greater or lesser degree unique to particular contexts (ie, relative to a specific rock type or individual project design requirements).

TEST	STANDARD
Determination of point load strength	DIHM based on ISRM Commission on Testing Methods, 1985
Determination of unconfined compressive strength	DIHM based on ASTM D2938-86
Determination of dry density & porosity (N)	ISRM method
Determination of water content (N)	ISRM method

SOIL DESCRIPTION

Soil descriptions are generally given in accordance with Clause 41 of BS 5930: 1981 as follows:

Mass characteristics	-Strength or compactness	Material characteristics	-Colour
	-State of weathering		-Particle grading and shape
			-Soil name in capitals

The strength and compactness descriptions are made in accordance with the following:

Cohesive soils		Non-cohesive soils	
Term	Undrained shear strength (kN/m ²)	Term	SPT Values (blows)
Very soft	less than 20	Very loose	0-4
Soft	20 to 40	Loose	4-10
Soft to firm	40 to 50	Medium dense	10 to 30
Firm	50 to 75	Dense	30 to 50
Stiff	75 to 150	Very dense	over 50
Very stiff	over 150		

The soil name is based on particle size distribution and plasticity properties. In general a soil containing more than 35% fine material (less than 0.06mm particle size) is described as a clay or silt. With less than 35% of fine material it is described variously as sand, gravel, cobbles or boulders (as appropriate).

ISSUE DATE: 13th JANUARY 1998 REV: 1

United Kingdom Accreditation Service

TESTING LABORATORY
No. 1796

SCHEDULE



National
Accreditation of
Measurement
And
Sampling

Address of permanent laboratory Terra Tek Ltd 62 Rochsolloch Road Airdrie Lanarkshire Scotland ML6 9BG Telephone : 01236 748084 Fax : 01236 748062		Category 0 Permanent Laboratory Testing performed on permanent laboratory premises Laboratory Contact: Mr G Wilson Issue No: 1 Date: 22 August 1997
Materials/Products Tested	Types of Test/Properties Measured Range of Measurement	Standard Specifications Equipment/Techniques Used
ROCK	<u>Physical Tests</u> Water content Porosity and density - by saturation and caliper techniques	ISRM Suggested Methods - Rock Characterization Testing and Monitoring. Ed. E T Brown - 1981 ISRM Suggested Methods - Rock Characterization Testing and Monitoring. Ed. E T Brown - 1981
SOILS for civil engineering purposes	<u>Chemical Tests</u> Organic matter content Mass loss on ignition Sulphate content of soil and ground water - gravimetric method Water-soluble chloride content Acid-soluble chloride content pH value <i>continued on sheet 2</i>	— BS 1377:Part 3:1990 BS 1377:Part 3:1990 BS 1377:Part 3:1990 BS 1377:Part 3:1990 BS 1377:Part 3:1990 BS 1377:Part 3:1990

United Kingdom Accreditation Service



National
Accreditation of
Measurement
And
Sampling

TESTING LABORATORY
No. 1796

Category 0
Permanent Laboratory

Issue No: 1

Date: 22 August 1997

SCHEDULE

Materials/Products Tested	Types of Test/Properties Measured Range of Measurement	Standard Specifications Equipment/Techniques Used
SOILS for civil engineering purposes	<p><u>Mechanical Tests</u></p> <p>California Bearing Ratio (CBR) (loads from 0.4 to 20kN)</p> <p>Undrained shear strength - triaxial compression without measurement of pore pressure (loads from 0.4 to 20kN)</p> <p>Undrained shear strength - triaxial compression with multistage loading and without measurement of pore pressure (loads from 0.4 to 20kN)</p> <p><u>Physical Tests</u></p> <p>Moisture content - oven drying method</p> <p>Liquid limit - cone penetrometer</p> <p>Plastic limit</p> <p>Plasticity index and liquidity index</p> <p>Density - linear measurement</p> <p>Particle size distribution - wet sieving</p> <p>Particle size distribution - dry sieving</p> <p>Particle size distribution - sedimentation - hydrometer method</p> <p>Dry density/moisture content relationship (2.5 kg rammer)</p> <p><i>continued on sheet 3</i></p>	<p>BS 1377:Part 4:1990</p> <p>BS 1377:Part 7:1990</p> <p>BS 1377:Part 7:1990</p> <p>BS 1377:Part 2:1990</p> <p>BS 1377:Part 2:1990</p> <p>BS 1377:Part 2:1990</p> <p>BS 1377:Part 2:1990</p> <p>BS 1377:Part 2:1990</p> <p>BS 1377:Part 2:1990</p> <p>BS 1377:Part 2:1990</p> <p>BS 1377:Part 4:1990</p>

United Kingdom Accreditation Service



National
Accreditation of
Measurement
And
Sampling

<p>TESTING LABORATORY No. 1796</p> <p>SCHEDULE</p>	<p>Category 0 Permanent Laboratory</p> <p>Issue No: 1</p> <p>Date: 22 August 1997</p>
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Materials/Products Tested	Types of Test/Properties Measured Range of Measurement	Standard Specifications Equipment/Techniques Used
<p>SOILS for civil engineering purposes</p>	<p><u>Physical Tests</u></p> <p>Dry density/moisture content relationship (4.5 kg rammer)</p> <p>MCV/moisture content relation</p>	<p>BS 1377:Part 4:1990</p> <p>BS 1377:Part 4:1990</p>
	<p>END</p>	



SCHEDULE

Address of permanent laboratory Terra Tek Ltd 62 Rochsolloch Road Airdrie Lanarkshire Scotland ML6 9BG Telephone : 01236 748084 Fax : 01236 748062		Category I Testing performed by staff sent out by a permanent laboratory accredited by UKAS Laboratory Contact: Mr G Wilson Issue No: 1 Date: 22 August 1997	Site Testing
Types of Site Location	Materials/Products Tested Types of Test/Properties Measured Range of Measurement	Standard Specifications Equipment/Techniques Used	
CIVIL ENGINEERING CONSTRUCTION SITES	SOILS for civil engineering purposes <u>Mechanical Tests</u> In-situ California Bearing Ratio (CBR) <i>(loads from 0.4 to 20kN)</i> <u>Physical Tests</u> In-situ density - sand replacement method (large pouring cylinder) In-situ density - nuclear method Moisture condition value - at natural moisture content	BS 1377:Part 9:1990 BS 1377:Part 9:1990 BS 1377:Part 9:1990 SDD Tech Memo SH7/83. SDD Appls Guide No1 (Rev 1989)	
	END		

NOTES ON CHEMICAL TESTING PROCEDURES

All chemical testing methods are, where possible Nationally or Internationally recognised and validated. Analytical methods for Soil and Water analysis are taken in the main from the following;

- A. Methods for the examination of waters and associated materials, standing committee of analysts; UK Department of the Environment.
- B. Standard methods for the examination of water and waste water; American Public Health Authority.
- C. Test methods for evaluating solid waste; Publication SW846, United States Environmental Protection Agency.
- D. The Analysis of Agricultural materials; Ministry of Agriculture Fisheries and Food.
- E. Methods of analysis of soil for engineering purposes; BS1377
- F. Building Research Establishment Paper; BRE 363.
- G. The American Society for the testing of materials.
- H. The Institute of Petroleum.
- I. The Association of official analytical chemists.

TERRA TEK Limited

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Site
FORFAR LEISURE CENTRE

Borehole
Number
1

Boring Method Cable percussion	Diameter 150mm Cased to 10.00m	Ground Level (mOD)	Client Angus Council	Job Number 3424
	Location Forfar	Dates 03/03/98	Engineer Property Services	Sheet 1/1

Depth m	Samples / Tests	Casing Depth m	Water Depth m	Field Records	Level (mOD)	Depth m (Thickness)	Description	Legend
						(0.40)	TOPSOIL	
						0.40	Brown, silty, sandy gravel and cobbles. FILL	
1.00	B1			pH SO3 Sol SO3 PSD		(0.80)		
1.20-1.65	SPT N=11			2,3/2,3,3,3		1.20 (0.30)	Soft, brown, very silty CLAY with occasional gravel and ash. FILL	
1.40	B2			PSD		1.50		
				Water strike(1) at 1.70m.			Moderately compact, dark brown, slightly clayey, silty sand and gravel with paper, plastic, glass, rubber, ash and organic matter. FILL	
2.20-2.65	SPT N=21			4,3/4,5,5,7		(2.70)		
	B3			pH SO3 Sol SO3 PSD ICRL				
3.20-3.65	SPT N=23			5,6/4,5,7,7				
3.80	B4			PSD				
4.20-4.65	SPT N=11			5,5/4,3,2,2		4.20	Medium dense, becoming loose with depth, brown, very silty, fine SAND with occasional gravel.	
5.00	B5							
6.00-6.45	SPT N=9			1,2/2,2,3,2				
7.00	B6			pH SO3 Sol SO3 PSD		(5.80)		
7.50-7.95	SPT N=8			2,1/2,2,2,2				
8.50	B7							
9.00-9.45	SPT N=6			2,1/1,2,1,2				
				03/03/98:1.70m		10.00		

Remarks
Chiselling from 2.60m to 3.10m for 1 hour.

Scale
(approx)
1:50

Logged
By
DM/JG

Figure No.
1

See key sheet for symbols and abbreviations





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Site
FORFAR LEISURE CENTRE

Borehole Number
2

Boring Method Cable percussion	Diameter 150mm Cased to 10.00m	Ground Level (mOD)	Client Angus Council	Job Number 3424
	Location Forfar	Dates 04/03/98	Engineer Property Services	Sheet 1/1

Depth m	Samples / Tests	Casing Depth m	Water Depth m	Field Records	Level (mOD)	Depth m (Thickness)	Description	Legend
						(0.40)	TOPSOIL	
0.80	B1			pH SO3 Sol SO3 PSD		0.40	SAND and GRAVEL. FILL	
1.00-1.45	SPT N=12			2,2/3,2,3,4		(0.30)		
1.50	B2					0.70	Moderately compact, brown, clayey, silty sand with gravel, ash, paper, plastic, pottery, glass, wood and organic matter. FILL	
2.00-2.45	SPT N=22			3,4/5,5,6,6		(3.00)		
2.50	B3			pH SO3 Sol SO3 PSD			Loose, brown, very silty, fine SAND with occasional gravel and bands of sand and gravel.	
3.00-3.45	SPT N=28			4,5/6,7,7,8				
3.50	B4					3.70		
4.00-4.45	SPT N=7			2,1/2,1,2,2				
5.00	B5			pH SO3 PSD				
5.50-5.95	SPT N=8			2,2/1,2,3,2				
6.50	B6					(6.30)		
7.00-7.45	SPT N=8			2,2/2,3,1,2				
8.00	B7			PSD				
8.50-8.95	SPT N=9			1,2/2,3,2,2				
9.50	B8			04/03/98:3.50m				
10.00-10.45	SPT N=10			2,2/3,2,2,3		10.00		

Remarks
Chiselling from 2.50m to 3.00m for 1 hour.

Scale (approx)
1:50

Logged By
DM/JG

Figure No.
2

See key sheet for symbols and abbreviations

SUMMARY OF LABORATORY TEST RESULTS

TABLE 1

SITE: FORFAR

REF: 3424

BOREHOLE No.	SAMPLE		MOISTURE CONTENT (%)	ATTERBERG LIMITS					DENSITY (Mg/m ³)		APPARENT COHESION (kN/m ²)	ANGLE OF SHEARING RESISTANCE (°)	OTHER TESTS	DESCRIPTION OF SAMPLE
	No.	DEPTH (m)		TYPE	% PASSING 425µm	LL (%)	PL (%)	PI (%)	BULK	DRY				
1	B1	1.00	-	-	-	-	-	-	-	-	-	SIEVE HYDROMETER pH VALUE SULPHATE 2:1 EXTRACT	Brown slightly silty sandy GRAVEL and COBBLES [FILL].	
	B2	1.40	-	-	-	-	-	-	-	-	SIEVE HYDROMETER	Mottled brown slightly clayey silty SAND and GRAVEL, including fragments of ceramic, glass, rubber and coal, with organic matter (rootlets) [FILL].		
	B3	2.50	-	-	-	-	-	-	-	-	SIEVE HYDROMETER pH VALUE SULPHATE 2:1 EXTRACT ICRCCL	Mottled grey/brown clayey very silty SAND and GRAVEL, including fragments of wood, metal, glass and plastic, with occasional cobbles and organic matter (rootlets) (faint oily/organic odour detected) [FILL].		

TERRA TEK

SUMMARY OF LABORATORY TEST RESULTS

TABLE 1

REF: 3424

SITE: FORFAR

BOREHOLE No.	SAMPLE		MOISTURE CONTENT (%)	ATTERBERG LIMITS					DENSITY (Mg/m ³)		ANGLE OF SHEARING RESISTANCE (°)	OTHER TESTS	DESCRIPTION OF SAMPLE
	No.	DEPTH (m)		TYPE	% PASSING 425µm	LL (%)	PL (%)	PI (%)	BULK	DRY			
1	B4	3.80	-	-	-	-	-	-	-	-	-	SIEVE HYDROMETER	Mottled grey/brown slightly clayey silty very sandy GRAVEL, including fragments of metal, plastic, wood, ceramics and glass, with inclusions of ash (strong oily/organic odour detected) [FILL].
	B6	7.00	-	-	-	-	-	-	-	-	-	SIEVE HYDROMETER pH VALUE SULPHATE 2:1 EXTRACT	Brown silty SAND with occasional gravel.
2	B1	0.80	-	-	-	-	-	-	-	-	-	SIEVE HYDROMETER pH VALUE SULPHATE 2:1 EXTRACT	Brown slightly clayey silty very sandy GRAVEL with cobbles and occasional organic matter (rootlets) [FILL].
	B3	2.50	-	-	-	-	-	-	-	-	-	SIEVE HYDROMETER pH VALUE SULPHATE 2:1 EXTRACT	Brown slightly clayey silty sandy ASH and GRAVEL, including fragments of glass, wood, rubber and plastic, with organic matter (rootlets) [FILL].

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SUMMARY OF LABORATORY TEST RESULTS

TABLE 1

SITE: FORFAR

REF: 3424

BOREHOLE No.	SAMPLE		MOISTURE CONTENT (%)	ATTERBERG LIMITS					DENSITY (Mg/m ³)		APPARENT COHESION (kN/m ²)	ANGLE OF SHEARING RESISTANCE (°)	OTHER TESTS	DESCRIPTION OF SAMPLE
	No.	DEPTH (m)		TYPE	% PASSING 425µm	LL (%)	PL (%)	PI (%)	BULK	DRY				
2	B5	5.00	-	-	-	-	-	-	-	-	-	-	SIEVE HYDROMETER pH VALUE SULPHATE	Brown silty SAND and GRAVEL with occasional cobbles.
	B7	8.00	-	-	-	-	-	-	-	-	-	-	SIEVE HYDROMETER	Brown silty SAND with occasional gravel.

NOTES ON TABLE 1

- Preparation and testing carried out in accordance with the appropriate Sections of BS 1377 : 1990. Full details of the testing procedures employed are given in the "Notes On Laboratory Procedures" in the Appendix.
- ABBREVIATIONS:- m = metres below ground level ; HYDROMETER = sedimentation analysis ; 2:1 EXTRACT = soluble sulphate content in 2:1 water:soil extract determination ; ICRL = suite of chemical analysis for contaminants ; - = analysis not required.
- pH value and sulphate determinations performed by Fugro Scotland Ltd.
- ICRL performed by G.S.B. Environmental Laboratories Ltd.

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RESULTS OF VISUAL AND OLFACTORY EXAMINATIONS

TABLE 2

SITE: FORFAR

REF:3424

BOREHOLE No.	SAMPLE No.	DEPTH (m)	VISUAL CONTAMINATION	OLFACTORY CONTAMINATION	DESCRIPTION
1	B3	2.50	NONE	Faint oily/organic odour detected	Mottled grey/brown clayey very silty SAND and GRAVEL, including fragments of wood, metal, glass and plastic with occasional cobbles and organic matter (rootlets and plant remains) (FILL).

NOTES ON TABLE 2

1. The visual and olfactory assessment carried out only refers to the sample submitted to the laboratory.

RESULTS OF pH VALUE AND SULPHATE CONTENT DETERMINATIONS

TABLE 3

SITE: FORFAR

REF: 3424

B.H. No.	SAMPLE No.	DEPTH (m)	pH VALUE	SULPHATE CONTENT (% SO ₃)	PERCENT DRY MASS PASSING 2mm TEST SIEVE	SULPHATE CONTENT (g/L SO ₃)	SULPHATE CONTENT (2:1 EXTRACT) (g/L SO ₃)	QUALITATIVE ANALYSIS
								SULPHIDES PRESENT
1	B1	1.00	8.4	0.41	35	-	0.23	No
	B3	2.50	7.4	0.54	40	-	0.25	No
	B6	7.00	7.3	0.22	100	-	0.11	No
2	B1	0.80	7.2	0.61	21	-	0.28	No
	B3	2.50	7.4	0.92	CTP	-	0.30	No
	B5	5.00	8.0	0.20	57	-	0.08	No

Notes on Table 3

1/Abbreviations:- B.H. = Borehole ; m = metres below ground level ; SO₃ = Sulphate ; % = percentage ; mm = millimetres ; g/L = grams per litre ; CTP = crushed to pass ;
- = Analysis not required.

2/Sulphate testing carried out in accordance with BS 1377 : Part 3 : 1990, section 5 - gravimetric method.

3/pH value determined in accordance with BS 1377 : Part 3 : 1990, section 9.5.

4/Total sulphate calculated on the basis that material retained on the 2mm BS test sieve is free of sulphate.

5/pH value and sulphate determinations performed by Fugro Scotland Ltd.

TERRA TEK

RESULTS OF CHEMICAL ANALYSIS FOR CONTAMINANTS

TABLE 4

SITE : FORFAR

REF: 3424

B.H. No.	SAMPLE No.	DEPTH (m)	ICRCL GUIDELINES SOIL:-												
			As mg/kg	Cd mg/kg	Cr mg/kg	Pb mg/kg	Hg mg/kg	Se mg/kg	Cu mg/kg	Ni mg/kg	Zn mg/kg	Phenols mg/kg	Tol X mg/kg	S2 mg/kg	Cn mg/kg
			10	3	600	500	1	3	130	70	300	5	(0-5000)	250	250
			40	15	1000	2000	20	6	-	-	-	5	(0-5000)	250	250
1	B3	2.50	12.9	0.7	26	214	<0.1	<0.5	90	40	337	0.52	4354	0.73	<0.5

TERRA TEK

RESULTS OF CHEMICAL ANALYSIS FOR CONTAMINANTS

TABLE 4

SITE : FORFAR

REF: 3424

Notes on table 4

1/ Abbreviations:- As = Total arsenic ; Cd = Total cadmium ; Cr = Total chromium ; Pb = Total lead ; Hg = Total mercury ; Se = Total selenium ; Cu = Total copper ; Ni = Total nickel ; S2- = Total sulphide ; Zn = Total zinc ; Phenols = Total phenols ; Cn = Total cyanide ; Tol X = Toluene extract ; mg/kg = milligrams per kilogram ; B.H. = Borehole ; m = metres below ground level ; < = less than.

2/ ICRCL "threshold" Guidelines: Reference should be made to the conditions and footnotes of Tables 5.14 and 5.15 of Department of the Environment Publication ICRCL 59/83.

3/ (0 - 5000) HSE Guideline for typically un-contaminated soil.

4/ (5000mg/kg - 1%) HSE Guideline indicating slight soil contamination.

5/ (1% - 5%) HSE Guideline indicating soil contamination.

6/ Notes 4 and 5 regarding TOLX, for information only.

7/ --- denotes contaminant level exceeds guideline adopted (ICRCL Industrial).

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RESULTS OF ASBESTOS IDENTIFICATION ANALYSIS

TABLE 5

B.H. No.	SAMPLE No.	DEPTH (m)	SLIDE REF No.	CHRYSTOLE (WHITE ASB)	ANTHOPHYLLITE (WHITE ASB)	AMOSITE (BROWN ASB)	CROCIDOLITE (BLUE ASB)
1	B3	2.50	-	NF	NF	NF	NF

SITE : FORFAR

REF: 3424

Notes on Table 5

- 1/ Identification normally by Optical Microscopy but where identification proves uncertain, X-Ray Diffraction techniques may be employed on request.
- 2/ The report refers only to the sample presented to the identification Laboratory.
- 3/ A " Not Found " report for Crocidolite on a single sample cannot exclude its presence on the site.
- 4/ Abbreviations:- B.H. = borehole ; m = metres below ground level ; NF = asbestos type not found ; F = asbestos found ; ASB = asbestos.

TERRA TEK

Site Name : FORFAR LEISURE CENTRE

Client : Angus Council

Engineer : Property Services

Job Number

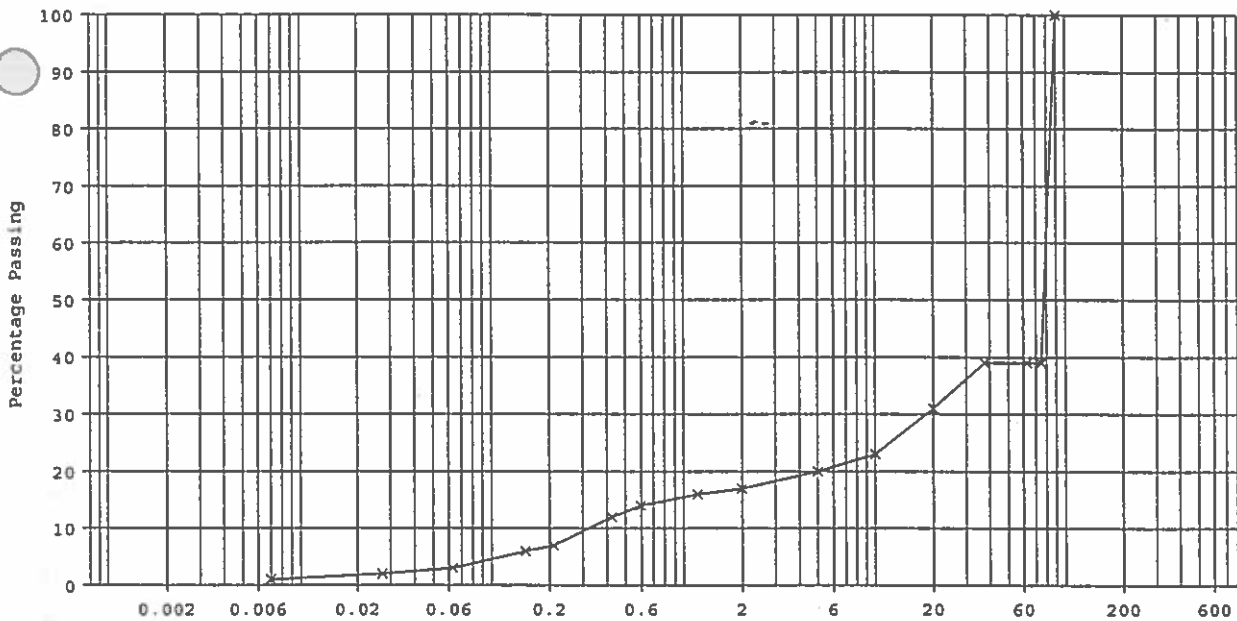
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit No.	Depth (m)	Sample	Description
1	1.00	B1	Brown slightly silty sandy GRAVEL and COBBLES [FILL].



Sieve / Particle Size	% Passing
90mm	100.0
75mm	39.0
63mm	39.0
37.5mm	39.0
20mm	31.0
10mm	23.0
5mm	20.0
2mm	17.0
1.18mm	16.0
600µm	14.0
425µm	12.0
212µm	7.0
150µm	6.0
63µm	3.0
27µm	2.0
7µm	1.0

CLAY	Fine	Medium	Coarse	SILT	Fine	Medium	Coarse	SAND	Fine	Medium	Coarse	GRAVEL	COBBLES	BOULDERS

Grading Analysis	
D85	86.1mm
D60	79.9mm
D10	321.8µm
Uniformity Coefficient	248.2

Particle Proportions	
Cobbles + Boulders	61.0%
Gravel	22.0%
Sand	14.1%
Silt	-
Clay	-

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

TERRA TEK Limited

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Laboratory Test Results

Site Name : FORFAR LEISURE CENTRE

Client : Angus Council

Engineer : Property Services

Job Number

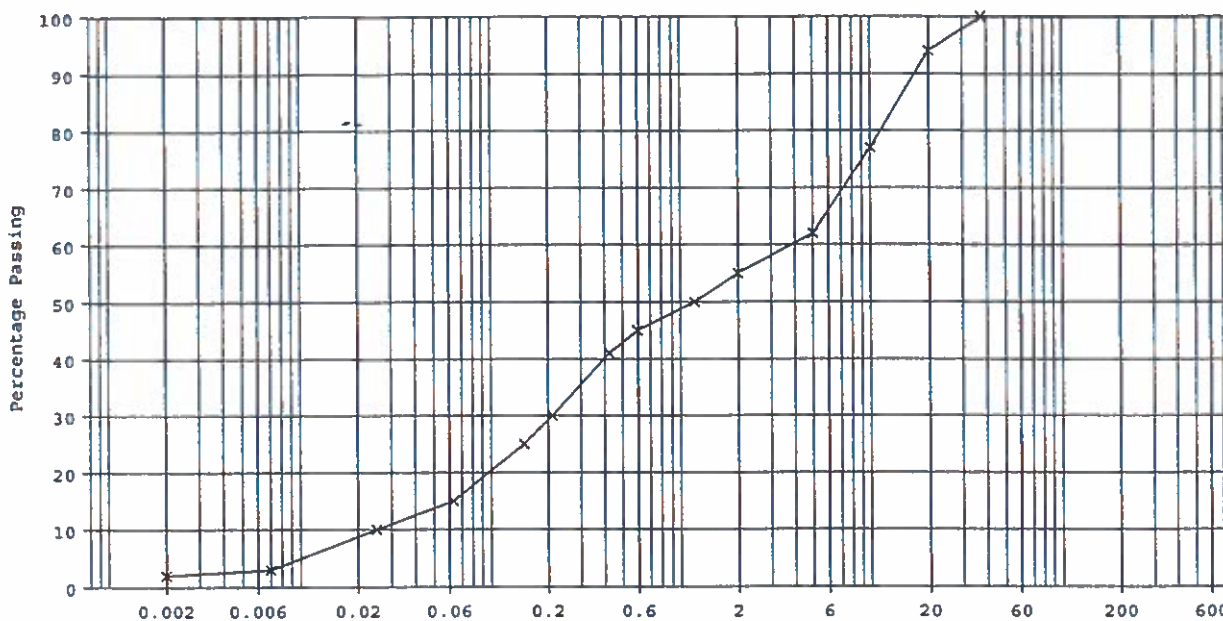
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit No.	Depth (m)	Sample	Description
1	1.40	B2	Mottled brown slightly clayey silty SAND and GRAVEL, including fragments of ceramic, glass, rubber and coal, with organic matter (rootlets) (FILL).



Sieve / Particle Size	% Passing
37.5mm	100.0
20mm	94.0
10mm	77.0
5mm	62.0
2mm	55.0
1.18mm	50.0
600µm	45.0
425µm	41.0
212µm	30.0
150µm	25.0
63µm	15.0
25µm	10.0
7µm	3.0
2µm	2.0

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

D85	13.9mm
D60	3.8mm
D10	25.0µm
Uniformity Coefficient	153.9

Cobbles + Boulders	0.0%
Gravel	45.0%
Sand	40.3%
Silt	12.7%
Clay	2.0%

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

Site Name : FORFAR LEISURE CENTRE

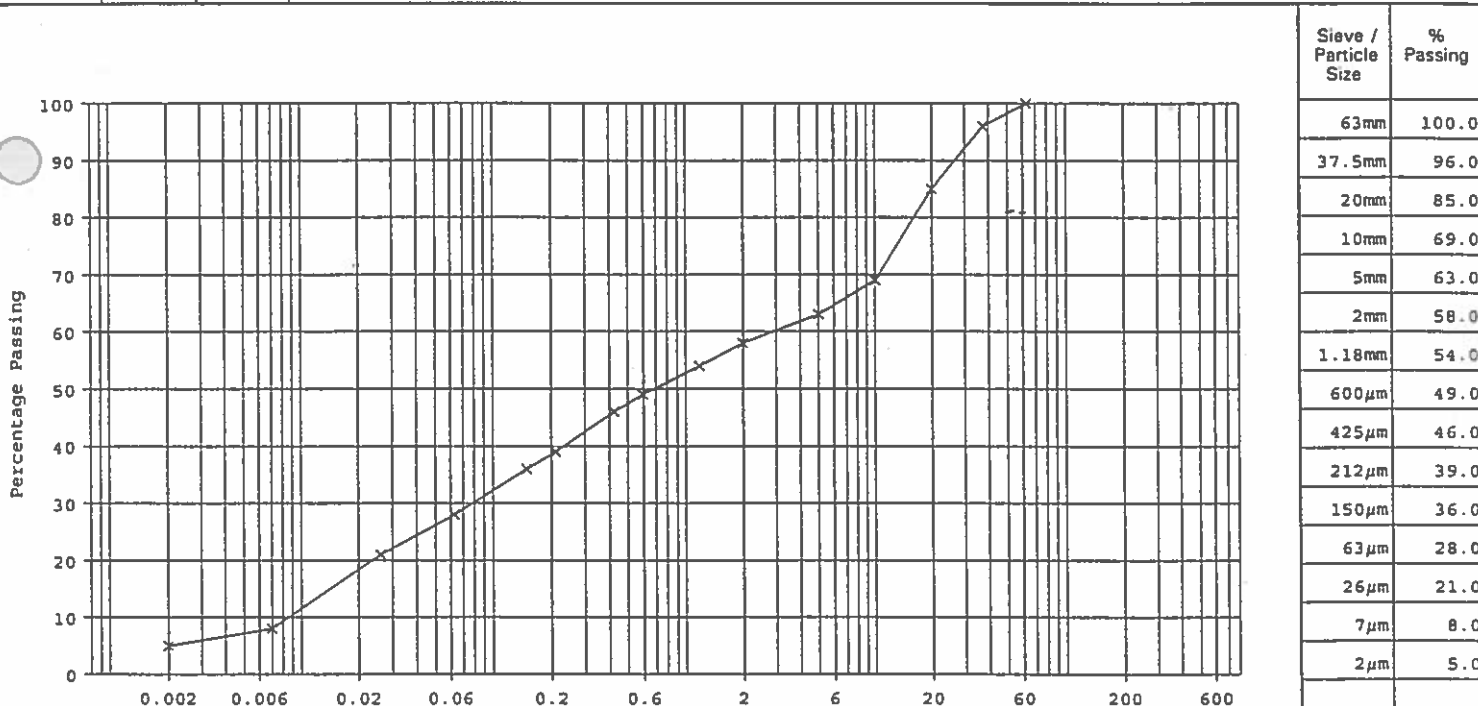
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Engineer : Property Services

Job Number
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit No.	Depth (m)	Sample	Description
1	2.50	B3	Mottled grey/brown clayey very silty SAND and GRAVEL, including fragments of wood, metal, glass and plastic, with occasional cobbles and organic matter (rootlets) (faint oily/organic odour noted) (FILL).



Sieve / Particle Size	% Passing
63mm	100.0
37.5mm	96.0
20mm	85.0
10mm	69.0
5mm	63.0
2mm	58.0
1.18mm	54.0
600µm	49.0
425µm	46.0
212µm	39.0
150µm	36.0
63µm	28.0
26µm	21.0
7µm	8.0
2µm	5.0

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Grading Analysis	
D85	20.0mm
D60	2.9mm
D10	8.6µm
Uniformity Coefficient	336.8

Particle Proportions	
Cobbles + Boulders	0.4%
Gravel	41.6%
Sand	30.4%
Silt	22.6%
Clay	5.0%

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

TERRA TEK Limited

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Laboratory Test Results

Site Name : FORFAR LEISURE CENTRE

Client : Angus Council

Engineer : Property Services

Job Number

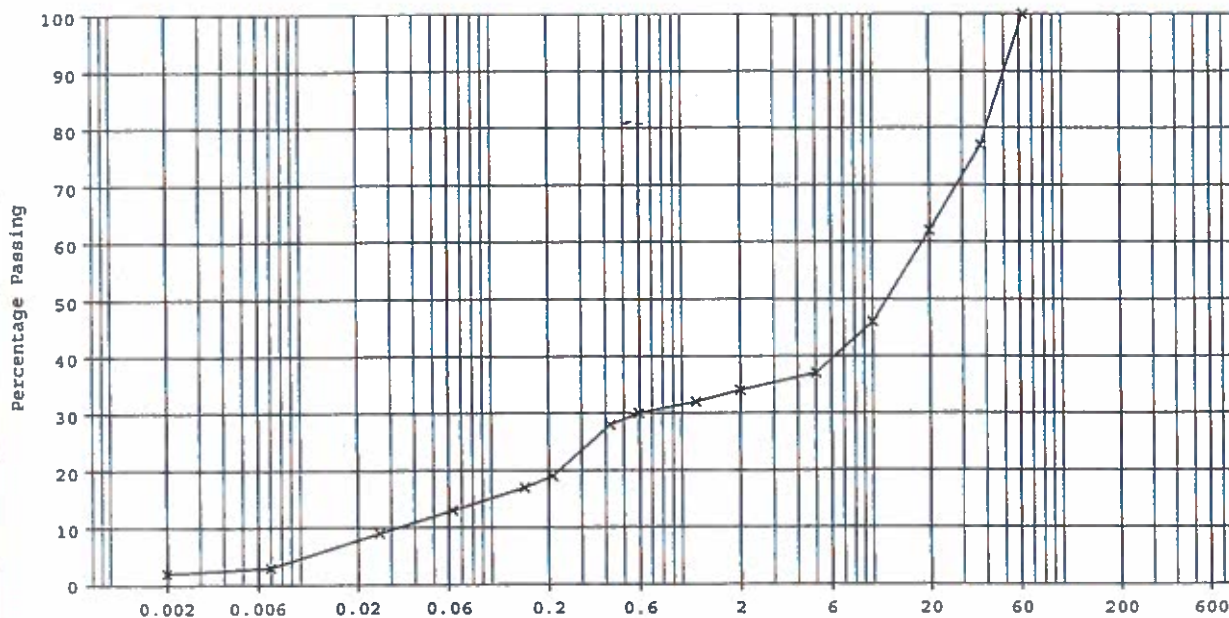
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit No.	Depth (m)	Sample	Description
1	3.80	B4	Mottled grey/brown slightly clayey silty very sandy GRAVEL, including fragments of metal, plastic, wood, ceramics and glass, with inclusions of ash (strong oily/organic odour noted) [FILL].



Sieve / Particle Size	% Passing
63mm	100.0
37.5mm	100.0
20mm	62.0
10mm	46.0
5mm	37.0
2mm	34.0
1.18mm	32.0
600µm	30.0
425µm	28.0
212µm	19.0
150µm	17.0
63µm	13.0
26µm	9.0
7µm	3.0
2µm	2.0

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Grading Analysis	
D85	44.9mm
D60	18.3mm
D10	32.4µm
Uniformity Coefficient	565.4

Particle Proportions	
Cobbles + Boulders	2.2%
Gravel	63.8%
Sand	21.2%
Silt	10.8%
Clay	2.0%

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

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Laboratory Test Results

Site Name : FORFAR LEISURE CENTRE

Client : Angus Council

Engineer : Property Services

Job Number

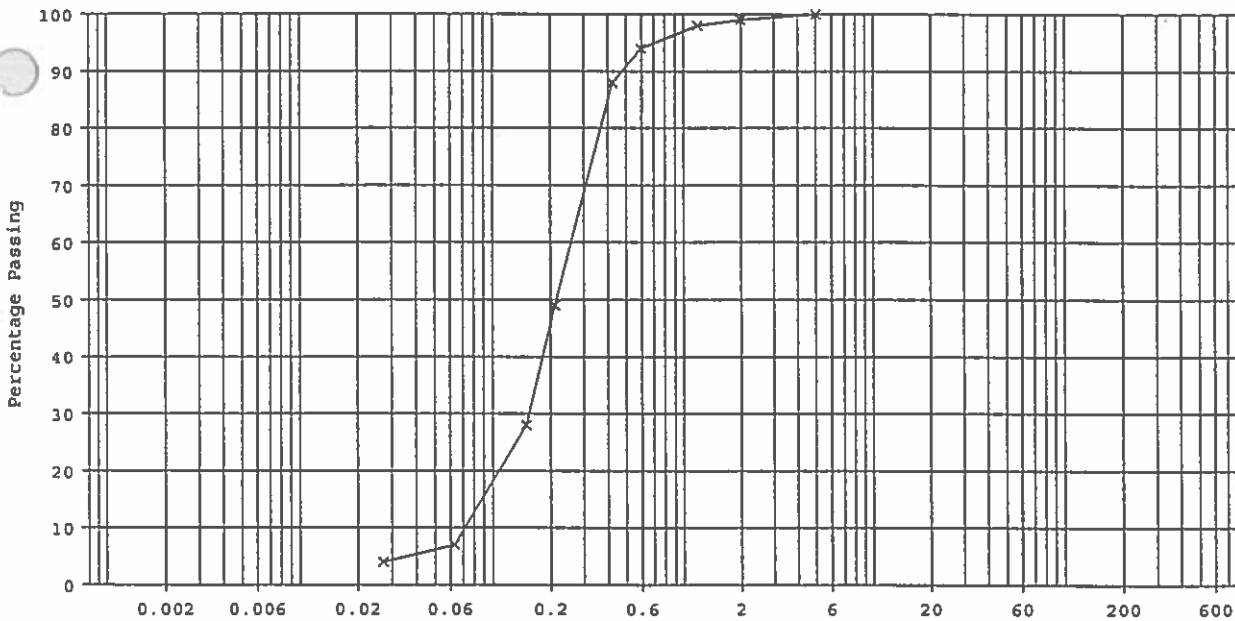
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit No.	Depth (m)	Sample	Description
1	7.00	B6	Brown silty SAND with occasional gravel.



Sieve / Particle Size	% Passing
5mm	100.0
2mm	99.0
1.18mm	98.0
600µm	94.0
425µm	88.0
212µm	49.0
150µm	28.0
63µm	7.0
27µm	4.0

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Grading Analysis	
D85	402.9µm
D60	257.9µm
D10	71.3µm
Uniformity Coefficient	3.6

Particle Proportions	
Cobbles + Boulders	0.0%
Gravel	1.0%
Sand	92.2%
Silt	-
Clay	-

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

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Laboratory Test Results

Site Name : FORFAR LEISURE CENTRE

Client : Angus Council

Engineer : Property Services

Job Number

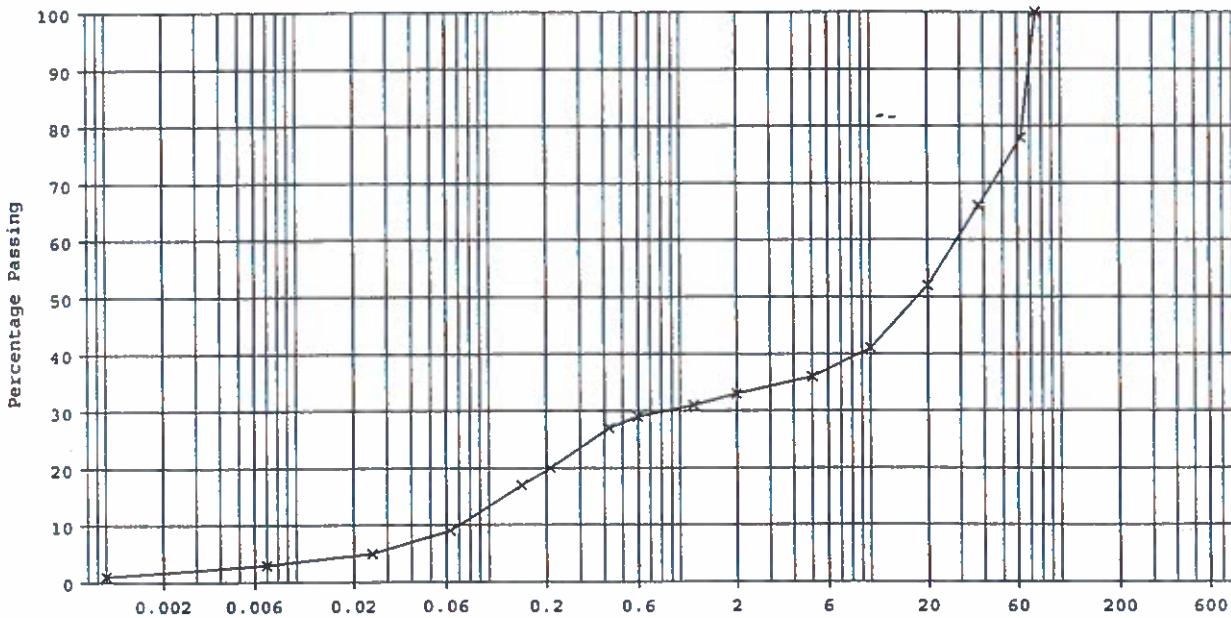
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit No.	Depth (m)	Sample	Description
2	0.80	B1	Brown slightly clayey silty very sandy GRAVEL with cobbles and occasional organic matter (rootlets) [FILL].



Sieve / Particle Size	% Passing
75mm	100.0
63mm	78.0
37.5mm	66.0
20mm	52.0
10mm	41.0
5mm	36.0
2mm	33.0
1.18mm	31.0
600µm	29.0
425µm	27.0
212µm	20.0
150µm	17.0
63µm	9.0
25µm	5.0
7µm	3.0
1µm	1.0

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Grading Analysis	
D85	66.6mm
D60	28.6mm
D10	70.2µm
Uniformity Coefficient	407.9

Particle Proportions	
Cobbles + Boulders	23.1%
Gravel	43.9%
Sand	24.2%
Silt	7.1%
Clay	1.7%

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

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Laboratory Test Results

Site Name : FORFAR LEISURE CENTRE

Client : Angus Council

Engineer : Property Services

Job Number

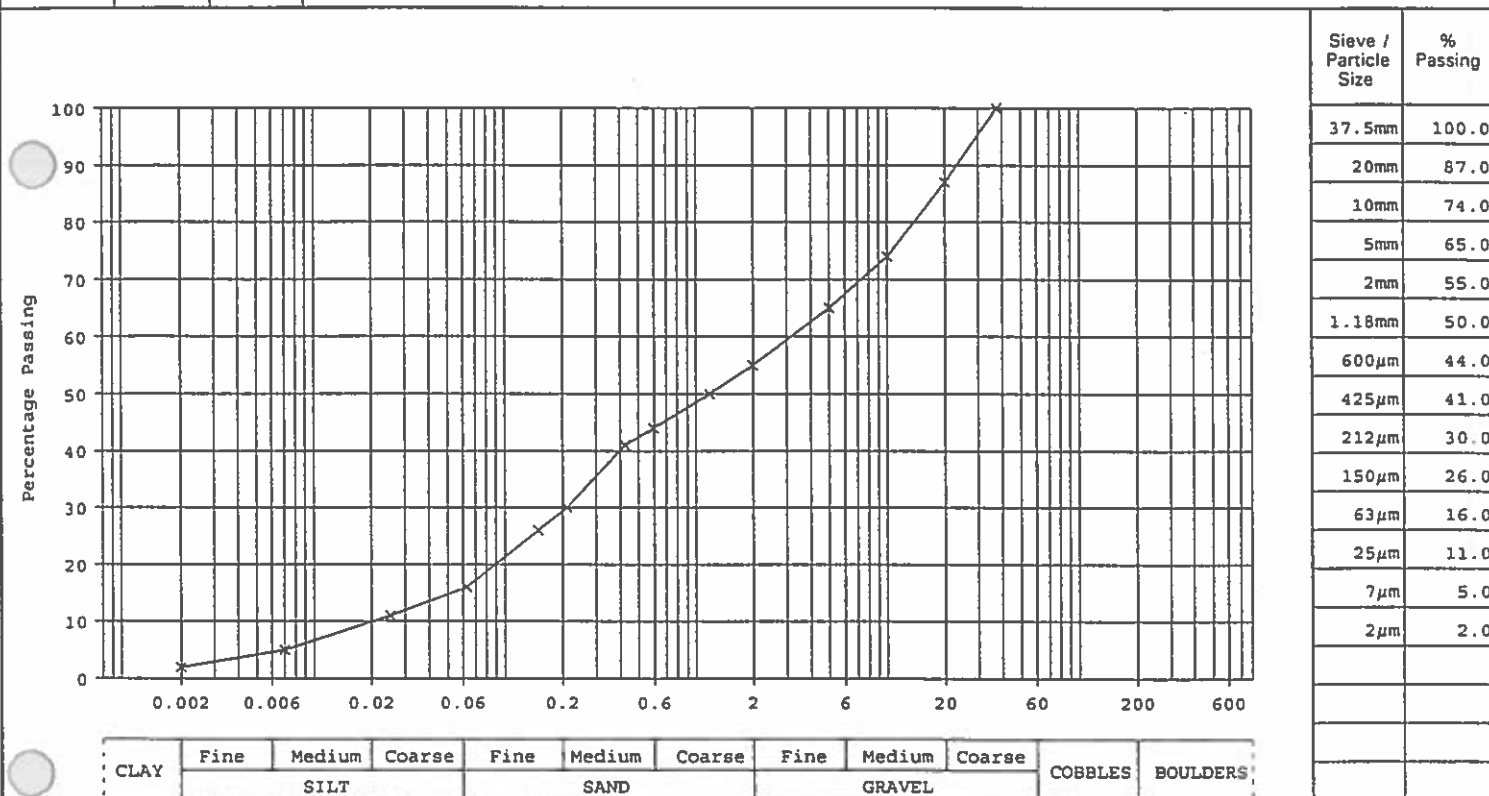
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit No.	Depth (m)	Sample	Description
2	2.50	B3	Brown slightly clayey silty sandy ASH and GRAVEL, including fragments of glass, wood, rubber and plastic, with organic matter (rootlets) [FILL].



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Grading Analysis	
D85	18.0mm
D60	3.2mm
D10	20.2µm
Uniformity Coefficient	156.4

Particle Proportions	
Cobbles + Boulders	0.0%
Gravel	45.0%
Sand	39.3%
Silt	13.7%
Clay	2.0%

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

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Laboratory Test Results

Site Name : FORFAR LEISURE CENTRE

Client : Angus Council

Engineer : Property Services

Job Number

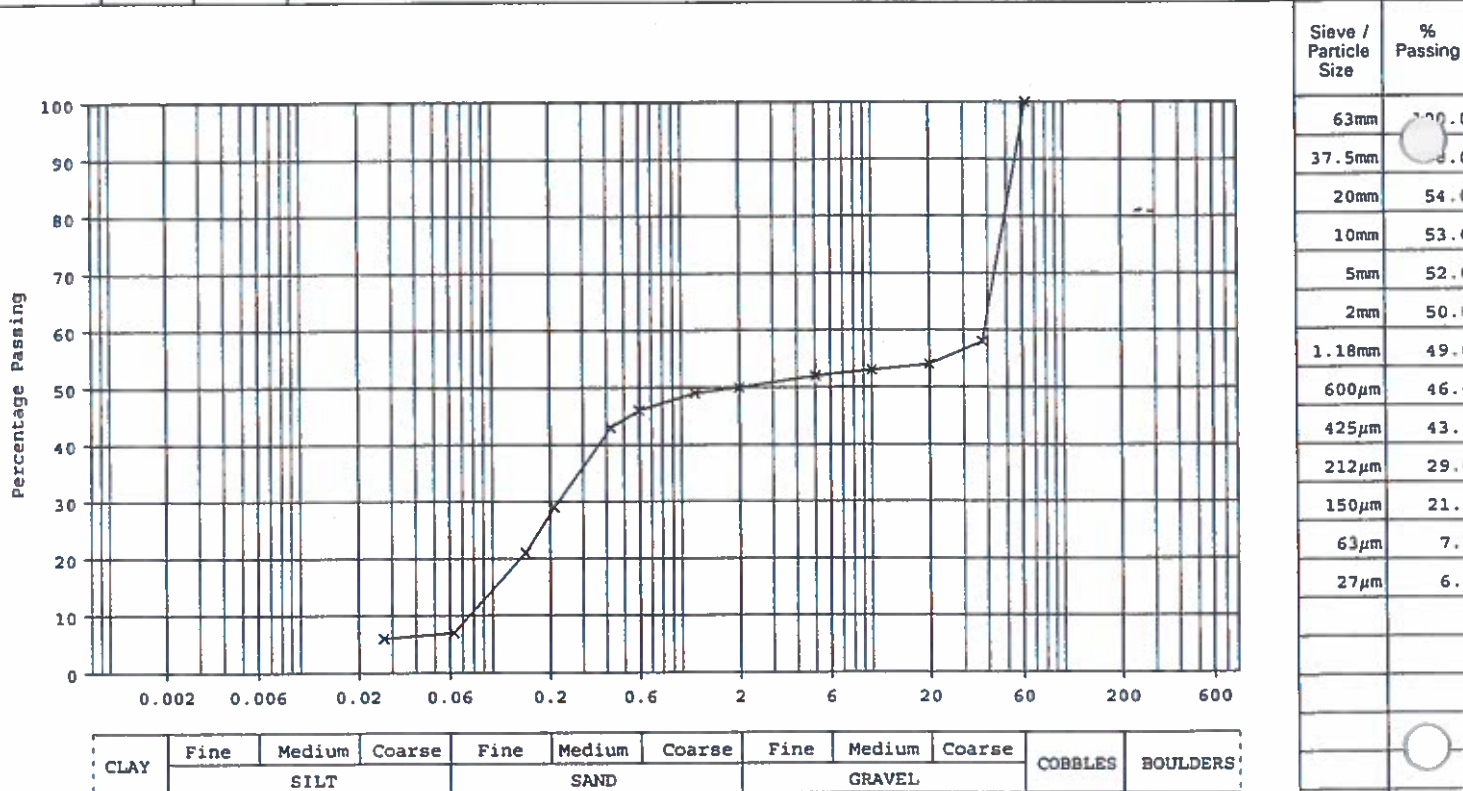
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit No.	Depth (m)	Sample	Description
2	5.00	B5	Brown silty SAND and GRAVEL with occasional cobbles.



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Grading Analysis	
D85	52.3mm
D60	38.4mm
D10	75.9µm
Uniformity Coefficient	506.6

Particle Proportions	
Cobbles + Boulders	3.9%
Gravel	46.1%
Sand	43.1%
Silt	-
Clay	-

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

Site Name : FORFAR LEISURE CENTRE

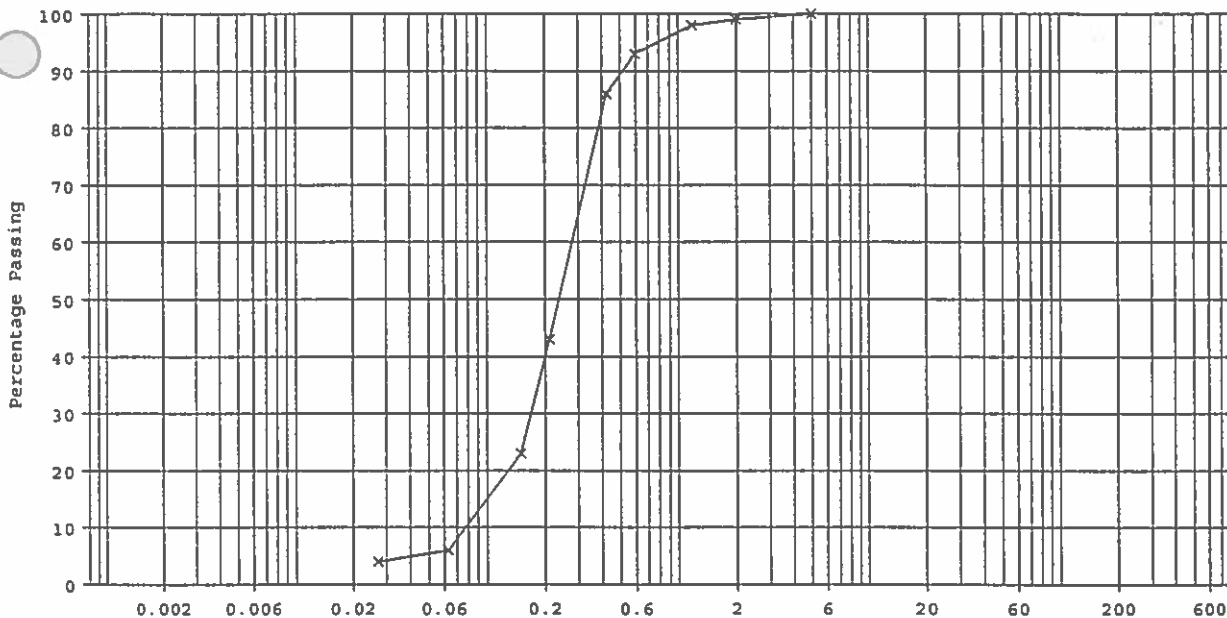
Client : Angus Council

Engineer : Property Services

Job Number
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit No.	Depth (m)	Sample	Description
2	8.00	B7	Brown silty SAND with occasional gravel.



Sieve / Particle Size	% Passing
5mm	100.0
2mm	99.0
1.18mm	98.0
600µm	93.0
425µm	86.0
212µm	43.0
150µm	23.0
63µm	6.0
27µm	4.0

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Grading Analysis	
D85	418.2µm
D60	279.1µm
D10	77.3µm
Uniformity Coefficient	3.6

Particle Proportions	
Cobbles + Boulders	0.0%
Gravel	1.0%
Sand	93.1%
Silt	-
Clay	-

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :



APPENDIX A2 - ANGUS DISTRICT COUNCIL CRACK MONITORING RESULTS / NOTES



BRICK

- 1) Movement mainly occurs over summer months.
- 2) Instert bar area, fixed with low density grout
- 3) Possible failure with increased load with suitable adhesion, compression & tension capabilities.
- 4) Provision of New door etc to original structure.



FLOOR REPAIRS CAUSES

ATB MILLER
ATO ARMS WEST.

STRUCTURAL SURVEY.

REPORT - 10/6/84.

FOLLOWING A SITE MEETING WITH MESSRS E.R.M. KENNEDY, PROWSE,
ENGINEERS & ARCHITECTS CONSULTANTS ON 23RD MAY 1984 WHICH
IT WAS RECOMMENDED THAT STRUCTURAL SURVEYORS BE
UNDERTAKEN TO ASCERTAIN WHETHER ANY FURTHER MOVEMENT IS TAKING
PLACE "METAL PIN" TELL TAPS WERE FITTED TO FLOOR BEAMS
AREAS OF VARIOUS AREAS ACROSS CRACKS TO THE FLOOR SLABS.
THESE TELL TAPS ARE SET IN EPOXY RESIN WITHIN A DRILL
HOLE TO ENSURE NO POSSIBLE MOVEMENT, AND WERE FITTED
DURING THE WEEK ENDING 8TH JUNE 1984.

IT IS ENVISAGED THAT A REGULAR MEASUREMENTS ACROSS THE
TELL TAPS BE TAKEN, OVER A PERIOD OF SOME 3-4 MONTHS.
DEPENDANT ON THE RATE OF MOVEMENT, IF ANY, ON COMPLETION
OF THIS SURVEY MESSRS ERM KENNEDY SHOULD ADVISE ON
THE NECESSARY ACTION TO EFFECT A SATISFACTORY REPAIR.
ANY IRREGULAR READINGS ENCOUNTERED ARE TO BE REPORTED
TO MESSRS ERM KENNEDY IMMEDIATELY FOR COMMENT.
FOR PRELIMINARY AND MEASUREMENTS TO BE TAKEN IN MINUTES.

13/6/84 - IT WAS POINTED OUT BY THE ^{ARCHITECT} ~~MEASUREMENTS~~ SURVEYOR AT THE CENTRE
THAT A RECENT HOLE WAS OBSERVED IN THE FLOOR TILES TO THE
VIEWING LOUNGE AREA ON THE GROUND FLOOR - A SECTION OF
TILE WAS REMOVED ADJOINING THE WINDOW ON THE EXTERNAL WALL
WHICH REVEALED A CRACK ACROSS THE FLOOR SLAB WHICH APPEARED
TO BE OF A RECENT NATURE. - INSTRUCTIONS WERE GIVEN
TO HAVE SIMILAR METAL PIN TELL TAPS FITTED AND REGULAR
MEASUREMENTS WERE ALSO TO BE TAKEN TO THIS AREA.

25/6/84 - TELL TAPS TO NEW AREA OF CRACKING NOT FITTED.

3/7/84 - TELL TAPS FITTED AND FIRST READINGS TAKEN -

- FIRST INDICATION OF MOVEMENT TO ANY AREA - TO DISCOVERED
AREA E & F. ROOM

9/7/84 - SIGN OF SUCH MOVEMENT TO AREA WHICH NEW TELL TAPS
FITTED TO FLOOR SLAB (VIEWING LOUNGE ON GROUND FLOOR).

18/7/84 - INDICATION OF CRACK BETWEEN TELL TAPS TO CERTAIN AREAS LISTED THIS

30/7/84

- Measurements taken after 2 week break following Monday period - movement of further closure of crack to floor slab at corner base area on ground floor also, first indication of movement to stairs mill stone - bad case.

3/9/84

After very wet unseasoned evidence of movement showing to next visits.

Period of measurement across full three now extended to 1 1/2 weeks.

11/9/84

Meeting with Mr V. Wilson, ERM Kennedy & Mills - concluded when it was agreed that the measurements across full three would continue until spring but that period of measurement be extended to 2 weeks with the proviso that this can be further extended or reduced dependent on findings.

A note is also to be kept as regards of the weather conditions between readings and intermediate readings than if the latter necessary for 3-4 days after ordinary weather conditions.

15/11/84

Very little movement over last 2 month period of very wet weather conditions indicating that maximum movement would appear to take place during extremely dry & hot period and mainly to floor slabs.

26/11/84

- As little or no movement has occurred over last 2 months the visitation programme is being extended to 2 months at which time the readings observed will determine the day of visitation to the next visit.

21/1/85

~~Reads visits to 1 month to see if extremely wet and sunny weather has any effect on movement~~

As little movement was observed still keep visits to approx 2 month period.

22/3/85. - No movement indicated during winter wet months
which would suggest maximum movement takes
place during dryer months when ground "shrinks"
- The recent photographs showing a thin bar
that may be water as a possible solution
of some type of flexible finish.
Keep visits to two month periods as present -
can site meetings with engineer following
next visit in May.

22/6/85 No movement since last visit - Normal
1750 to 1800



WEATHER CONDITIONS SINCE PREVIOUS PERIODS.

- 13/9/84 - Wet - Heavy Rain (intermittent) over Fochortet.
- 1/10/84 - As Above
- 16/10/84 - Fairly Good - Wet Spells - Heavy Rain for most of day on 11/10/84
- 29/10/84 - Very wet over past 2 weeks (Heavy Rain.)
- 15/11/84 - Extremely wet over period - Heavy thunderstorms - Frooding etc
- 26/11/84 - As Above. (15/11/84)
- 21/1/85 - Very wet over past two months including heavy rains & snow.
- 22/3/85 - Continued wet and snow throughout Feb. Beginning of March fairly dry, but on March wet.
- 22/5/85 - Weather variable over past two months with exception of fairly dry period beginning of May



~~EXAMPLE SHEET~~

REAR BEARING COUPLER

TRELL TAPES.

DATE	PREVIOUS LEADING (mm)	PRESENT LEADING (mm)	DATE OF MOVEMENT (mm)	TOTAL DATE (mm) OF MOVEMENT
1/6/84	—	40 mm	—	—
8/6/84	40 mm	40 mm	—	—
15/6/84	40 mm	42 mm	+ 2 mm	+ 2 mm.
22/6/84	42 mm	46 mm	+ 4 mm	+ 6 mm.
29/6/84	46 mm	47 mm	+ 1 mm	+ 7 mm.



ARKAR RESORTS CENTRE.

TELL - TRAYS.

UPPER FLOOR - DISCOTEQUE AREA / G.P. LOBBY

CRACK TO PARTITION WALL ADJOINING UPPER DRAIFT STAIR AREA.

DATE	PREVIOUS LOADING (mm)	PRESENT LOADING (mm)	INTERMEDIATE	
			RATE OF MOVEMENT (mm)	TOTAL RATE OF MOVEMENT
4/6/84	-	72 mm.	-	-
4/6/84	72	72 mm	-	-
25/6/84	72	72 mm.	-	-
5/7/84	72 mm	73 mm	+ 1 mm	+ 1 mm.
9/7/84	73 mm	73 mm.	-	+ 1 mm.
16/7/84	73. mm	73 mm.	-	+ 1 mm.
30/7/84	73 mm	73 mm	-	+ 1 mm
6/8/84	73 mm	73 mm	-	+ 1 mm.
14/8/84	73 mm	73 mm	-	+ 1 mm.
22/8/84	73 mm	72 mm	- 1 mm	-
3/9/84	72 mm	72 mm.	-	-
COPY RECEIVED SENT TO G.P.M KENNEDY & PARTS				
12/9/84	72 mm	72 mm	-	-
1/10/84	72 mm	72 mm	-	-
16/10/84	72 mm	72 mm	-	-
28/10/84	72 mm	72.5 mm	+ .05 mm	+ .05 mm
15/11/84.	72.5	72.5	-	+ .05 mm
26/11/84	72.5.	72.5	-	+ .05
21/1/85.	72.5	72.5	-	+ .05.
22/3/85	72.5	72	- .05 mm	-
22/5/85	72	72	-	-

FORKAR NURSERY CENTRE.

TALL - TALLS

UPPER FLOOR - COFFEE BAR ADJOINING RECEPTION AREA.

CRACK TO FLOOR.

DATE	PREVIOUS (mm) READINGS	PRESENT (mm) READINGS	INTERMEDIATES	
			LATE OF (mm) MOVEMENTS	TOTAL LOSS (mm) OF MOVEMENT
11/6/84	-	95 mm.	-	-
13/6/84	95	95	-	-
25/6/84	95	95	-	-
3/7/84	95 mm	95 mm	-	-
9/7/84	95 mm	95 mm	-	-
16/7/84	95 mm.	94 mm	- 1 mm	- 1 mm.
30/7/84	94 mm	94 mm	mm -	- 1 mm.
6/8/84	94 mm	93.5 mm	- 0.5 mm	- 1.5 mm
14/8/84	93.5 mm	93 mm	- 0.5 mm	- 2 mm
22/8/84	93 mm.	92.5 mm	- 0.5 mm	- 2.5 mm
5/9/84	92.5 mm	93.5	+ 1 mm	- 1.5 mm
	93.5 mm.			
COPY READINGS SENT TO BRIT KENNEDY & PTDS				
18/9/84	93.5 mm	93.5 mm	-	- 1.5
1/10/84	93.5	93.5	-	- 1.5
16/10/84	93.5 mm	93.5 mm	-	- 1.5
29/10/84	93.5 mm	93.5 mm	-	- 1.5
15/11/84	93.5	94 mm	+ 0.05 mm	- 1 mm
26/11/84	94 mm	94 mm	-	- 1 mm
21/1/84.	94 mm	94	-	- 1 mm.
	94 mm.			
TALL-TALLS REMOVED DURING EARL CONSTRUCTION & FLOOR WITH HIGHER WEIGHT SLAB - NO INDICATION OF MOVEMENT (APPROX 6 WREAS AFTER FINISH).				

FOR THE LETSORE CENTERS

TBL - TALGS

GROUND FLOOR - SPACES HALL STAIRS - CORNER TO RH SIDE EX COR NO 58
TO MARK SURROUNDING RST (AS VIEWED FROM INSIDE.)

DATE	PREVIOUS (mm) REMAINING	PRESENT (mm) REMAINING	INTERMEDIATE	TOTAL RATE (mm) OF MOVEMENT
			RATE OF MOVEMENT	
11/6/84	-	90 mm	-	-
18/6/84	90	90	-	-
25/6/84	90	90	-	-
3/7/84	90 mm	90	-	-
9/7/84	90 mm	90	-	-
16/7/84	90 mm	90 mm	-	-
30/7/84	90 mm	88.5 mm	- 1.5 mm	- 1.5 mm
6/8/84	88.5 mm	87.5 mm	- 1 mm	- 2.5 mm
14/8/84	87.5 mm	88.5 mm	+ 1 mm	- 1.5 mm
20/8/84	88.5 mm	89 mm	+ 0.5 mm	- 1 mm
3/9/85	89 mm	88.5 mm	- 0.5 mm	- 1.5 mm
	88.5 mm			
COPY RECORDS SENT TO GUY KENNEDY & HILL				
13/9/84	88.5 mm	88.5 mm	-	- 1.5 mm
1/10/84	88.5	88.5	-	- 1.5
16/10/84	88.5	88.5	-	- 1.5 mm
29/10/84	88.5	89	+ 0.5 mm	- 1 mm
15/11/84	89	89	-	- 1 mm
26/11/84	89	90	+ 1 mm	-
21/1/85	90	89	- 1 mm	- 1 mm
22/3/85	89	89	-	- 1 mm
22/5/85	89	89	-	- 1 mm

FOR THE 1075000 CENTER

TOLL - TRAILS

GROUND FLOOR - SOUTH WALL STAIRS - CRACK TO LH SIDE OF DOOR NO 52 (AS VIEWED FROM INSIDE)

DATE	PREVIOUS READING (mm)	PRESENT READING (mm)	INTERMEDIATES	
			DATE OF MEASUREMENT (mm)	TEMP. RATE (mm) OR MEASUREMENT
11/6/84	-	(82) 82 mm	-	-
13/6/84	82	82 mm	-	-
25/6/84	82	82 mm	-	-
3/7/84	82 mm	82 mm	-	-
9/7/84	82 mm	82 mm	-	-
16/7/84	82 mm	82 mm	-	-
30/7/84	82 mm	81 mm	- 1 mm	- 1 mm
6/8/84	81 mm	81 mm	-	- 1 mm
14/8/84	81 mm	81 mm	-	- 1 mm
22/8/84	81 mm	81 mm	-	- 1 mm
3/9/84	81 mm	81 mm	-	- 1 mm
COPY READING SENT TO O&T			READY & POK	
13/9/84	81 mm	81 mm	-	- 1 mm
1/10/84	81	81	-	- 1 mm
16/10/84	81	81	-	- 1 mm
24/10/84	81	81	-	- 1 mm
15/11/84	81	81	-	- 1 mm
26/6/84	81	81	-	- 1 mm
21/1/85	81	81	-	- 1 mm
22/3/85	81	81.5	+ 0.05 m	- 0.05 m
22/5/85	81.5	81.5	-	- 0.05 m

FORUM ADVISORS CENTER

TELL - TANKS.

GROUND FLOOR - VIEWING LOUNGE.

CRACK ACROSS FLOOR SLAB

DATE.	PREVIOUS READING mm	PRESENT READING mm	INTERMEDIATE	
			RATE OF MOVEMENT mm	TOTAL RATE OF MOVEMENT mm
3/7/84	—	104 mm	—	—
9/7/84	104 mm	104.5 mm	+ 0.5 mm	+ 0.5 mm
16/4/84	104.5 mm	104 mm	- 0.5 mm	—
30/4/84	104 mm	103.5 mm	- 0.5 mm	- 0.5 mm
6/8/84	103.5 mm	103 mm	- .05 mm	- 1 mm
14/8/84	103 mm	103 mm	—	- 1 mm
22/8/84	103 mm	103 mm	—	- 1 mm
13/9/84	103 mm	103.5 mm	+ .005 mm	- .005 mm
	103.5 mm			
	COPY READINGS SENT TO OROT LABORATORY & ATCS			
13/9/84	103.5 mm	103.5 mm	—	— .05
1/10/84	103.5	103.5	—	— .05
18/10/84	103.5	103.5	—	— .05
29/10/84	103.5	103.5	—	— .05
15/11/84	103.5	104	+ 0.05 mm	—
26/11/84	104	104	—	—
21/1/85	104 mm	104 mm	—	—
22/3/85	104 mm	104 mm	—	—
22/5/85	104	104	—	—



Messrs. G. R. M. Kennedy & Partners,
24 Rutland Street,
EDINBURGH

F.A.O. Mr. J. Wilson

AM/JS

Mr. Miller

13 September 1984

Dear Sirs,

LEISURE CENTRE, FORFAR

I refer to your site meeting of 11 September 1984 with my Area Technical Officer, Mr. Miller, at the above property and enclose as agreed a copy of the "tell-tale" readings over the past three months. Further readings will be forwarded for your information over the next six months after which it is hoped a clearer picture will emerge as to how the building is moving, particularly in relation to weather conditions which shall also now be noted.

Yours faithfully,

DIRECTOR OF TECHNICAL SERVICES

Encl.



FORFAR LEISURE CENTRE

TELL TALES

UPPER FLOOR - DISCOTHEQUE AREA/G.P. ROOM

CRACK TO PARTITION WALL ADJOINING UPPER DRAMA STUDIO AREA

Date	Previous Reading (mm)	Present Reading (mm)	Intermediate Rate of Movement (mm)	Total Rate of movement (mm)
11/6/84	-	72	-	-
18/6/84	72	72	-	-
25/6/84	72	72	-	-
3/7/84	72	73	+1	+1
9/7/84	73	73	-	+1
16/7/84	73	73	-	+1
30/7/83	73	73	-	+1
6/8/84	73	73	-	+1
14/8/84	73	73	-	+1
22/8/84	73	72	-1	-
3/9/84	72	72	-	-

UPPER FLOOR - COFFEE BAR ADJOINING RECREATION AREA

CRACK ACROSS FLOOR SLAB

Date	Previous Reading (mm)	Present Reading (mm)	Intermediate Rate of Movement (mm)	Total Rate of movement (mm)
11/6/84	-	95	-	-
18/6/84	95	95	-	-
25/6/84	95	95	-	-
3/7/84	95	95	-	-
9/7/84	95	95	-	-
16/7/84	95	94	-1	-1
30/7/84	94	94	-	-1
6/8/84	94	93.5	-0.5	-1.5
14/8/84	93.5	93	-0.5	-2
22/8/84	93	92.5	-0.5	-2.5
3/9/84	92.5	93.5	+1	-1.5

GROUND FLOOR - SPORTS HALL STORE

CRACK TO RIGHT HAND SIDE OF DOOR NO. 58 TO WALL SUPPORTING RSJ (VIEWED FROM INSIDE)

Date	Previous Reading (mm)	Present Reading (mm)	Intermediate Rate of Movement (mm)	Total Rate of movement (mm)
11/6/84	-	90	-	-
18/6/84	90	90	-	-
25/6/84	90	90	-	-
3/7/84	90	90	-	-
9/7/84	90	90	-	-
16/7/84	90	90	-	-
30/7/84	90	88.5	-1.5	-1.5
6/8/84	88.5	87.5	-1	-2.5
14/8/84	87.5	88.5	+1	-1.5
22/8/84	88.5	89	+0.5	-1
3/9/84	89	88.5	-0.5	-1.5

GROUND FLOOR - SPORTS HALL STORE

CRACK TO LEFT HAND SIDE OF DOOR NO. 58 (VIEWED FROM INSIDE)

Date	Previous Reading (mm)	Present Reading (mm)	Intermediate Rate of Movement (mm)	Total Rate of movement (mm)
11/6/84	-	82	-	-
18/6/84	82	82	-	-
25/6/84	82	82	-	-
3/7/84	82	82	-	-
9/7/84	82	82	-	-
16/7/84	82	82	-	-
30/7/84	82	81	-1	-1
6/8/84	81	81	-	-1
14/8/84	81	81	-	-1
22/8/84	81	81	-	-1
3/9/84	81	81	-	-1

GROUND FLOOR - VIEWING LOUNGE

CRACK ACROSS FLOOR SLAB AT EXTERNAL WINDOW

Date	Previous Reading (mm)	Present Reading (mm)	Intermediate Rate of Movement (mm)	Total Rate of movement (mm)
3/7/84	-	104	-	-
9/7/84	104	104.5	+0.5	+0.5
16/7/84	104.5	104	-0.5	-
30/7/84	104	103.5	-0.5	-0.5
6/8/84	103.5	103	-0.5	-1
14/8/84	103	103	-	-1
22/8/84	103	103	-	-1
3/9/84	103	103.5	+0.5	+0.5



AM

461 Union Street
Aberdeen AB1 2DB
Tel Aberdeen (0224) 59127

GRM Kennedy & Partners

architects, engineers
& planning consultants

Mr Guthrie
Angus District Council
Department of Technical Services
County Buildings
FORFAR

our ref R-/FG/386/5.2

your ref

date 29 June 1984

Dear Sir

FORFAR LEISURE CENTRE

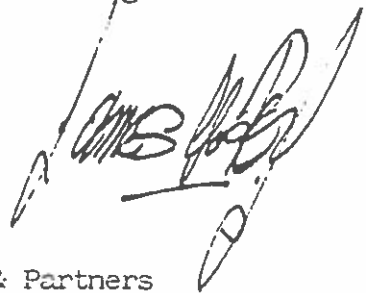
As requested we enclose here a copy letter from our Structural Engineer which details the resin treatments recommended by him for the "filling in" work to cracked walls and floors.

It is understood that no such work is to proceed presently until all are satisfied that movement is no longer occurring.

Because our Mr Parker is now on holiday, our Mr Roy will arrange to visit with Mr Wilson during the next 2 weeks.

We trust that this arrangement is satisfactory.

Yours faithfully



for GRM Kennedy & Partners

Enc

cc Mr J Wilson GRM Kennedy & Partners Edinburgh



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Esplanade, Lerwick
Shetland ZE1 0LL
Telephone Lerwick (0595) 2145



COPY TO A. MILLER
12/6/84
SP

461 Union Street
Aberdeen AB1 2DB
Tel Aberdeen (0224) 59127.

GRM Kennedy & Partners

architects, engineers
& planning consultants

Angus District Council
Department of Technical Services
County Buildings
FORFAR

our ref RP/FG/386/5.2
your ref
date 7 June 1984

For the Attention of Mr Guthrie

Dear Sir

FORFAR LEISURE CENTRE

We enclose here a copy of a letter dated 6 June 1984 from our Engineer, in which you will note that the structural stability of the column within the "boat store" at the rear of the Centre is entirely sound.

Information relating to the resins will be passed to you immediately they have been received by ourselves.

Yours faithfully



for GRM Kennedy & Partners

Enc

cc Mr J Wilson GRM Kennedy & Partners Edinburgh



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FORM	AVGB	
FILE		
CIRCULATION		
- 7 JUN 1984		
ACKN. RECEIPT	RP	
ACTION BY	7/7/84	
ACTION TAKEN	Rotted - Mr Guthrie	

24 Rutland Street
Edinburgh EH1 2AN
Telephone 031-229 8921

GRM Kennedy & Partners *architects, engineers & planning consultants*

GRM Kennedy & Partners
461 Union Street
ABERDEEN
AB1 2DB

our ref JW/JR/386/4.1
your ref
date 6 June 1984

For the attention of R Parker Esq

Dear Sirs

FORFAR LEISURE CENTRE

We are in receipt of your letter dated 24 May 1984 and confirm that we will pass to you the details of the various resins recommended in our report dated 23 March.

With regard to comments being made regarding strengthening of the support column in the boat store, we have no knowledge of these comments and in fact the column appears structurally sound. The load on the brick column is from a light roof only and the majority of the load is from self weight.

We confirm that we will await your instructions regarding a site meeting once the tell tales have been positioned.

Yours faithfully

Janet Reddy

for GRM Kennedy & Partners

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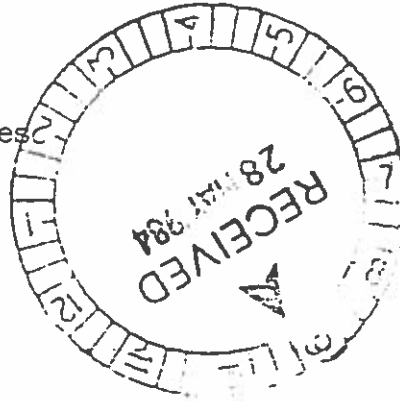
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GRM Kennedy & Partners

architects, engineers
& planning consultants

Angus District Council
Director of Technical Services
County Buildings
FORFAR



our ref RP/FG/386/2.1
your ref
date 24 May 1984

Dear Sir

FORFAR LEISURE CENTRE

We refer to our meeting yesterday with your Mr Guthrie, Mr Millar and the Manager of the Centre, when we examined again the various areas of cracking within the building, and confirm below the various points now to be carried out:

- 1 In order to ascertain whether any further movement is taking place, it was agreed that Mr Millar would have fitted another set of "tell tales". These would be of the "metal pin" type rather than glass, would be fitted at least within the disco area, the sports hall store and drama hall store, and would be fixed to the load bearing walling rather than in certain places to plaster or render. Consistent monitoring would be carried out over at least a 3 month period.
- 2 A further visit will be arranged with ourselves and the Structural Engineer to re-assess the position and to examine the roof covering.
- 3 Detailed information will be supplied regarding eventual remedial action to be taken, in particular specification information for resins to be used.
- 4 Polysulphide sealant is to be applied to all junctions of wall/door/windows/asphalt within the climbing tower (carefully fill "hole" between window and side wall), as a first step to deal with water ingress: the problem to be monitored for further ingress.
- 5 Information to be obtained on a suggested change to gas from present oil fuel.

Kindly/

Partners
George RM Kennedy DA (Edin) RIBA RIAS
Alan WG Burnett DA (Edin) RIBA RIAS
Russell Parker BA Hons Arch (Manchester) RIBA RIAS
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GRM Kennedy & Partners

2

24 May 1984

Director of Technical Services

Kindly advise us when the "tell tales" have been fitted in order that the next visit can then be arranged: we will write again once further information is available on the other matters.

Yours faithfully

A handwritten signature in black ink, appearing to be 'J. Wilson', written in a cursive style.

for GRM Kennedy & Partners

cc Mr J Wilson GRM Kennedy & Partners Edinburgh
Manager Forfar Leisure Centre



Copy to R. Munn 29/5/84 21 1

461 Union Street
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GRM Kennedy & Partners

architects, engineers
& planning consultants

Scottish Gas
50 East Dock Street
DUNDEE

our ref RP/FG/386/6.5
your ref
date 24 May 1984

Dear Sir

FORFAR LEISURE CENTRE

The above Centre was completed several years ago, and an oil fired central heating system installed.

Consideration is now being given to this being changed to a gas fired system and we would be obliged if you would advise us of the costs involved in bringing a gas supply to the Centre from Craig O'Loch Road, what capital expenditure would be required to the existing boiler installation for its conversion and lastly some indication of the annual running costs were gas fuel to be used here.

We would be obliged if you could examine these matters at your earliest possible opportunity and report to us.

Yours faithfully



for GRM Kennedy & Partners

cc Angus District Council Director of Technical Services ✓
Manager Forfar Leisure Centre

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Messrs G R M Kennedy & Partners
Structural Engineers
24 Rutland Street
EDINBURGH
EH1 2AN

our ref RP/FG/386/4.1
your ref
date 24 May 1984

For the Attention of Mr J Wilson

Dear Sir

FORFAR LEISURE CENTRE

A further visit was made today to the Forfar Leisure Centre, and having examined again the cracking in various areas, requested that more "tell tales" are fixed over certain cracks in order to establish whether movement is still taking place: a copy of our letter is enclosed here.

In addition, we would be obliged if you could provide us with more detailed information regarding the proposed remedial work, and arrange to visit with us, following confirmation that the new "tell tales" have been fitted.

Lastly, we understand that comments had been made previously about the strengthening of the centre support column within the old boat store, where an inner brick wall has been removed. Would you please provide this information at your earliest opportunity.

Yours faithfully

for GRM Kennedy & Partners

Enc

cc Angus District Council Director of Technical Services ✓
Manager Forfar Leisure Centre

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24/5/84

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GRM Kennedy & Partners

architects, engineers
& planning consultants

Angus District Council
Maintenance Department
County Buildings
Market Street
FORFAR

our ref RP/FG/386/2.1

your ref

date 3 April 1984

For the Attention of Mr Guthrie

Dear Sir

FORFAR LEISURE AND RECREATION CENTRE

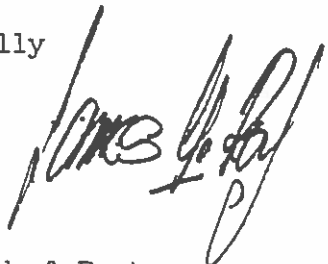
We have now received the detailed Structural Report from our Engineer following his examination of the Leisure Centre at Forfar: a copy of the Report with the accompanying drawings are enclosed here.

You will note that it is the Engineer's opinion that the cracks are essentially "cosmetic" problems due to differential settlement, and are not a cause for any concern over the structural stability of any part of the Centre.

Once you have considered the recommendations made there, perhaps you might feel that a further meeting would be helpful before deciding what action is to be taken, and to agree what other information should be provided regarding the Drama Studio etc.

We look forward to hearing from you.

Yours faithfully



for GRM Kennedy & Partners

Enc

cc Mr J Wilson GRM Kennedy & Partners Edinburgh

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GRM Kennedy & Partners
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ABERDEEN
AB1 2DB

our ref JW/JR/386/4.1
your ref
date 23 March 1984

For the attention of R Parker Esq

Dear Sirs

FORFAR LEISURE / RECREATION CENTRE

Please find enclosed our engineers notes and recommendations regarding the reported cracking at the above.

It would be appreciated if you could deal directly with Mr Guthrie of the local authority maintenance department regarding supervision, etc of the work to be undertaken.

If we can be of further assistance please do not hesitate to contact us.

Yours faithfully



for GRM Kennedy & Partners

Encs

GRMK	AW:GB		
DISCUSSION 10/3/84			
21 MAR 1984			
APPROVED BY			
ACTION TAKEN	2 April 84		

cc Folger.

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FILE	AW38		
24 MAR 1984			
DESCRIPTION			
DATE			

FORFAR LEISURE / RECREATION CENTRE

Following a request for a report on various cracks in the walls and floors at the above, our Mr Wilson met Mr Guthrie (the Maintenance Officer of the Local Authority) on site. The following is a record of the findings with recommendations regarding action required.

The project was constructed during 1973-74 on reclaimed land once covered by the Forfar Loch. The make up of the material used as fill was poorly compacted rubble and unburnt household waste. The area of the structure was stabilised using a vibro floatation method by Cementation Ltd. It is to be expected that some settlement would take place. The major settlement would be during construction and within the first two years and thereafter the rate would decrease with compaction unless ground conditions altered i.e. water table fluctuation.

We assume that none of the cracking is new but that perhaps some recent additional movement has exaggerated that already cracked. A reason for this could be that last summer was particularly dry during which the water level of the loch presumably fell and the surrounding soil dried more than normal. In particular if the soil contains clay then shrinkage is to be expected. The reverse would be the case during the following winter. With the resulting swelling of the soil any cracking could be exaggerated. This would also tend to push walls, etc. off plumb

The most apparent cracking is noted on the enclosed copies of the layout drawings and the following are our notes and recommendations:

Notes

DRAMA STUDIO

The walls on the south side have some horizontal cracks, possibly due to movement of the columns creating tension in the bed joints of the brick. There is no obvious cracking outside.

There is some horizontal cracking at high level at the north and south corners. This is possibly due to column movement creating tension in the bed joints of the brick. There is no obvious cracking on the outside.

The expansion joints in the west wall have opened up with some slight cracking adjacent to Door No 10.

There is a diagonal crack between the windows to the upper lounge.

There is some tearing of the lino floor finish. We assume this is over cracking in the joints of the precast floor slabs. The full extent of this cracking is unknown.

Recommendations

Rake out and repoint the brick. Patch the finish.

Rake out and repoint the brick. Patch the finish.

Rake out and repoint the brick. Patch the finish.

Rake out and repoint the brick. Patch the finish.

Lift the floor finish. Remove all dust, etc. from the cracks and fill with suitable resin.



DRAMA STORE

There is some slight cracking to one side of Door 9 and crushing of the brick on the other side.

There is a diagonal crack to one side of Door 11 and a vertical crack at the other side. The brickwork at the vertical crack has risband joints.

There is a diagonal crack in the soffit of a precast concrete unit at ceiling level.

Corridor to Green Room

There is a vertical crack above the radiator recess. This is unbonded brick and non-structural.

There are two lines on the floor finish. This looks like cracks under.

Between door 16 and the viewing lounge is a crack in the joint of the slabs above ceiling level. This is over the 230 wall at the end of the seating unit. The floor units have settled across this wall.

Viewing Lounge

There is a crack in the floor of the viewing lounge. This is along the joints of the precast floor units.

Corridor to Squash Courts

There is cracking over the door to Court 1. This is a hair crack and common with thermal movement or slight settlement.

There is a vertical crack in the corridor side of the duct between the male and female cloakrooms.

There is a small crack at high level adjacent to the seat unit on both sides of the wall forming the backwall of the male cloakroom.

SQUASH COURTS

There is a crack in one corner of Court No 2.

At the bottom of the wall lining is a gap of approximately 25mm. The squash balls are sticking in this gap.

Rake out and fill the crack. Remove the crushed brick and replace, dry pack under the slab.

Rake out and fill the cracks.

Rake out and fill the crack with suitable resin.

Fill the crack prior to decorating.

Lift the lino finish rake out the cracks and fill with suitable resin.

Fill the crack with suitable resin from above.

Lift the finish and fill the crack with suitable resin.

Fill the crack.

Chip off the wall finish over a strip to cover the full width of the cracked area. Cut vertically and form an expansion joint. Fill the cracks with suitable resin. The expansion joint to be 10mm wide with plaster stops each side and filled with Kork-Pak or equal and mastic pointing

Fill the cracks.

Fill the crack

We would suggest removing the temporary packing and filling the gap using compri-band (pre-compressed) or filling the gap with a fillit of wood glued to the floor.



There are some open joints in the wood-wool slab roof. There are no signs of leaks and no obvious tearing of the roof finish.

No action required.

There is some cracking at the end of the beams at high level to the viewing corridor.

Fill the cracks.

CORRIDOR BETWEEN SWQUASH COURTS AND SPORTS HALL

There is a vertical crack above a power power point. We suspect that this is over a line of conduit.

Fill the crack.

BOAT STORE

There are some cracks in the corners and at the end of a beam on the outside wall.

Fill all cracks using suitable resin.

There is a severely twisted joist supporting the woodwool roof. This may produce deflection in the roof and ponting or failure of the finish.

Provide 100 x 50 dwants between the joists to restrain the twisted joist. . If it is not possible to straighten the joist then pack up to support the woodwool roof slabs. The dwangs to be positioned in between at least three joists each side of twisted joist.

GROUNDSMANS STORE

There are some cracks in the corners, two of which are where the brick is built with risband joints.

Fill up the cracks.

SPORTS HALL STORE

There are some cracks at beam supports and at the corners behind RWP's. There are also some cracks running parallel to the door jambs.

Fill all cracks with suitable resin.

There appears to be a slight fall in the floor to the north of the middle dwarf wall. This could be slight settlement and would account for most of the cracks and the tendency for the north wall to lean outwards.

Fill all cracks with suitable resin.

There are open joints in the woodwool slab roof. There are no reported leaks hence no tearing of the felt.

No action required.

SPORTS HALL

There are some minor hair cracks in the brick.

No action required.

At/



At the south end the columns appear to have a slight bow. Since these are purely wind columns and carry virtually no vertical load we suspect that either the columns were erected to this shape or that slight heaving of the foundation has taken place or that the main columns have settled relative to the wind columns.

There is an open horizontal joint in the brick at this gable.

Externally there is no obvious cracking except on the north wall of the boat store. This is a vertical crack midway along this elevation.

DISCOTHEQUE AREA / G P ROOM

There are many cracks in the joints of the floor units. These are generally over the ground floor walls and are the result of differential settlement.

An expansion joint in the wall to the Drama Studio is open. The finish is not boss but there is a diagonal crack at high level.

Some of the roof joists have pulled out of the Drama Studio wall by approx. 10mm.

There is a crack in the floor across Door G 16 and into the Coffee Bar.

There is a crack approximately 25mm wide in the floor adjacent to the Coffee Bar in the Recreation area.

The corridor between doors 19 and 20 has a crack in the wall continuing from below and in line with the duct between the male and female cloakrooms.

There is a crack over the support to the junction of the two beams spanning over the viewing area to the squash courts.

No action required.

Fill the joint.

Remove a strip of render each side of the crack. Cut and form an expansion joint. Fill the crack with resin and patch the roughcast using render stop beads and expansion joint filler.

Lift the floor covering. Clear out the cracks and pour in suitable resin.

Remove the wall finish over the diagonal crack fill with suitable resin and patch the finish.

No action required.

Lift the floor covering, clean out the crack and fill with suitable resin.

Lift the floor covering, clean out the crack and fill with suitable resin.

Form an expansion joint as noted for the floor below.

Cut back the finish and fill the crack with suitable resin. Patch the finish.



Externally the only obvious cracking is that noted in the north wall of the Boat Store.

On the roof there are no obvious signs of movement affecting the finish. However in many places the mineralised felt used as flashing has bubbled and will probably crack in the near future, especially those areas subjected to the direct sunlight.

We understand that there is a continuous problem of leaks from the climbing tower, we did not investigate this.

We were asked for a report on the possibility of creating a new doorway within the Drama Studio where a new store is proposed with a roller shutter door forming one wall of the store. We were also asked to report on the possibilities of providing fixings to the floor for parallel bars. This will be reported at a later date when all the information is to hand regarding the equipment. It should be noted that the proposed roller shutter door may affect the acoustics of the Drama Studio.

It cannot be guaranteed that further cracking will not take place but we would expect this if any to be to a lesser degree.

A handwritten signature in black ink, appearing to be 'J. Kennedy', written in a cursive style.

JW/JR/386/4.1

23 March 1984



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GRM Kennedy & Partners

architects, engineers
& planning consultants

Angus District Council
Chief Architect
County Buildings
FORFAR
DD8 3LG

our ref RP/FG/386/2.1
your ref
date 27 June 1985

For the Attention of Mr A Miller

Dear Sir

FORFAR LEISURE AND RECREATION CENTRE

Following the visit to the Centre on Tuesday last by our Mr Wilson, Structural Engineer, we enclose here his report on the movement cracks within the building.

You will see that he notes no significant movement has occurred since the fitting of the 'tall tales' and advises that remedial work could now be undertaken to repair the wall and floor cracks.

Please do not hesitate to contact us if we can be of any further assistance in this matter.

Yours faithfully



for GRM Kennedy & Partners

Enc

cc Mr J Wilson Messrs G R M Kennedy & Partners Edinburgh

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Aberdeen

our ref JW/NG/386/4.1
your ref
date 26 June 1985

For the attention of R Parker

Dear Sirs

FORFAR LEISURE AND RECREATION CENTRE

We confirm having met with Mr Millar of the Maintenance Department regarding the repair of the previously reported cracking at the above. Continuous readings have been recorded on tell-tails and the outcome is that only minor movement is confirmed. The time of the readings and the weather conditions suggest that in most cases the movement is probably thermal, but the cracks in the joints of the floor slabs are consistent with ground movement. Our recommendation and conclusion is that:

1. In the walls all cracks should be raked out and grout filled prior to redecorating.
2. In the floors the cracks should be raked out and any variations in level smoothed out with grout filling to enable the floor covering to be laid level.

If any transverse cracks are found in the slabs when exposed then we should be informed.

Nor further action should be necessary but some minor cracking will recur, although this will become less obvious with successive decoration.

The organising and negotiating with contractors will be carried out by Mr Millar.

Yours faithfully

for GRM Kennedy & Partners

GRMK	ARTS-R		
FILE			
CIRCULAR			
27 JUN 1985			
ACKN. D.			
	AREN	27 Jun 1985	F.O.C.

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APPENDIX A3 - ANGUS COUNCIL CRACK MONITORING RESULTS

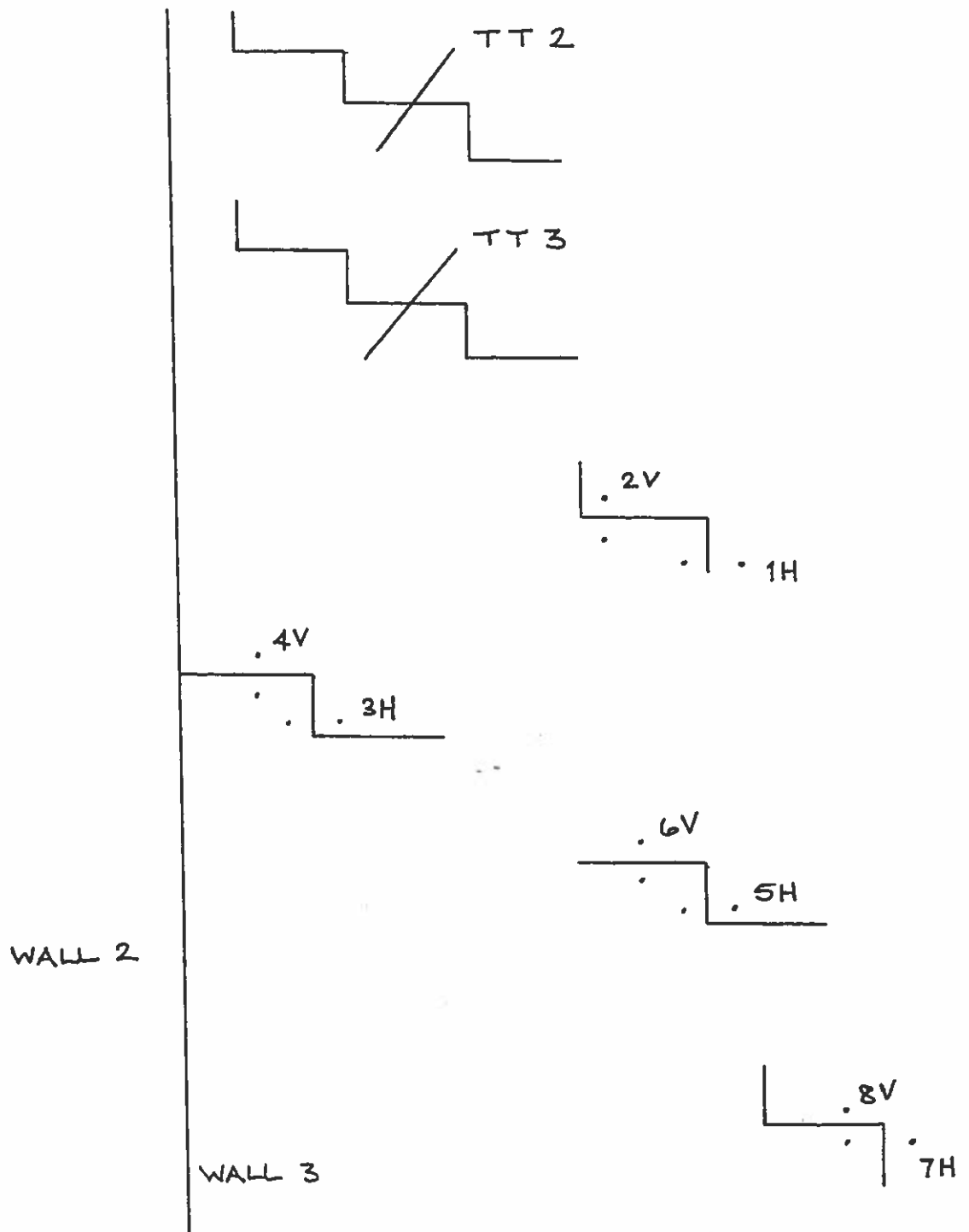


APPENDIX 3

WALL 2 - EXTERNAL WALL TO SPORTS HALL STORE

Wall 3 - Partition Wall Between Sports Store and Weightlifting Area / Crèche

Diagrammatic Representation of Cracks





LOCATION OF DISCS OR SCREWS

Date of Reading

6V

7H

8V

17/2/98

37.36

42.26

33.74

4/3/98

37.68

42.18

33.58

17/3/98

37.66

42.18

33.48

16/4/98

37.74

42.36

33.54

25/5/98

37.58

42.16

33.54

7/7/98

37.48

42.16

33.56

Date of Reading

LOCATION OF DISCS OR SCREWS

BOTTOM - BELOW
TELL - TALE No. 3

BOTTOM RIGHT OF
TELL - TALE No. 3

16/4/98

62.0



64.5



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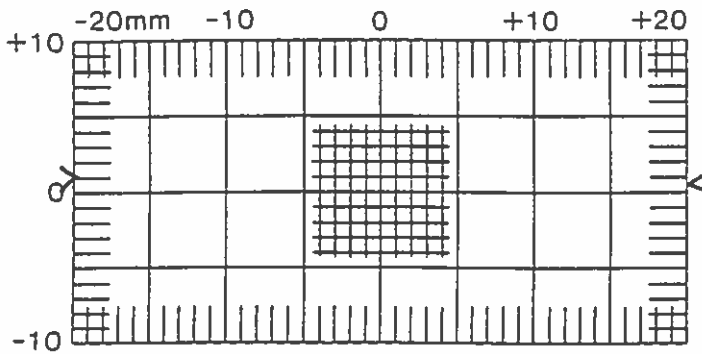
CRACK MONITORING RECORD FOR THE STANDARD AND CORNER TELL-TALE

PROJECT LOCHSIDE LEISURE CENTRE, FORFAR

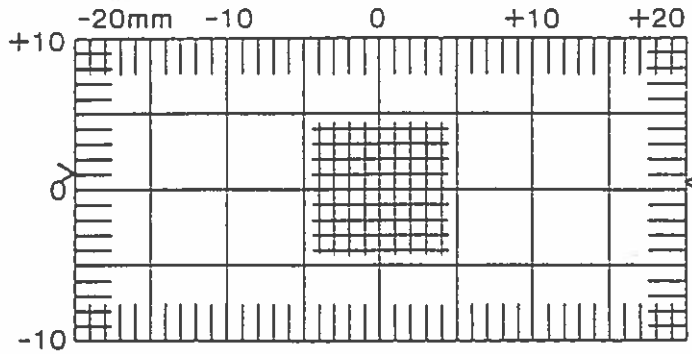
LOCATION OF TELL-TALE WALL 3 - No. 3

Indicate on the diagrams below the TELL-TALE movement at each reading
+ represents crack opening - represents crack closing

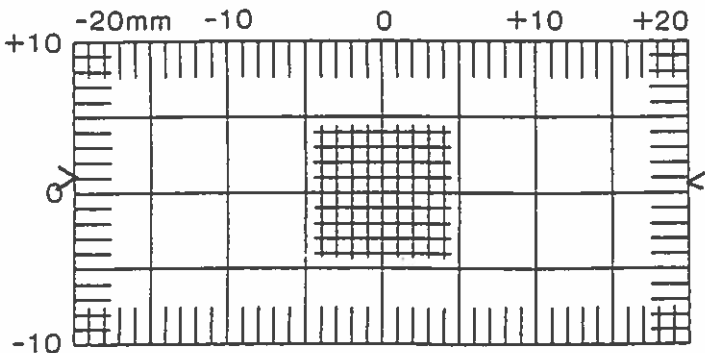
Date of Reading 17/2/98



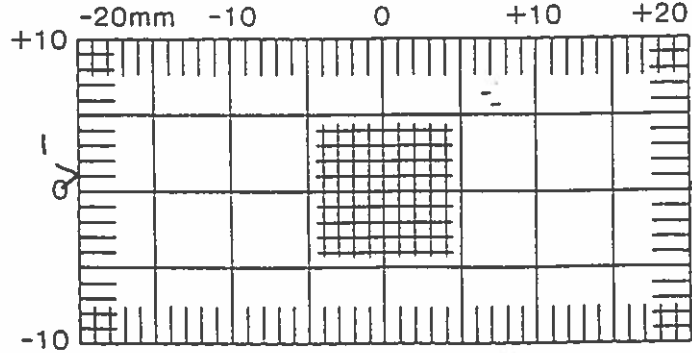
Date of Reading 4/3/98



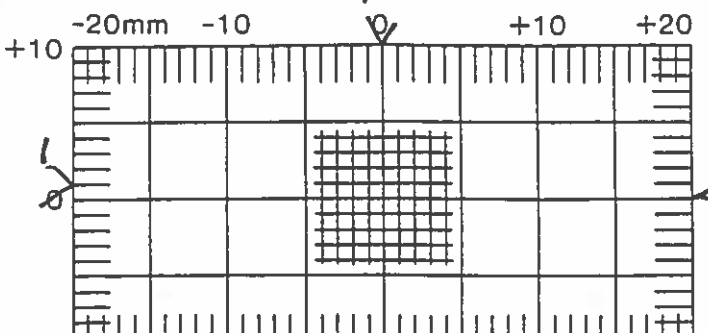
Date of Reading 17/3/98



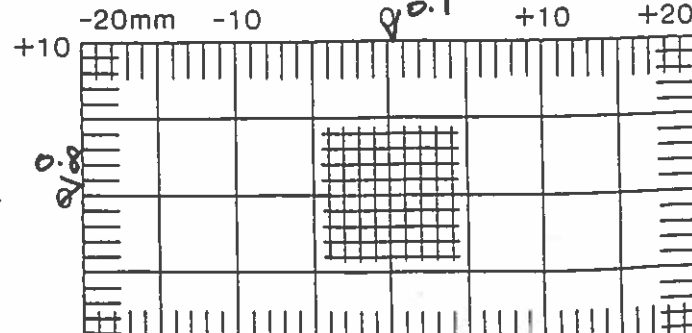
Date of Reading 16/4/98

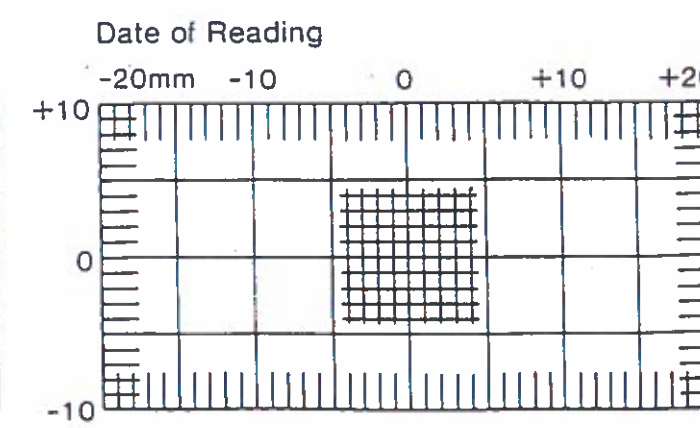
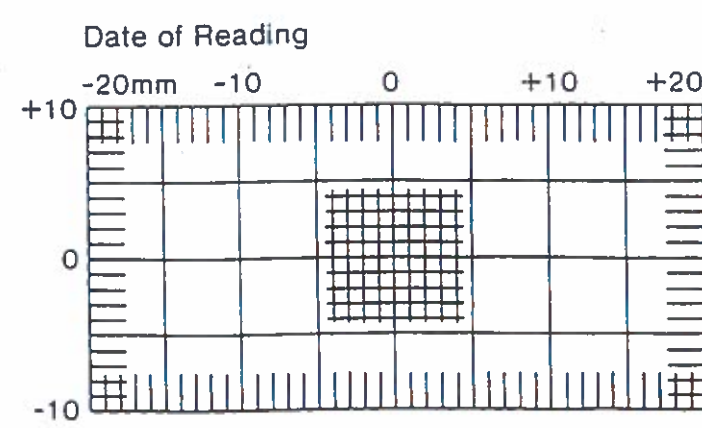
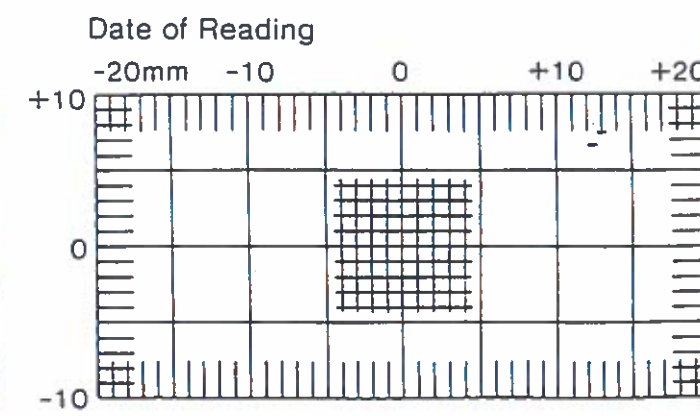
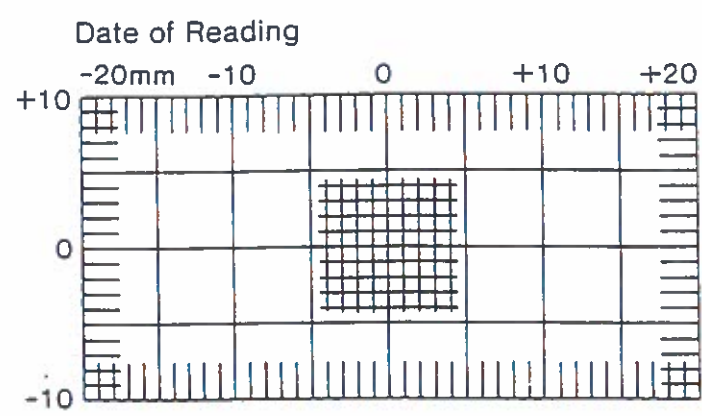
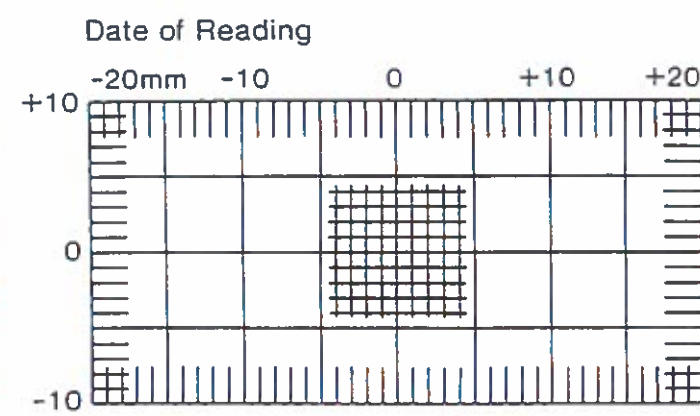
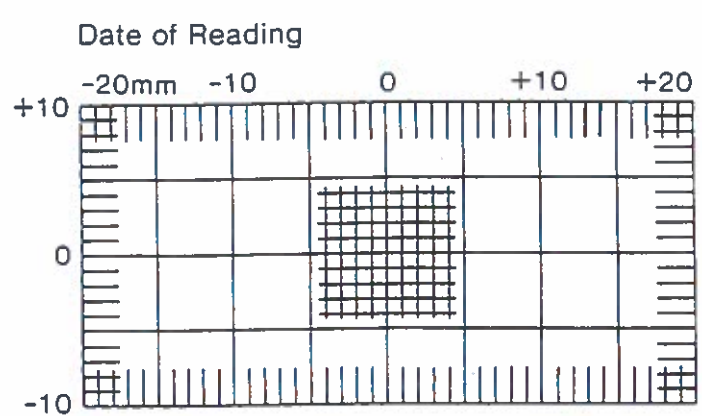
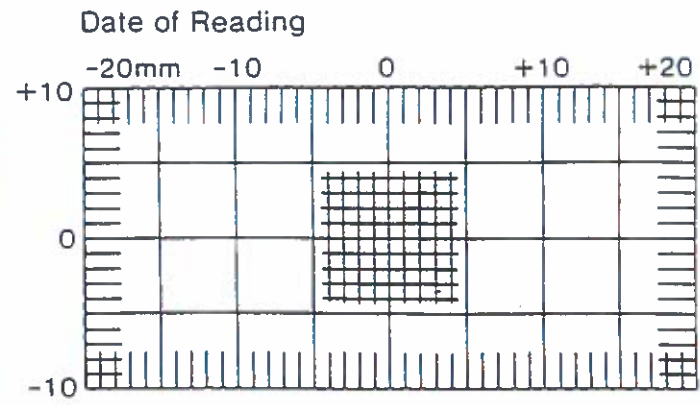
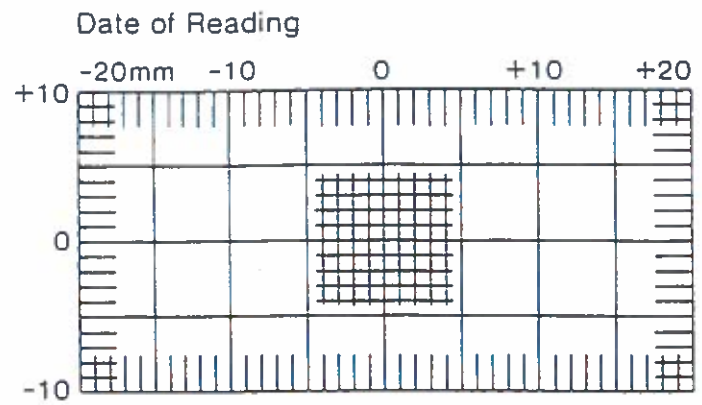
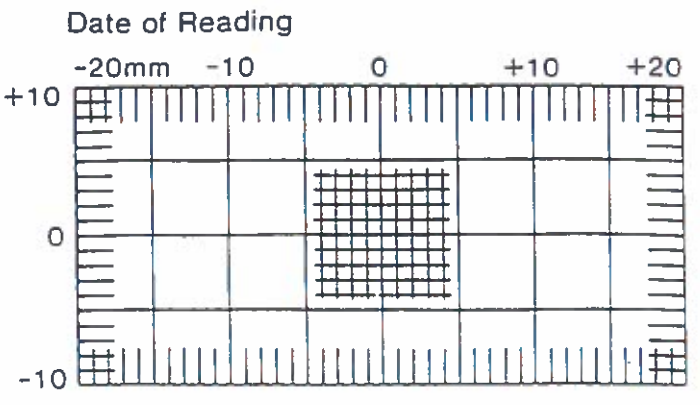
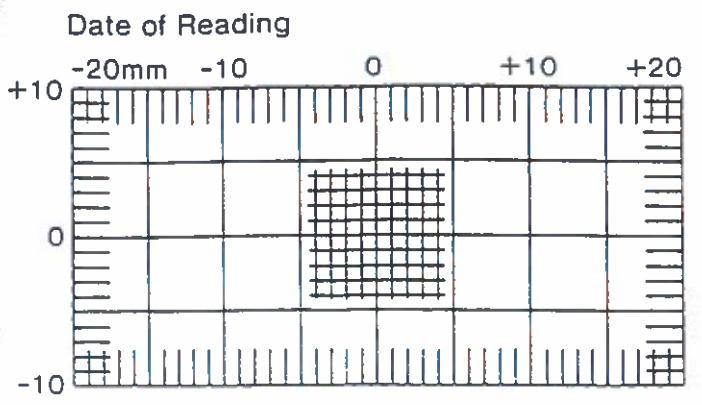


Date of Reading 25/5/98



Date of Reading 7/7/98





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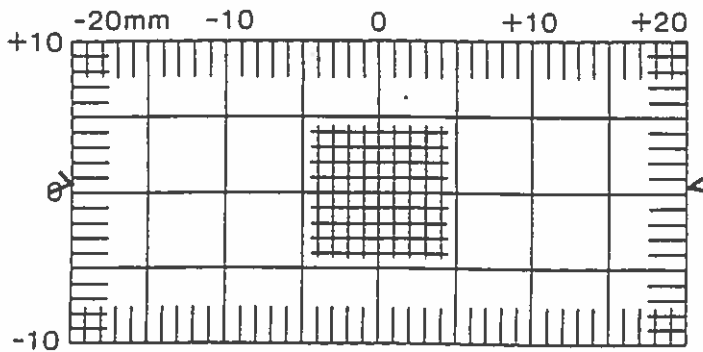
CRACK MONITORING RECORD FOR THE STANDARD AND CORNER TELL-TALE

PROJECT LOCHSIDE LEISURE CENTRE, FORFAR

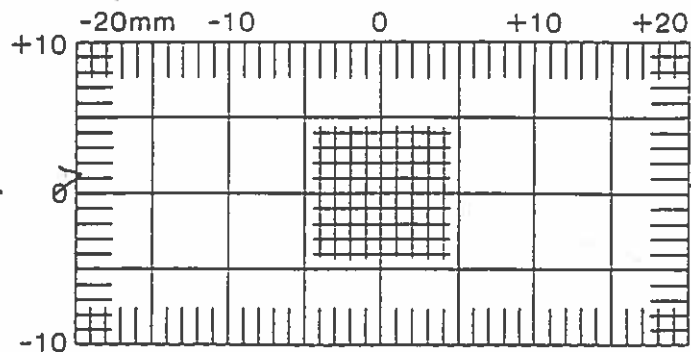
LOCATION OF TELL-TALE WALL 3 - No. 2

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+ represents crack opening - represents crack closing

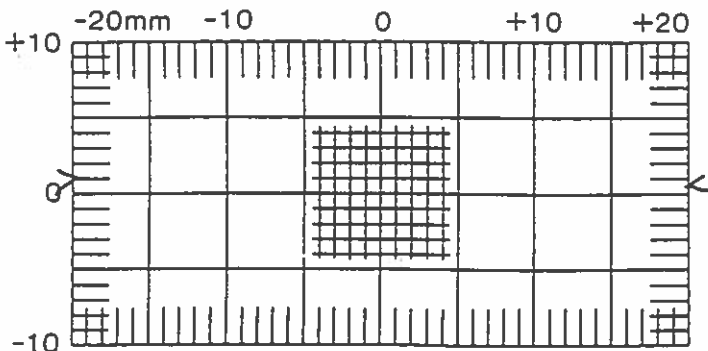
Date of Reading 17/2/98



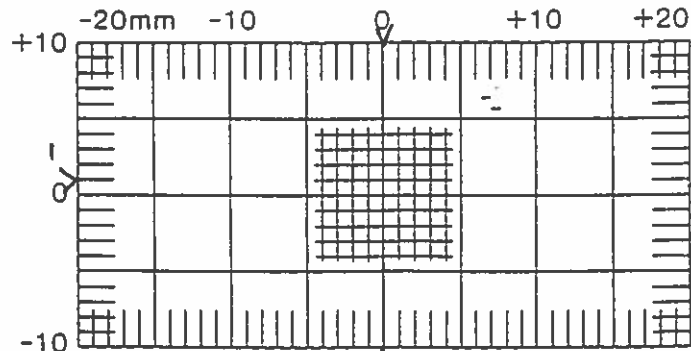
Date of Reading 4/3/98



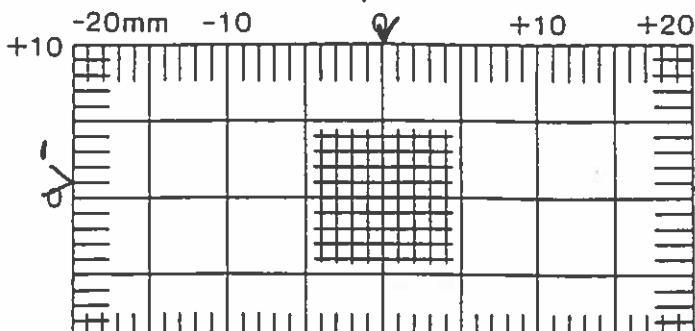
Date of Reading 17/3/98



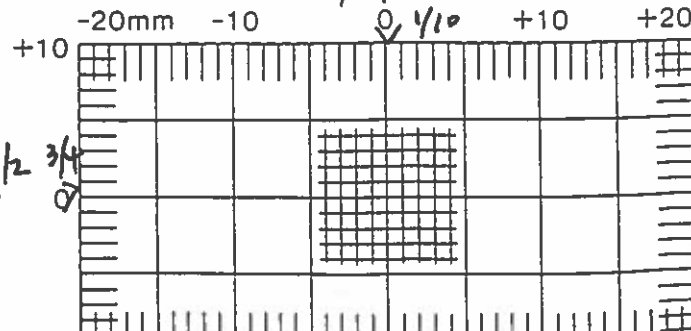
Date of Reading 16/4/98

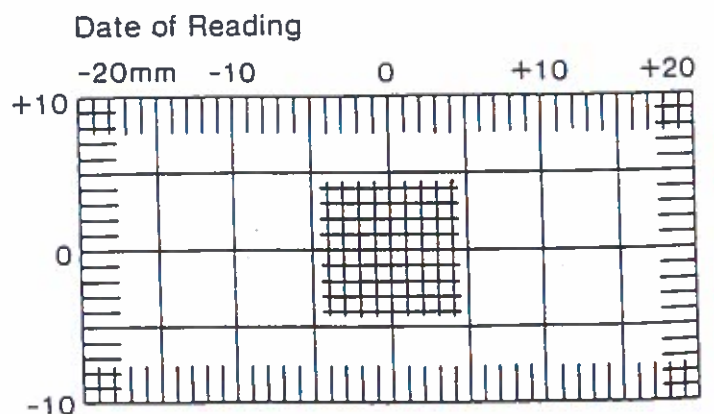
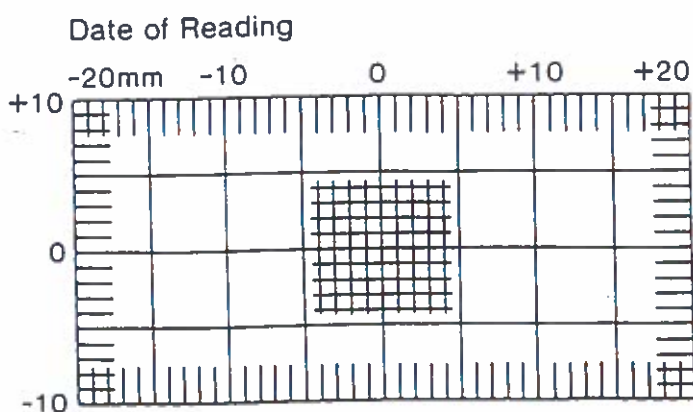
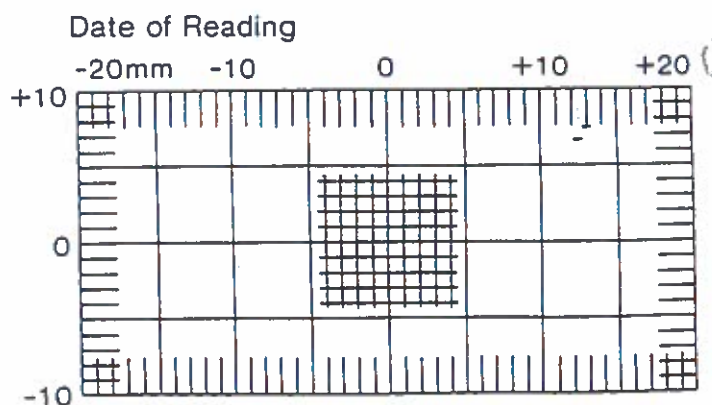
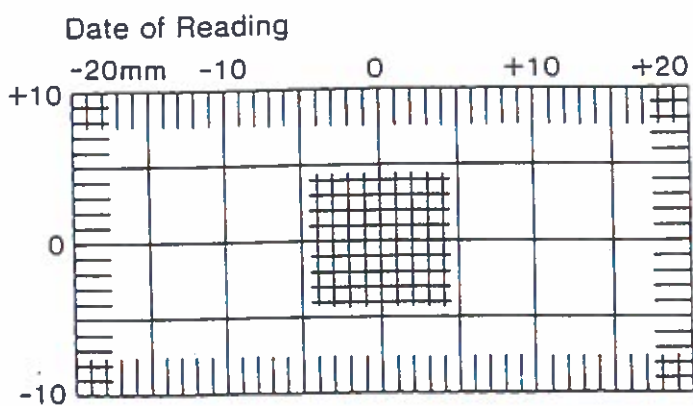
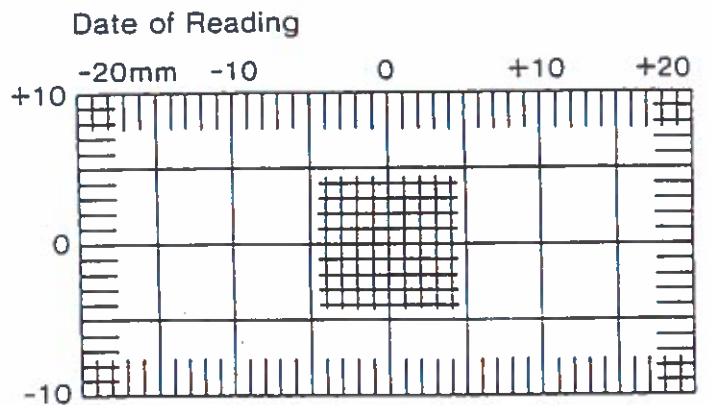
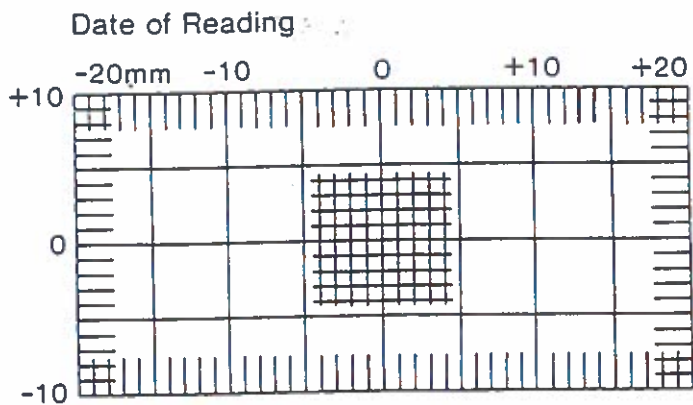
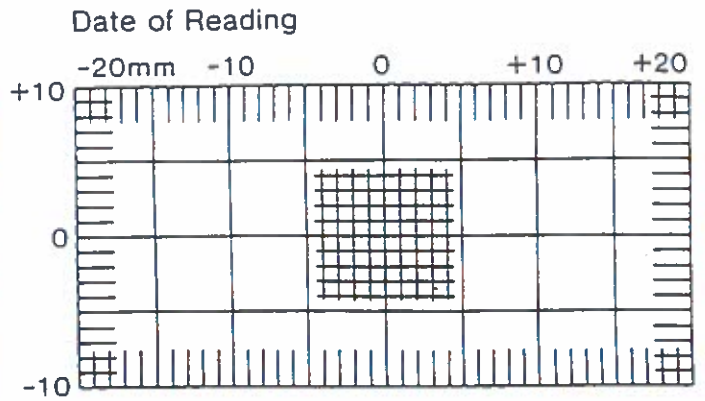
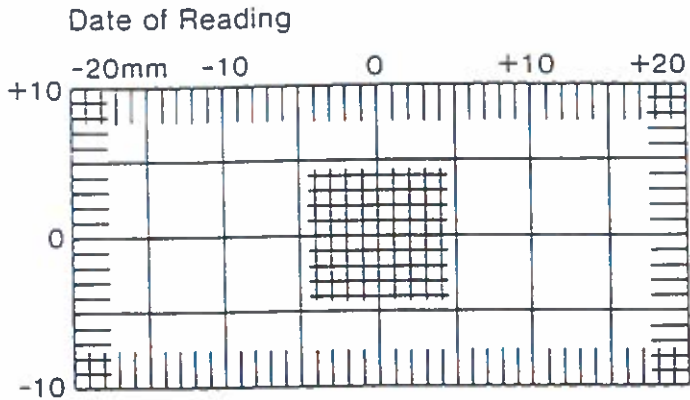
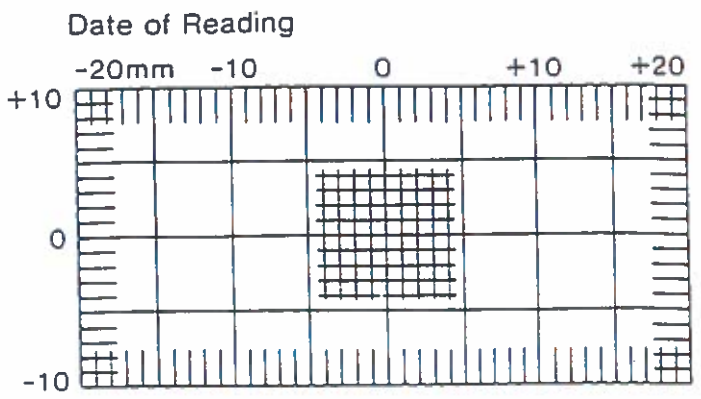
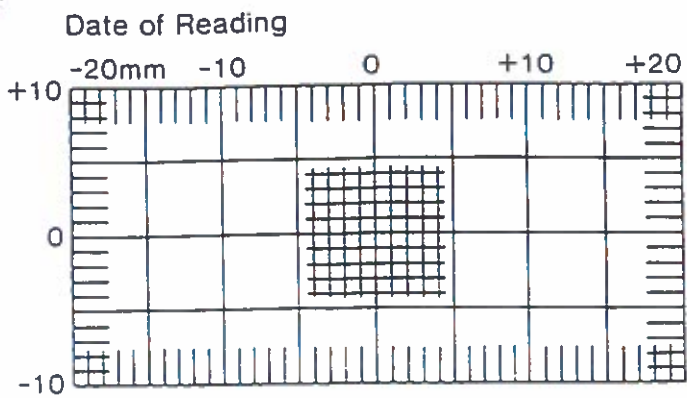


Date of Reading 25/5/98



Date of Reading 7/7/98



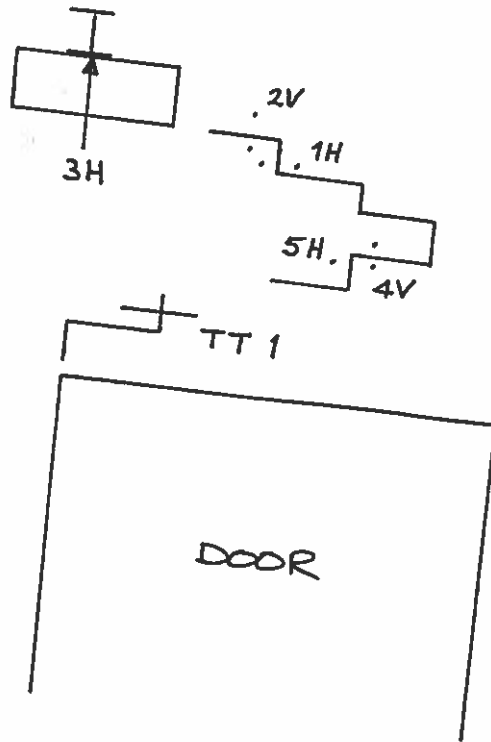


APPENDIX 4

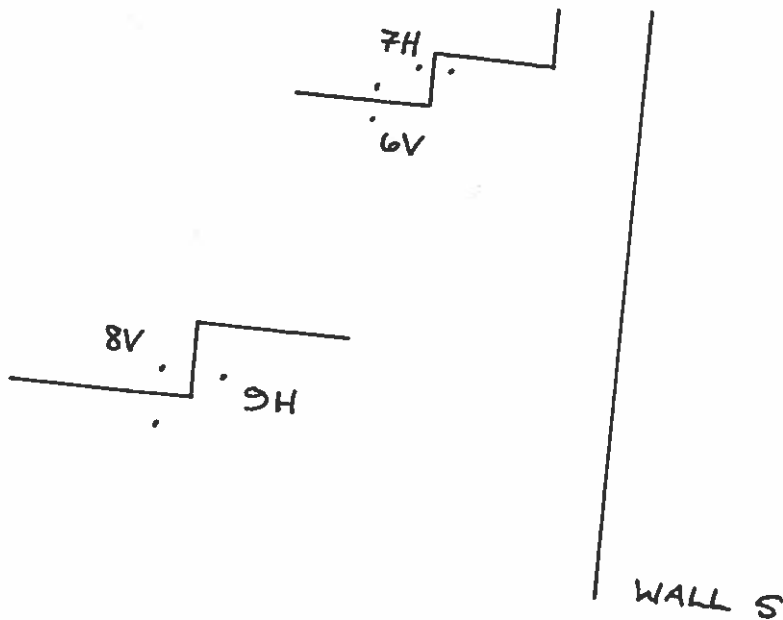
Wall 4 - Partition Wall Between Sports Store / Sports Hall -

Diagrammatic Representation of Cracks

Sports Store Side



Sports Hall Side





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CRACK MONITORING RECORD FOR THE VERNIER, DIAL AND DIGITAL CALIPER SET

PROJECT LOCHSIDE LEISURE CENTRE -
WALL 4 - SPORTS HALL

Date of Reading	LOCATION OF CRACKS				
		TOP LEFT			CENTRE LEFT?
20/4/98	46.0			188.0	
25/5/98	46.0		21.0	RETURNED TO PREVIOUS CRACK	
7/7/98	46.06			CENTRE RIGHT	

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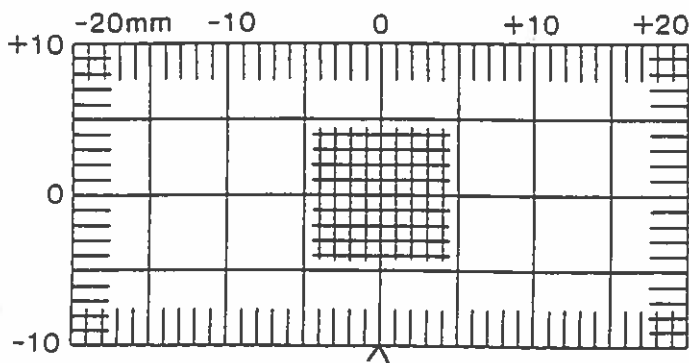
CRACK MONITORING RECORD FOR THE STANDARD AND CORNER TELL-TALE

PROJECT LOCHSIDE LEISURE CENTRE, FORFAR

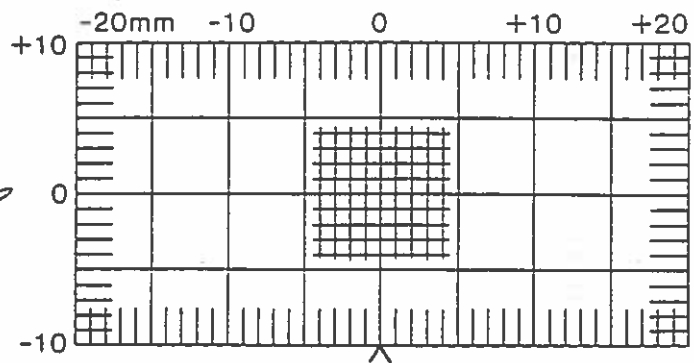
LOCATION OF TELL-TALE WALL 4 - No. 1

Indicate on the diagrams below the TELL-TALE movement at each reading
+ represents crack opening - represents crack closing

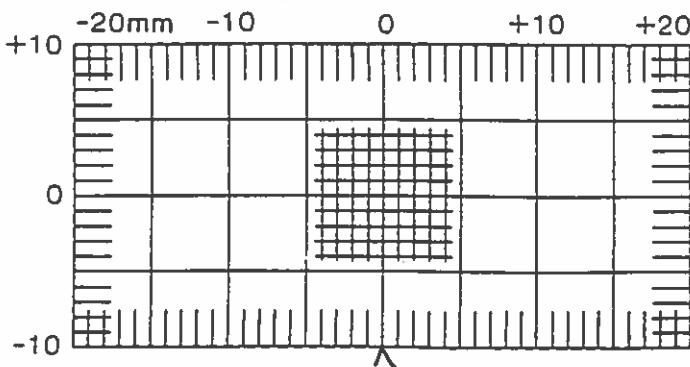
Date of Reading 17/2/98



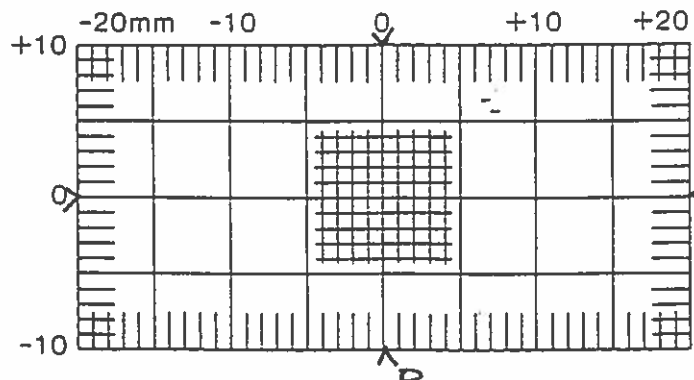
Date of Reading 4/3/98



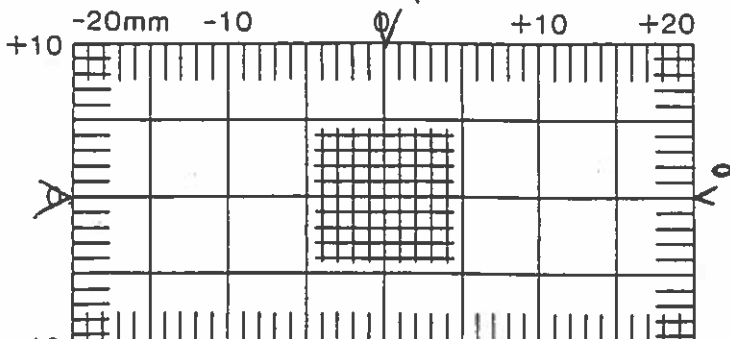
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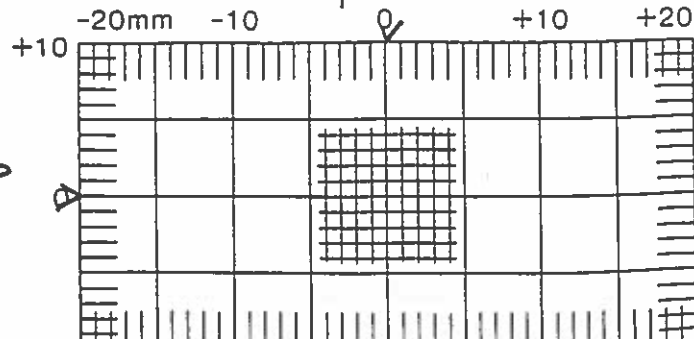
Date of Reading 16/4/98

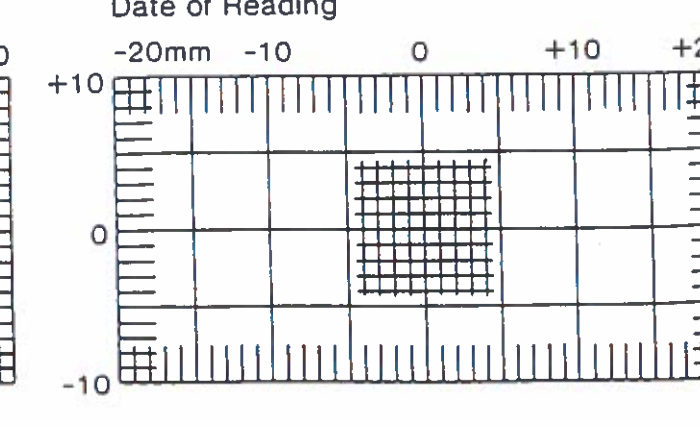
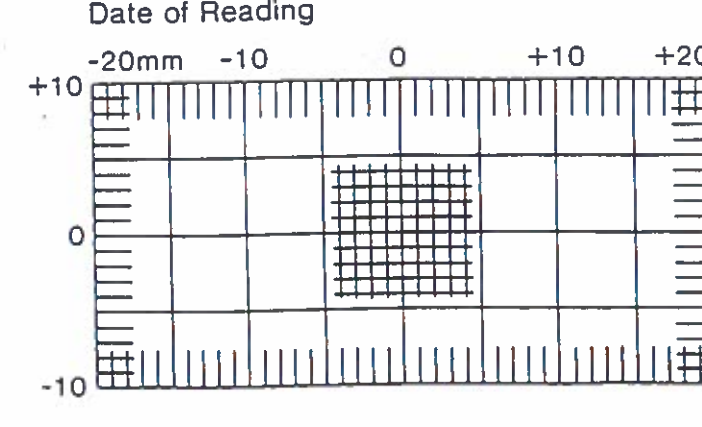
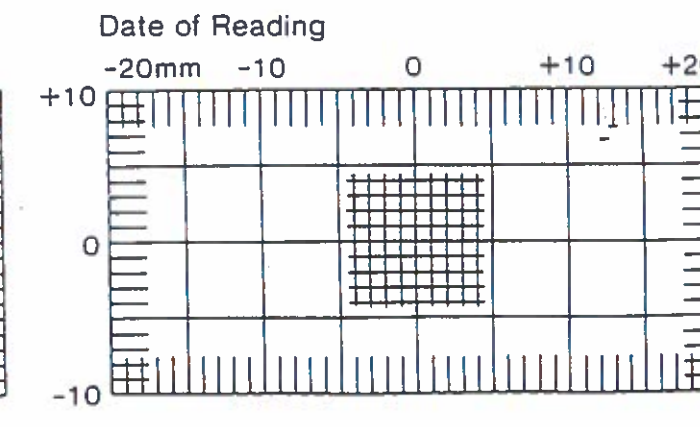
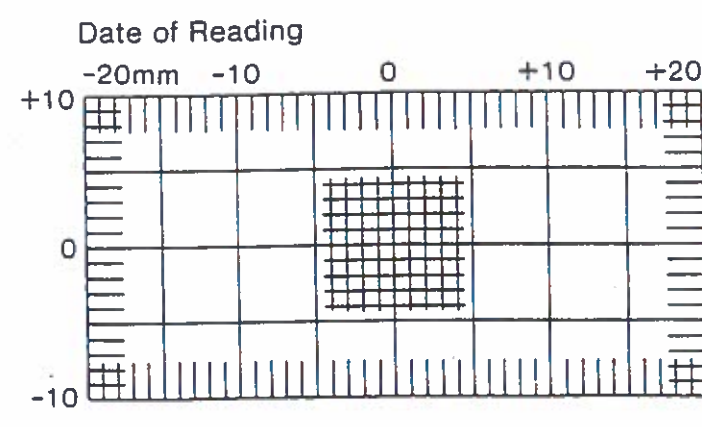
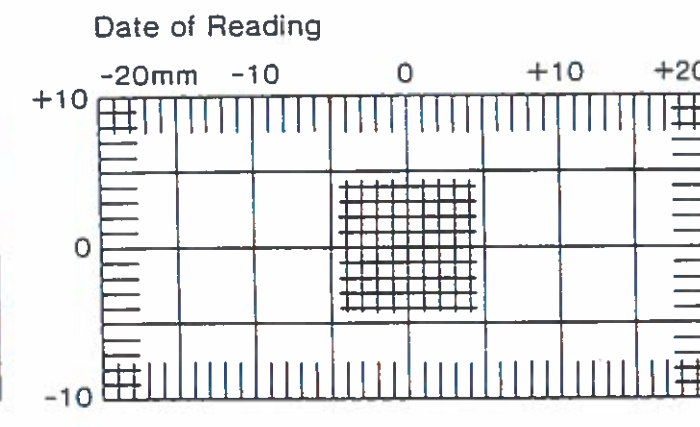
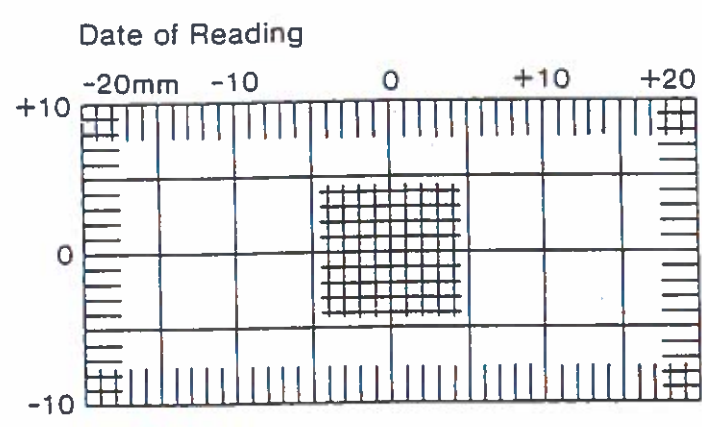
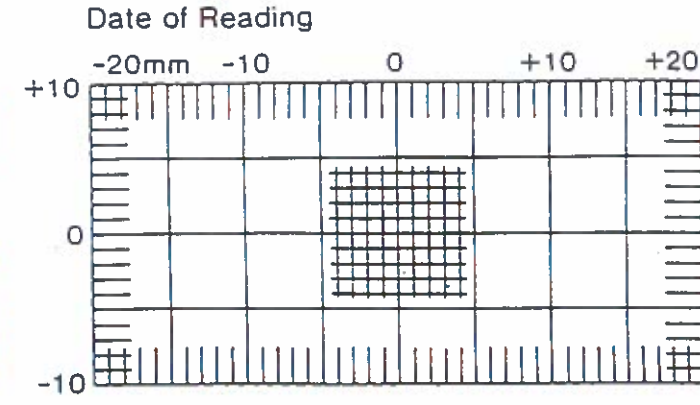
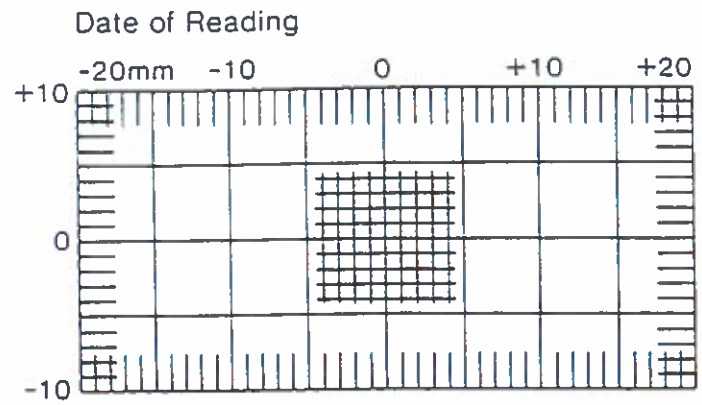
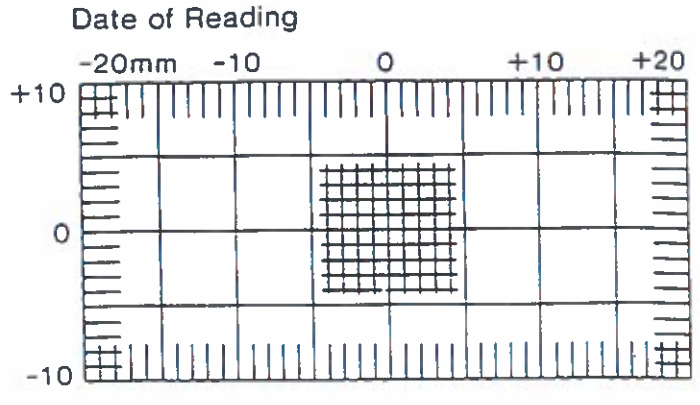
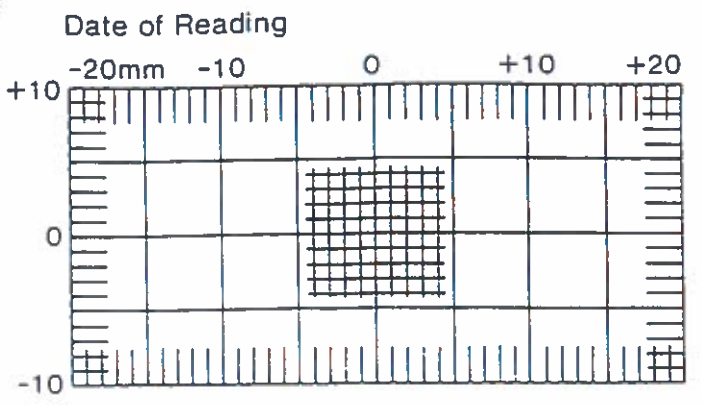


Date of Reading 25/5/98



Date of Reading 7/7/98

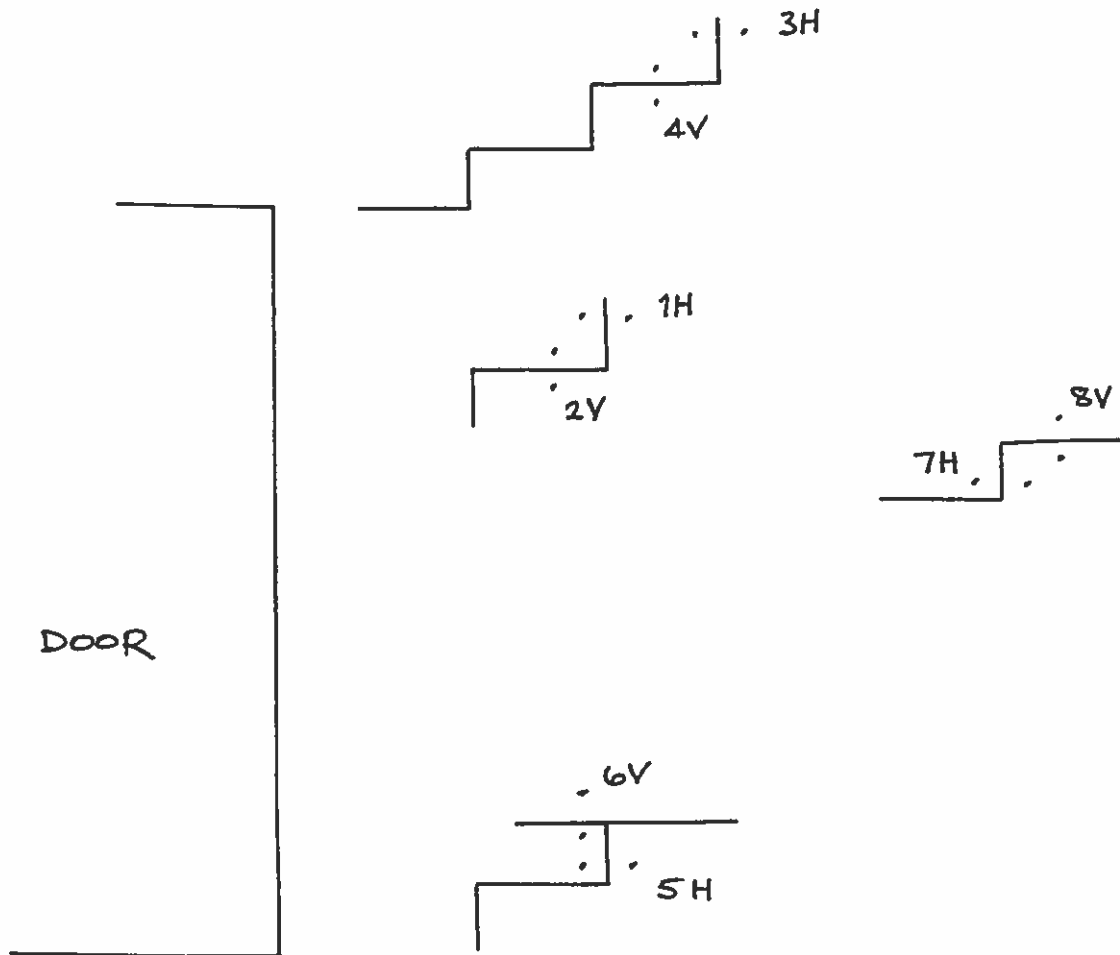




APPENDIX 5

Wall 5 - Partition Wall Between Sports Hall and Corridor

Diagrammatic Representation of Cracks





Date
of
Reading

LOCATION OF DISCS OR SCREWS

BOTTOM LEFT/CENTRE

14/4/98

14.0



25/5/98

14.0

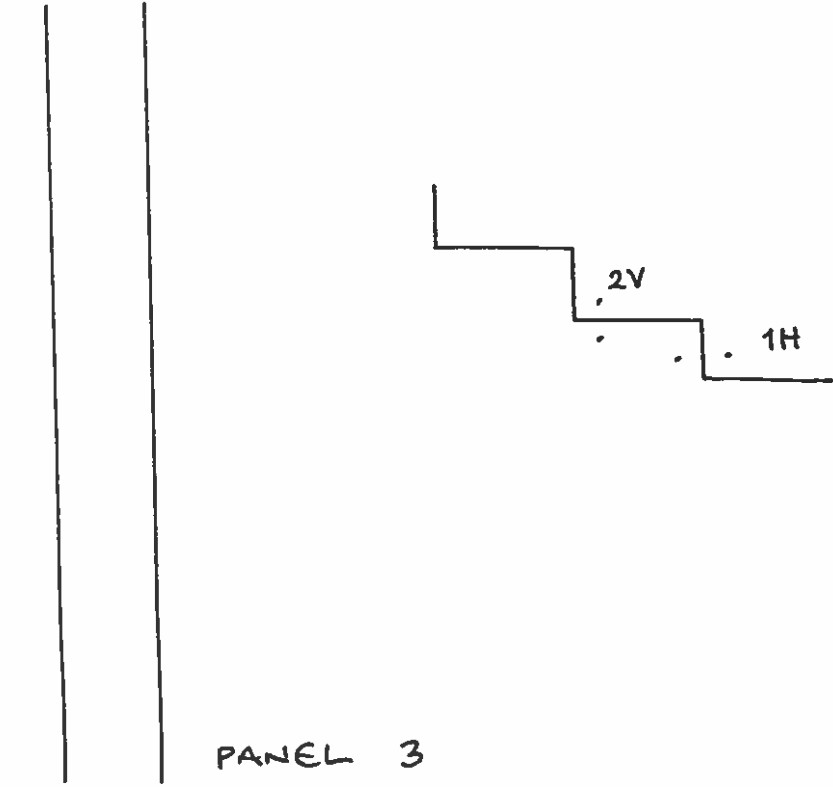
7/7/98

14.0

APPENDIX 6

Wall 6 - Partition Wall Between Canteen / Sports Hall

Diagrammatic Representation of Cracks





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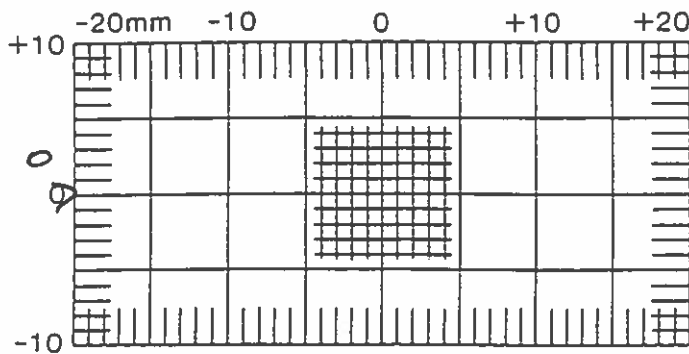
CRACK MONITORING RECORD FOR THE STANDARD AND CORNER TELL-TALE

PROJECT LOCHSIDE LEISURE CENTRE, FORFAR

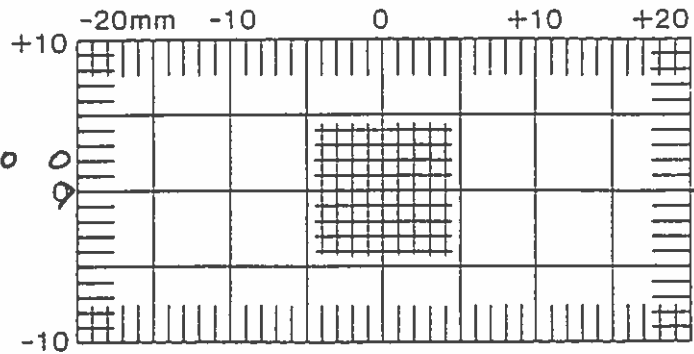
LOCATION OF TELL-TALE DRAMA STORE - No. 4

Indicate on the diagrams below the TELL-TALE movement at each reading
+ represents crack opening - represents crack closing

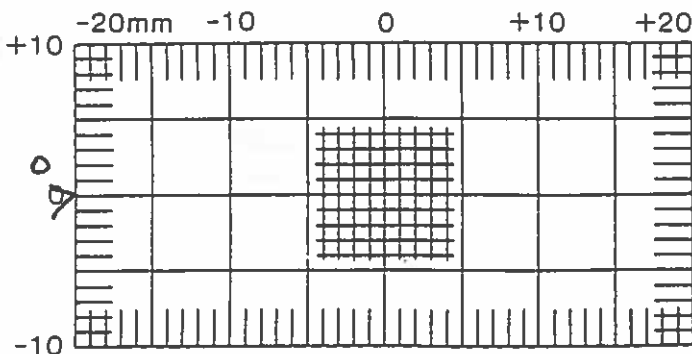
Date of Reading 17/2/98



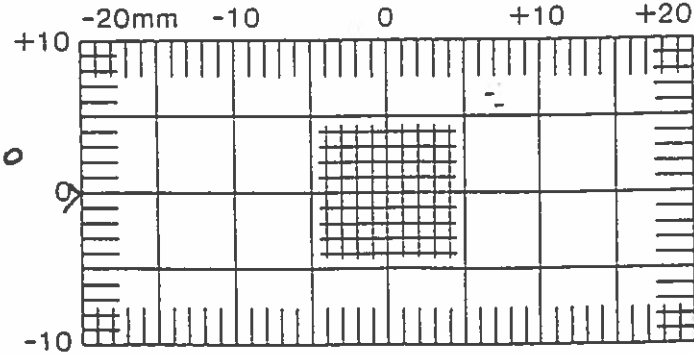
Date of Reading 4/3/98



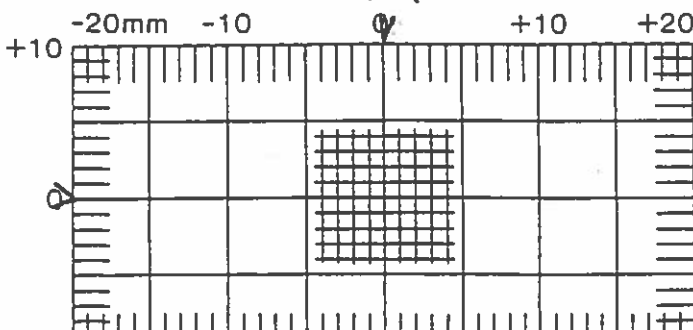
Date of Reading 17/3/98



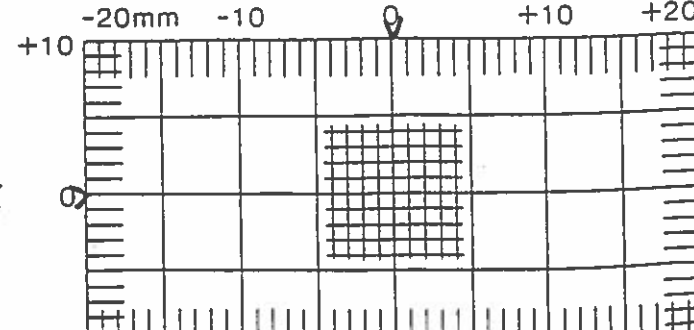
Date of Reading 16/4/98

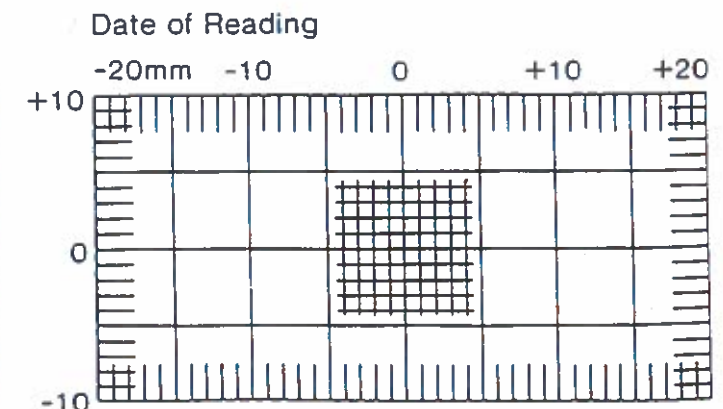
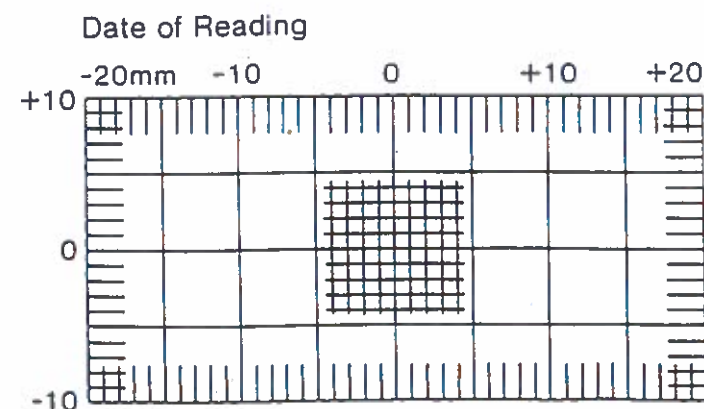
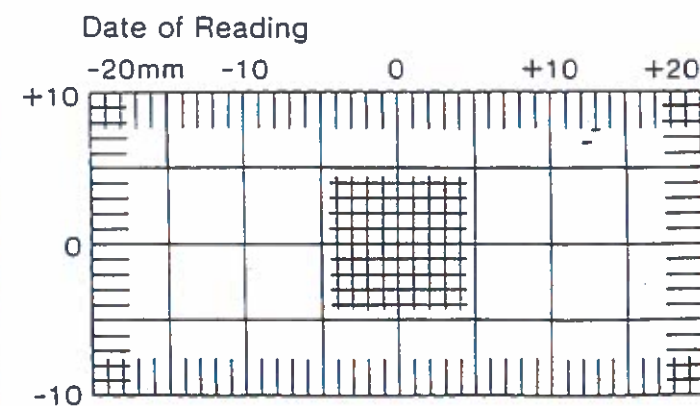
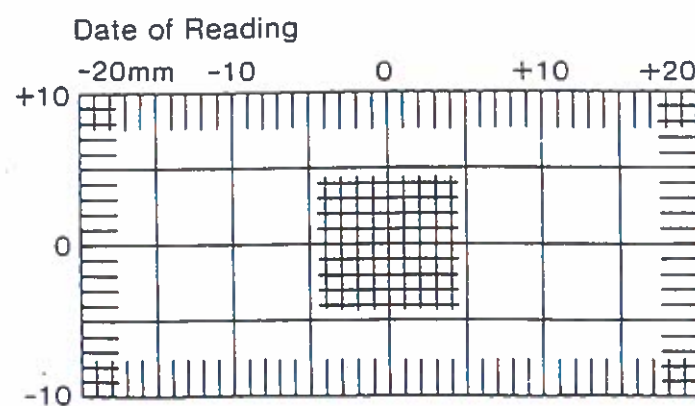
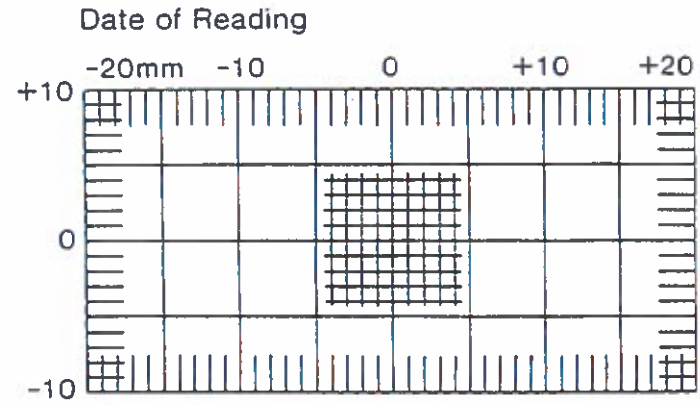
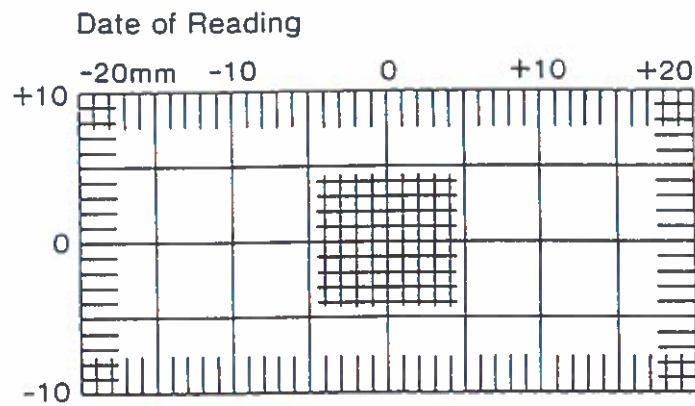
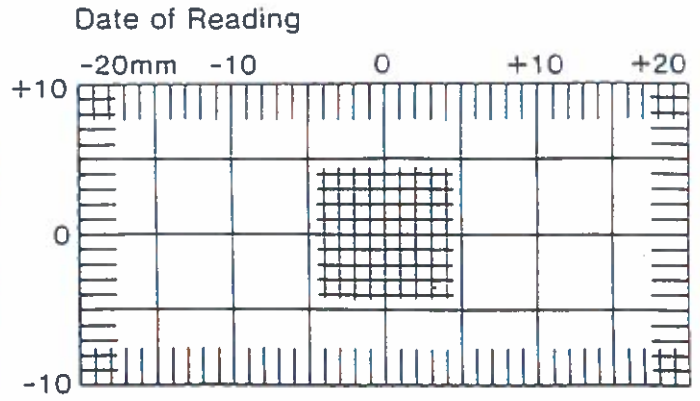
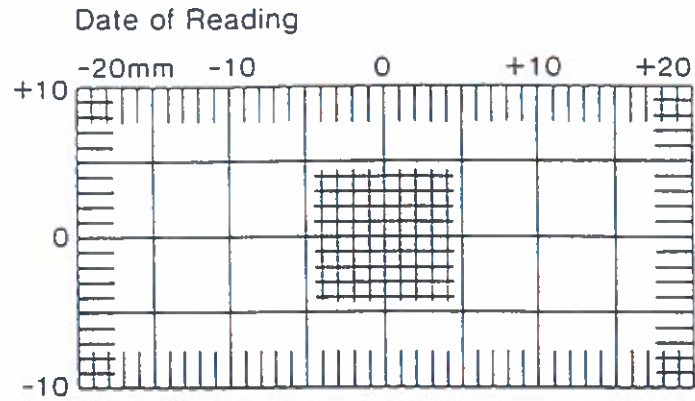
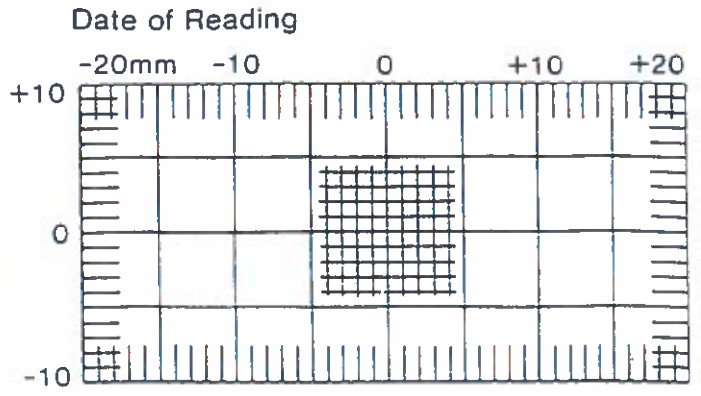
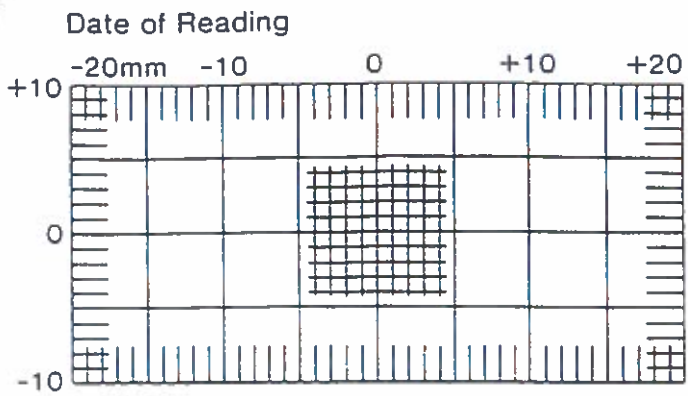


Date of Reading 25/5/98



Date of Reading 7/7/98





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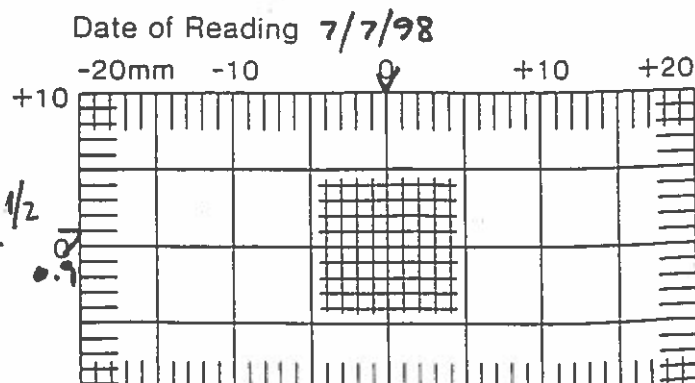
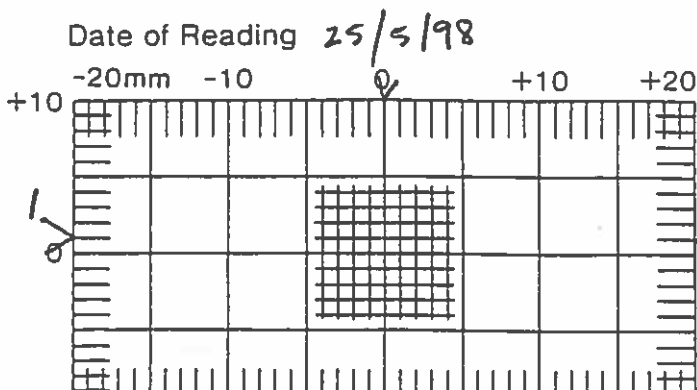
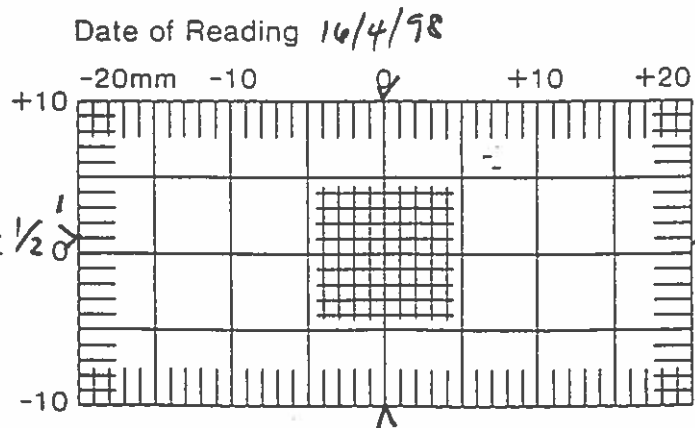
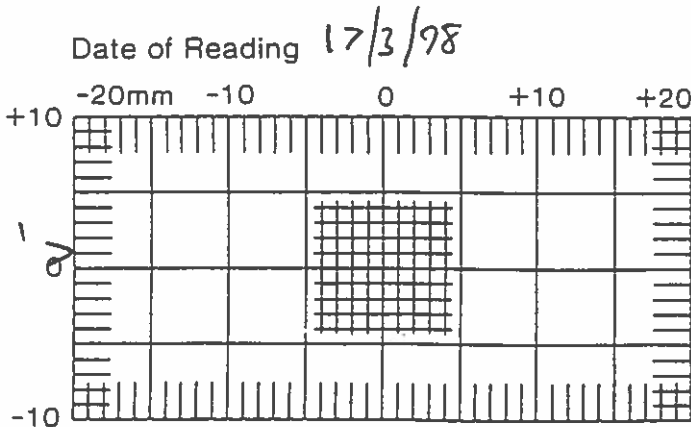
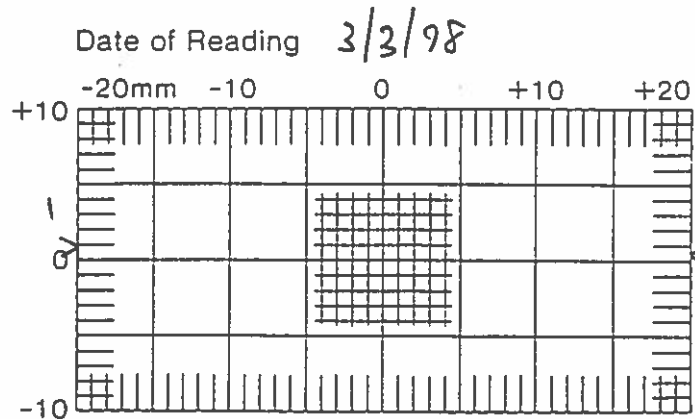
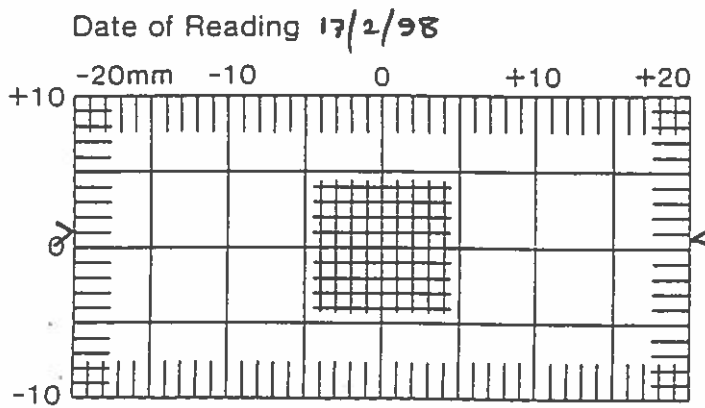
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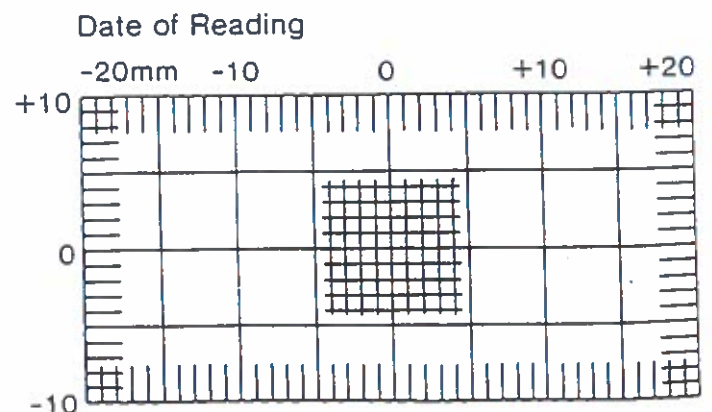
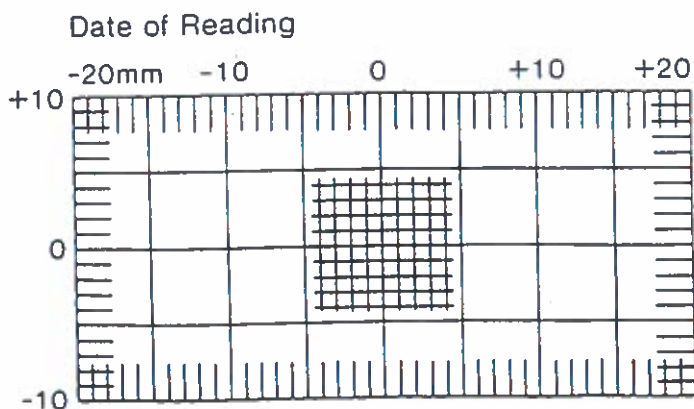
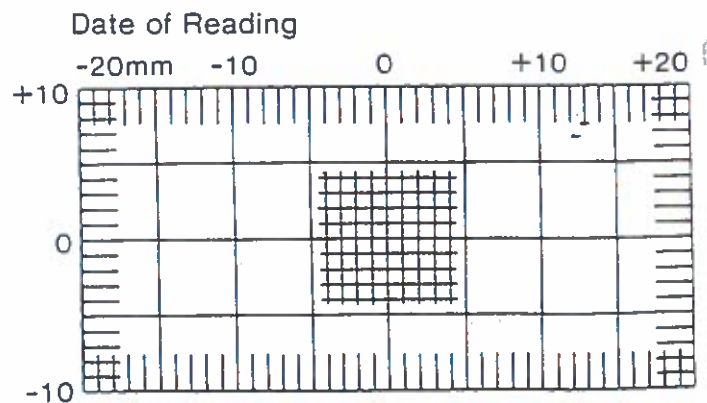
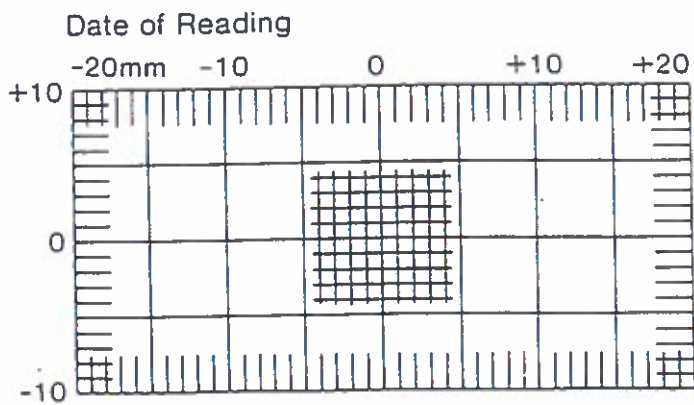
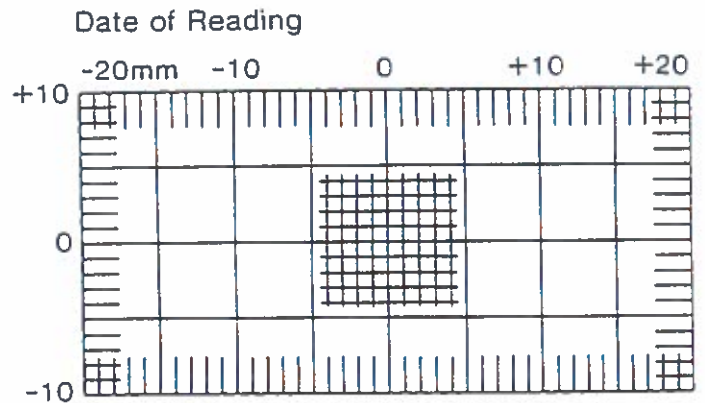
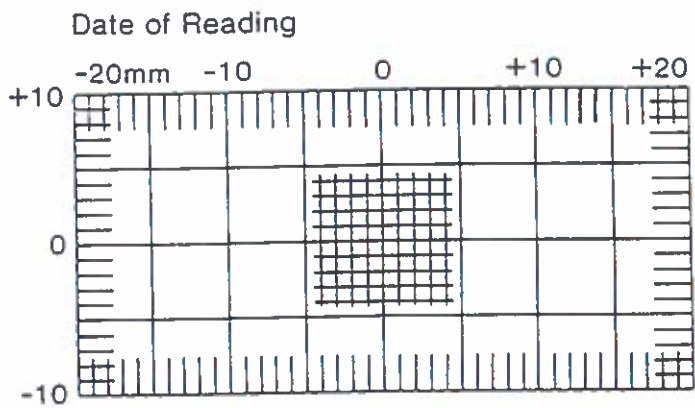
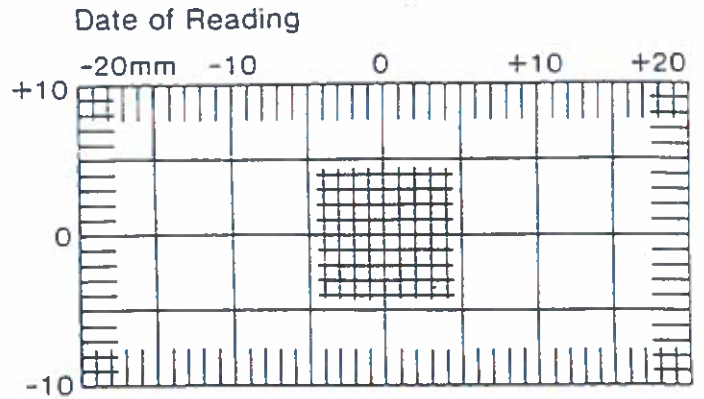
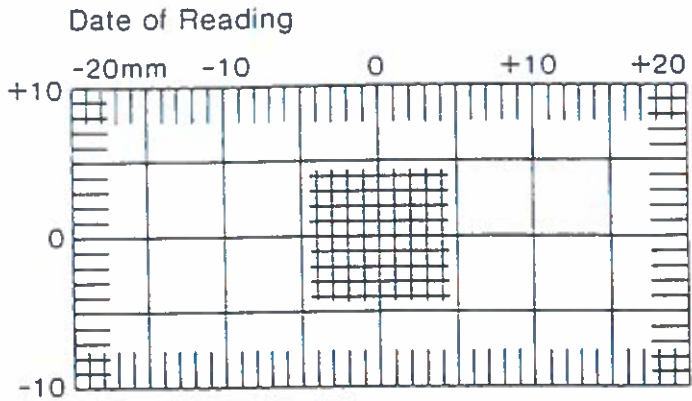
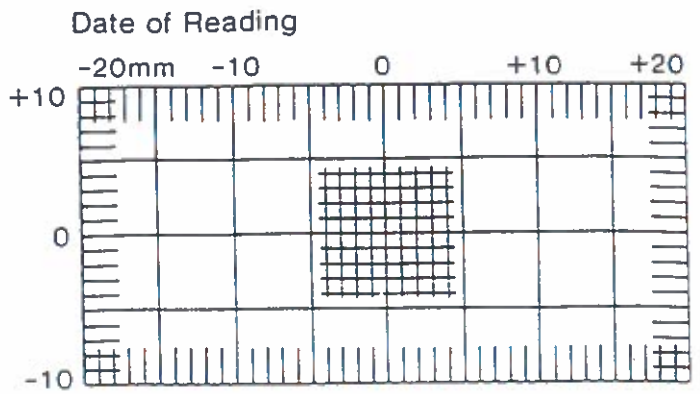
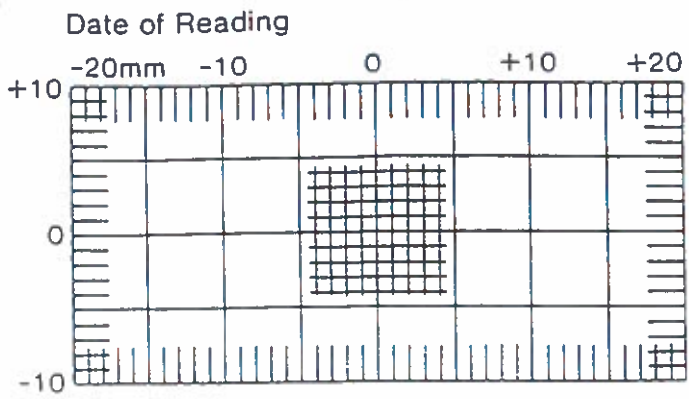
CRACK MONITORING RECORD FOR THE STANDARD AND CORNER TELL-TALE

PROJECT LOCHSIDE LEISURE CENTRE, FOPFAR

LOCATION OF TELL-TALE DRAMA STORE - No. 5

Indicate on the diagrams below the TELL-TALE movement at each reading
+ represents crack opening - represents crack closing





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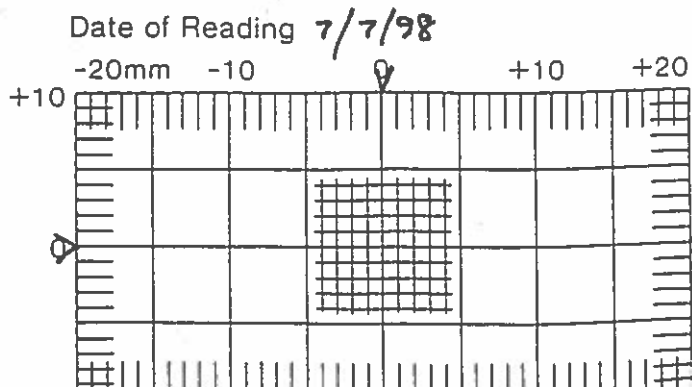
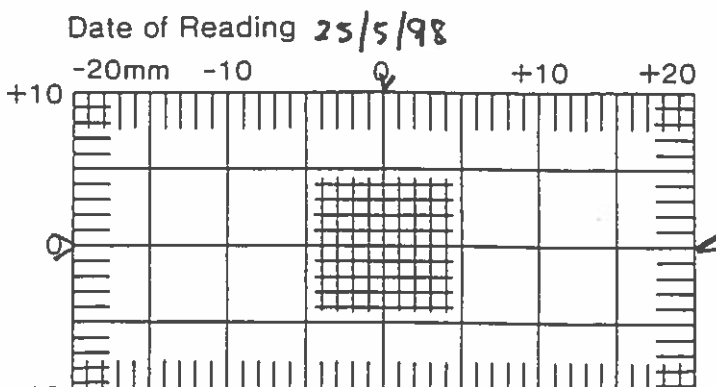
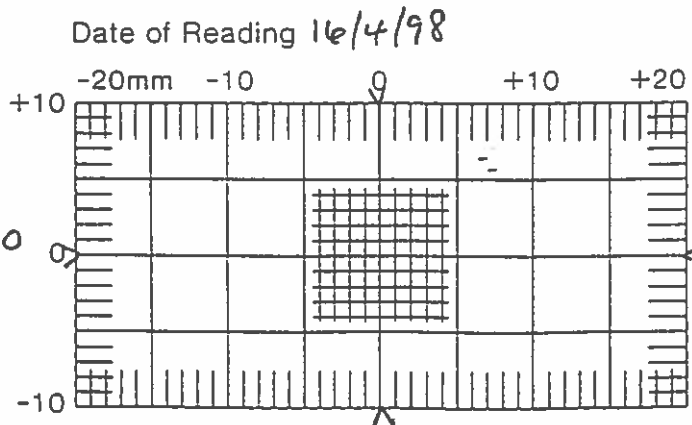
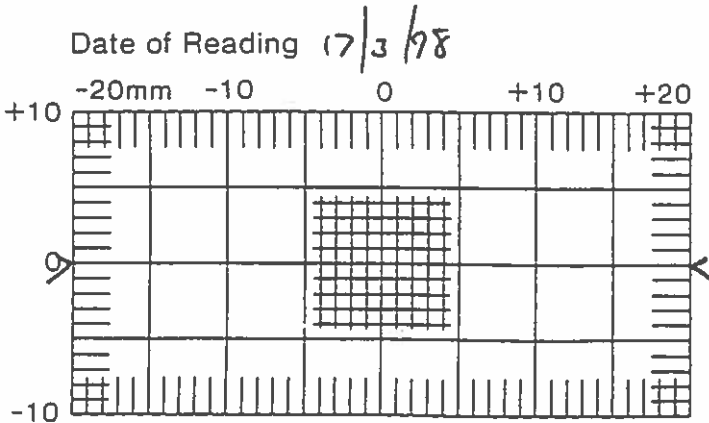
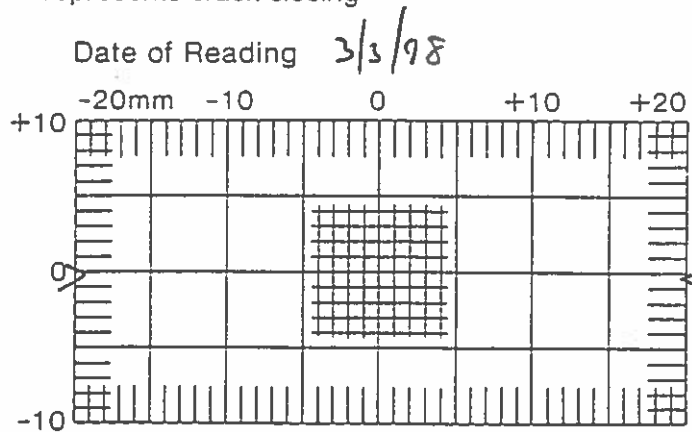
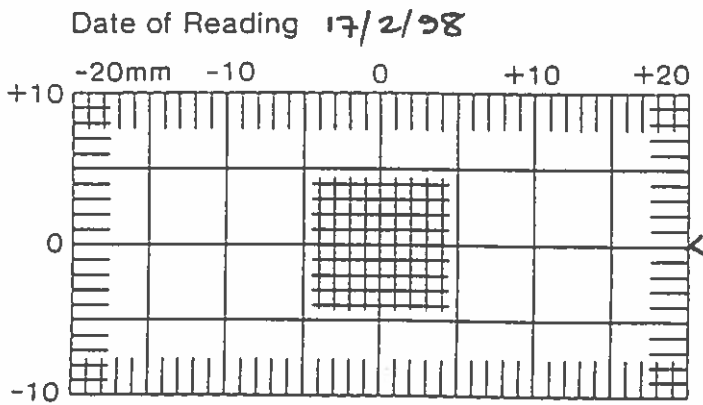
VAT Registered No 302 9872 56

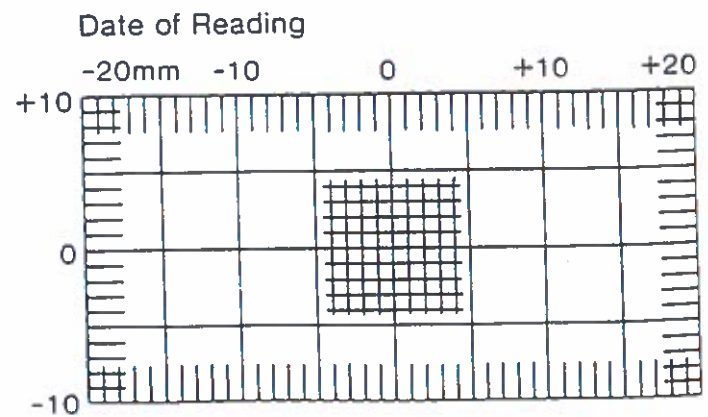
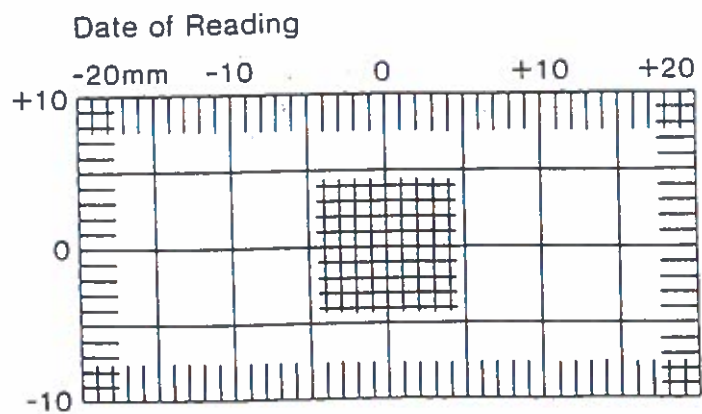
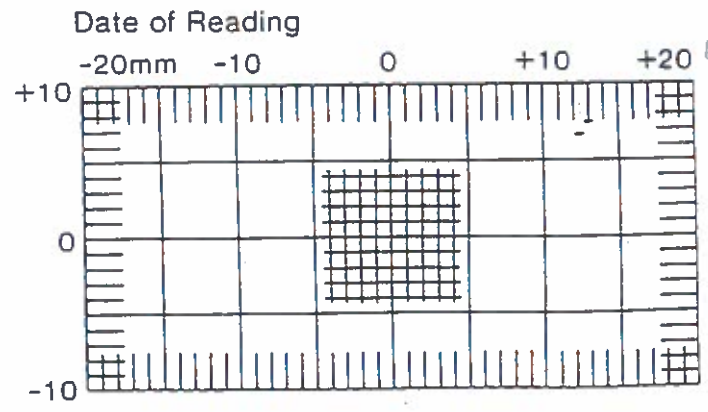
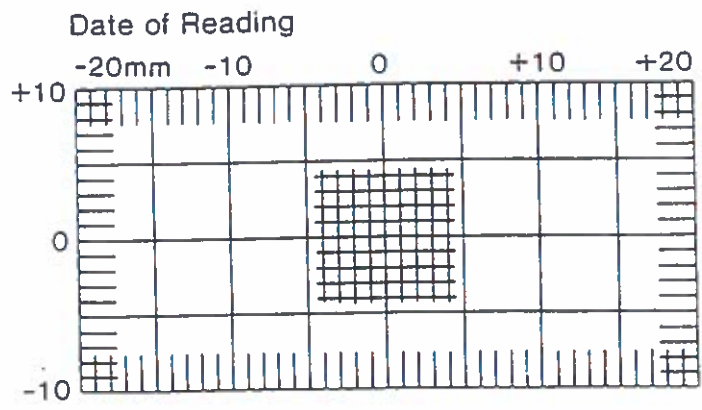
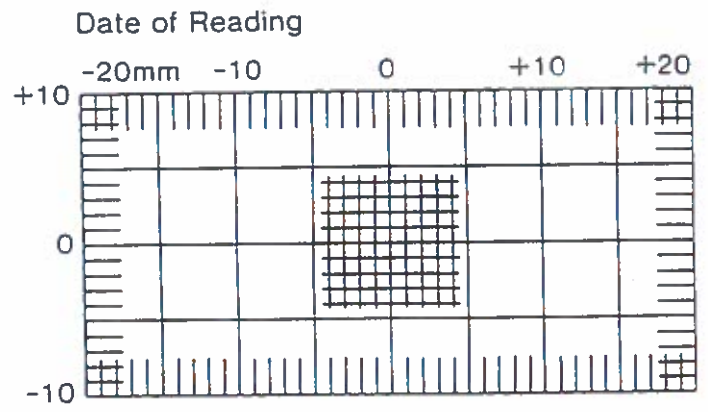
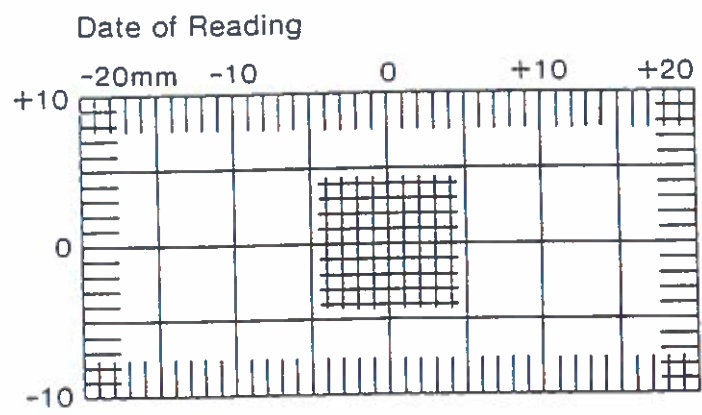
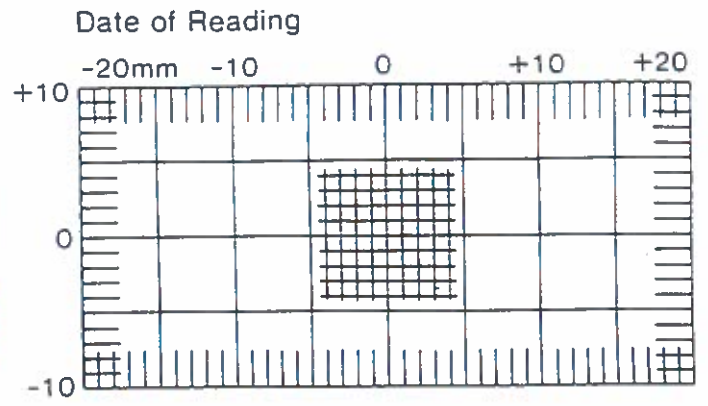
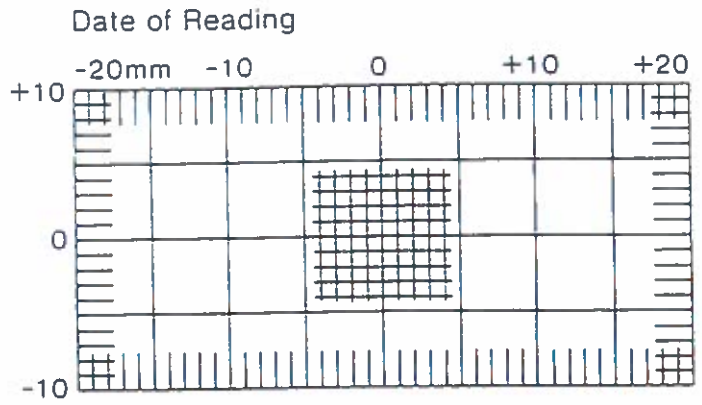
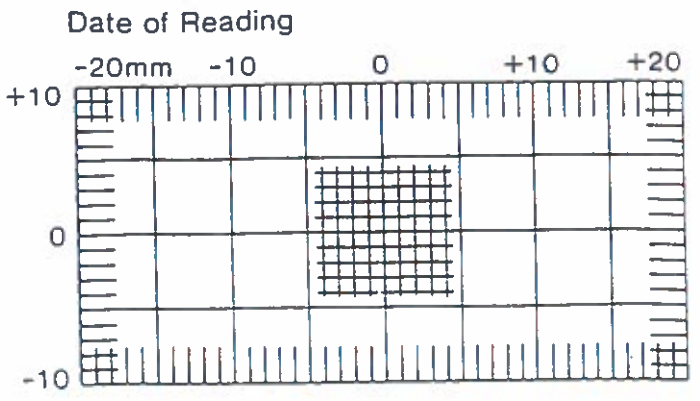
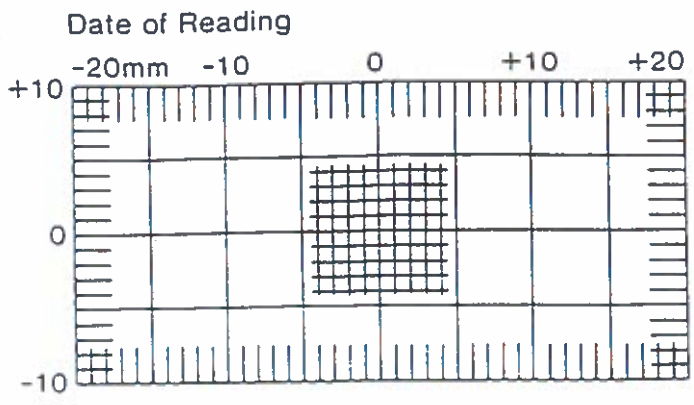
CRACK MONITORING RECORD FOR THE STANDARD AND CORNER TELL-TALE

PROJECT LOCHSIDE LEISURE CENTRE, FORFAR

LOCATION OF TELL-TALE DRAMA STORE - No. 6

Indicate on the diagrams below the TELL-TALE movement at each reading
+ represents crack opening - represents crack closing





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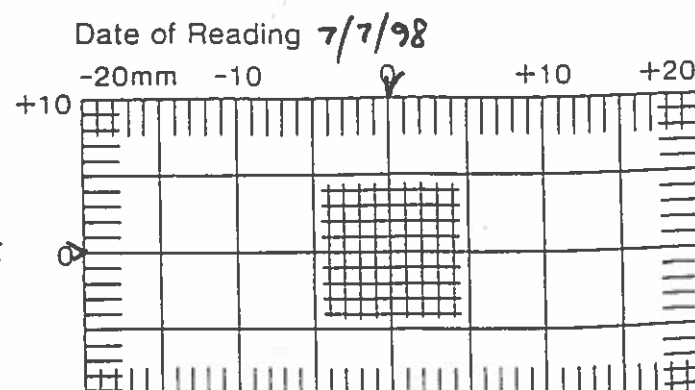
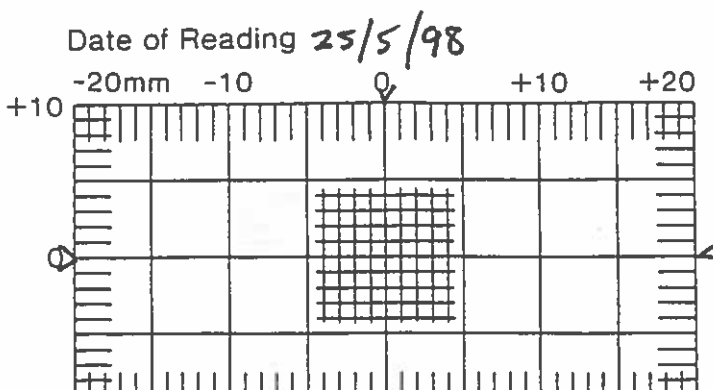
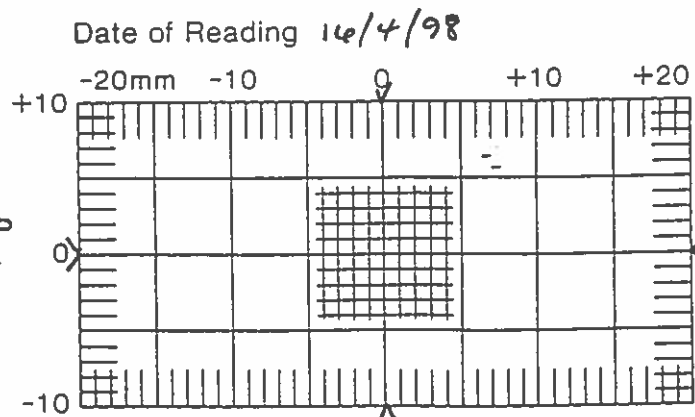
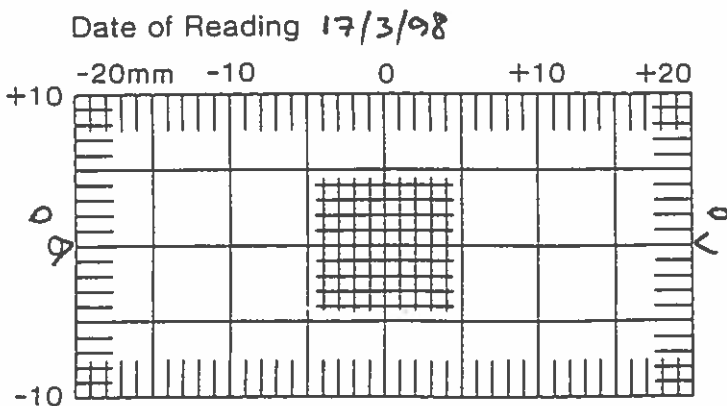
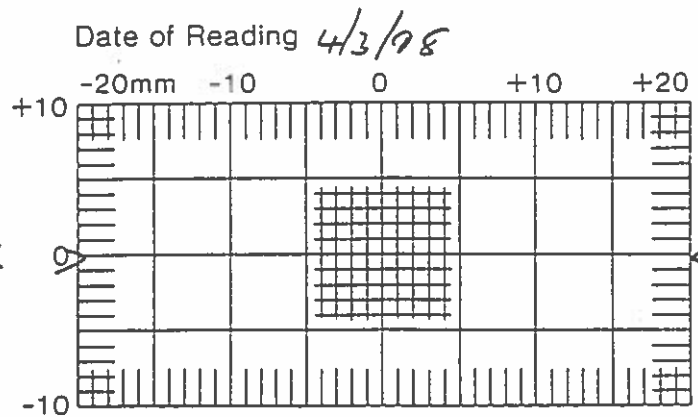
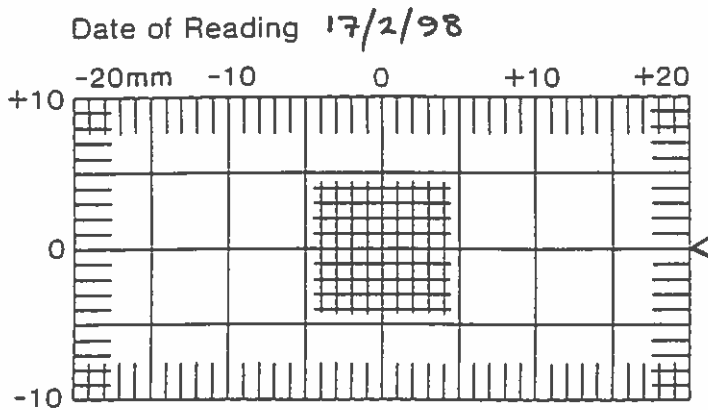
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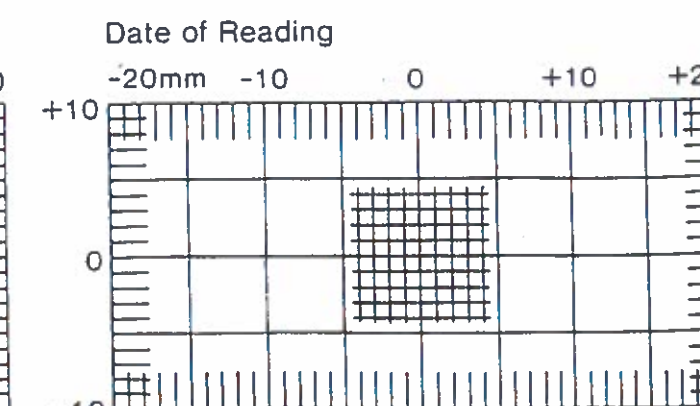
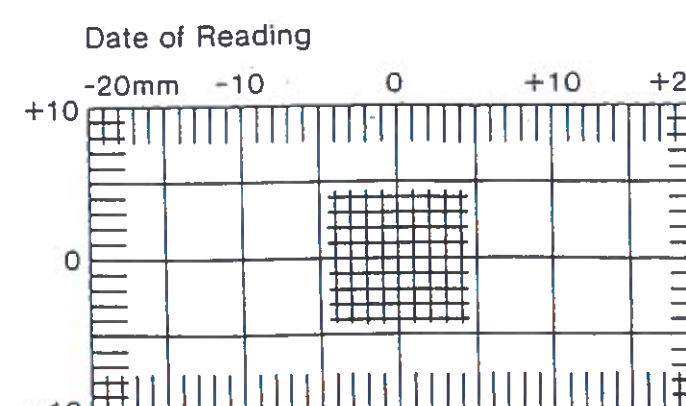
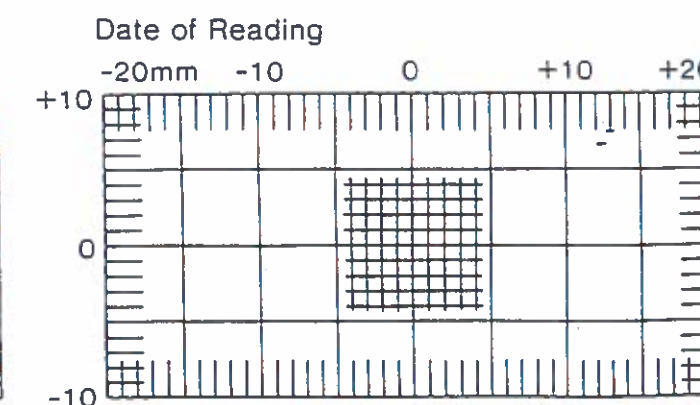
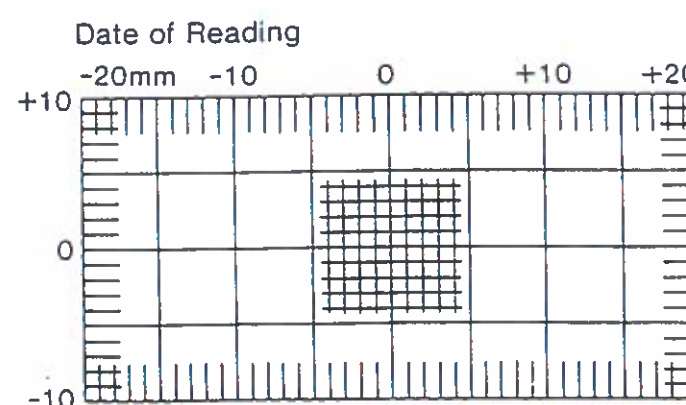
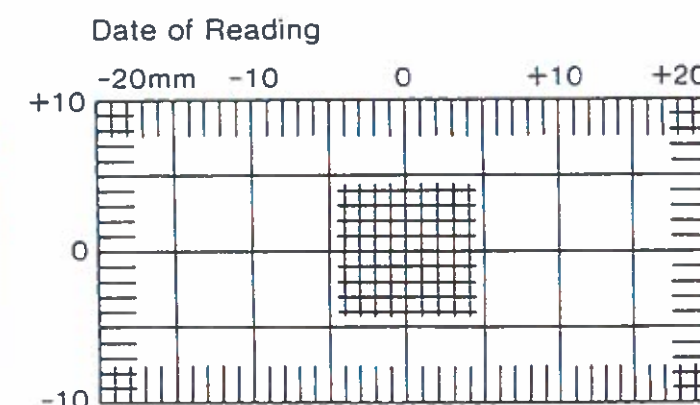
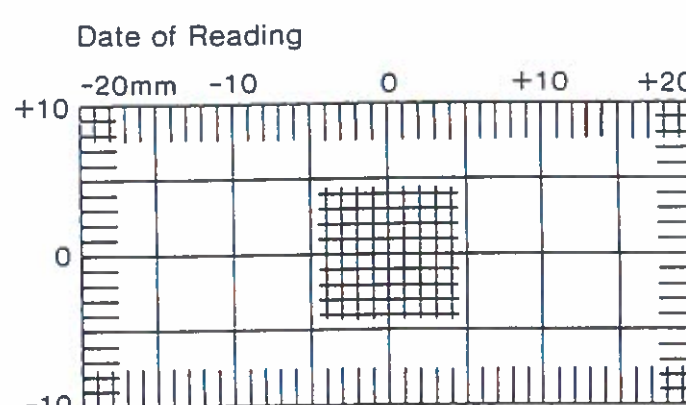
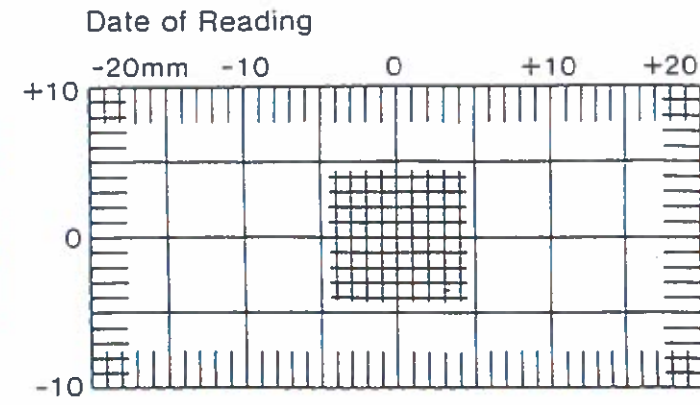
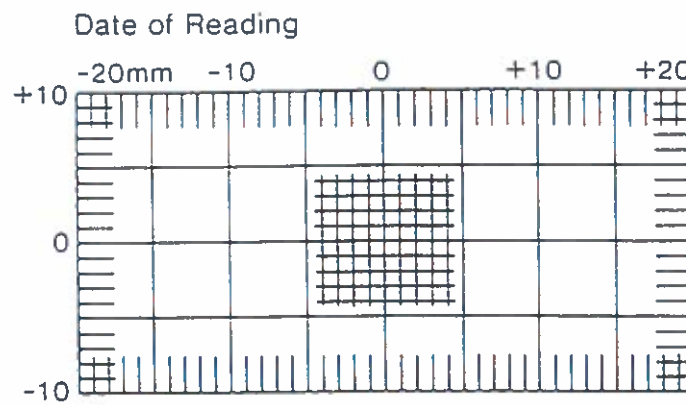
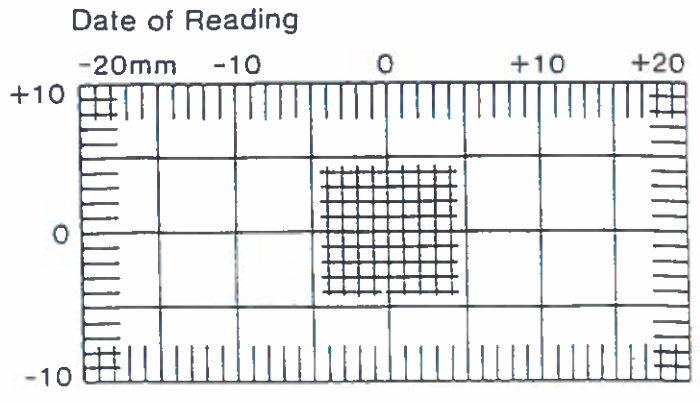
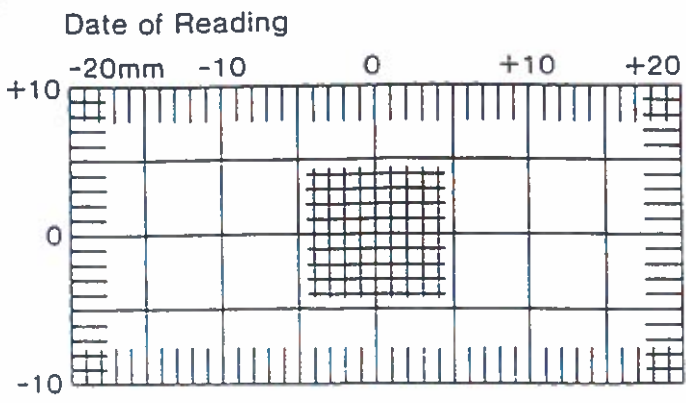
CRACK MONITORING RECORD FOR THE STANDARD AND CORNER TELL-TALE

PROJECT LOCHSIDE LEISURE CENTRE, FORFAR

LOCATION OF TELL-TALE DRAMA STORE - No. 7

Indicate on the diagrams below the TELL-TALE movement at each reading
+ represents crack opening - represents crack closing





AVONGARD®

Avongard Ltd, 61 Down Road, Portishead, Bristol BS20 8RB.
Telephone: 01275 849782 Facsimile: 01275 848062

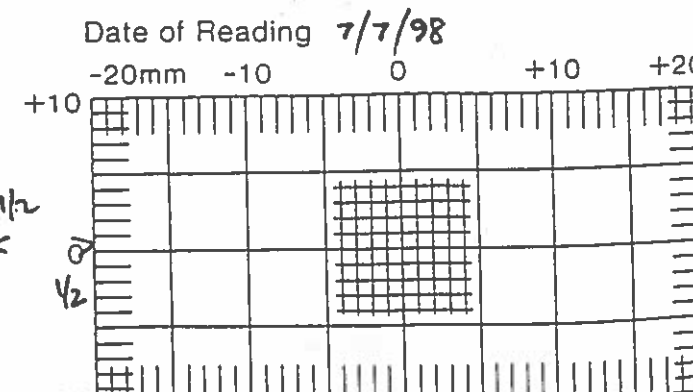
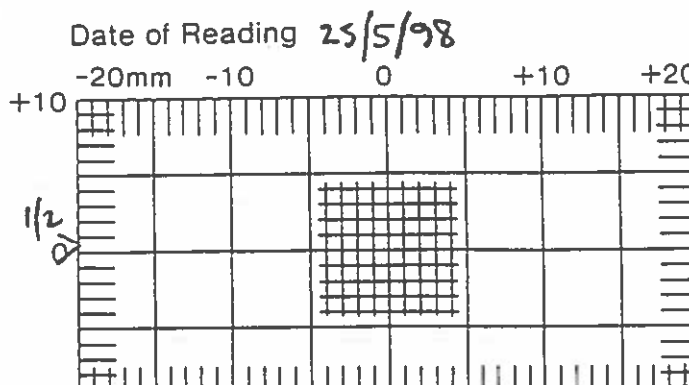
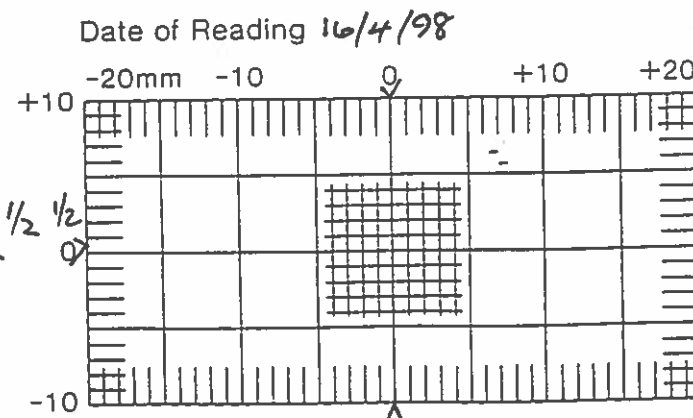
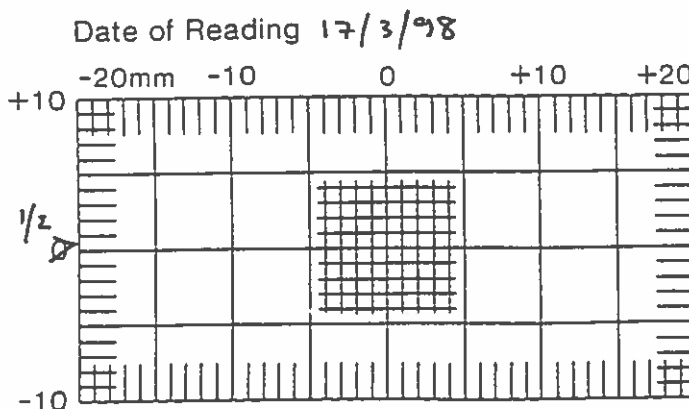
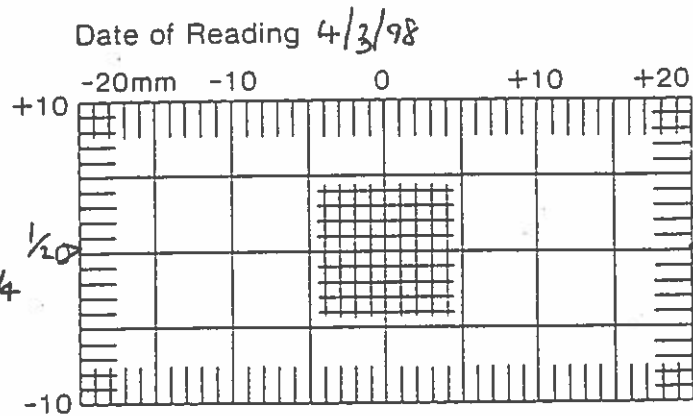
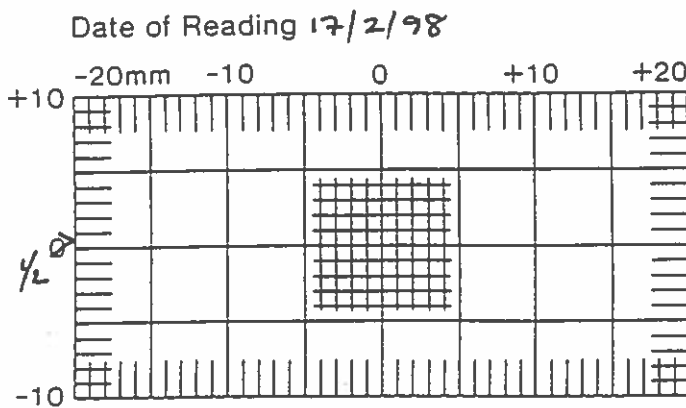
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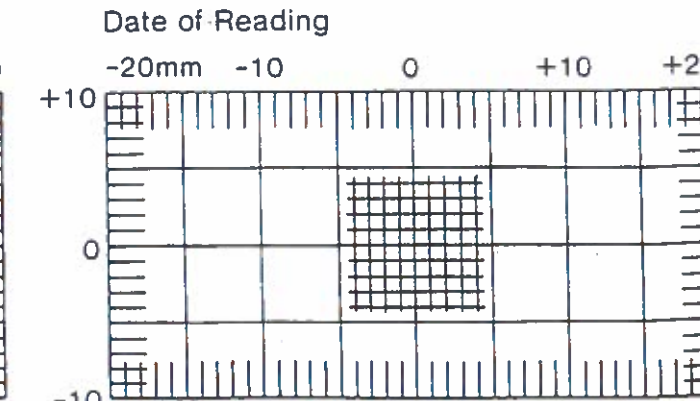
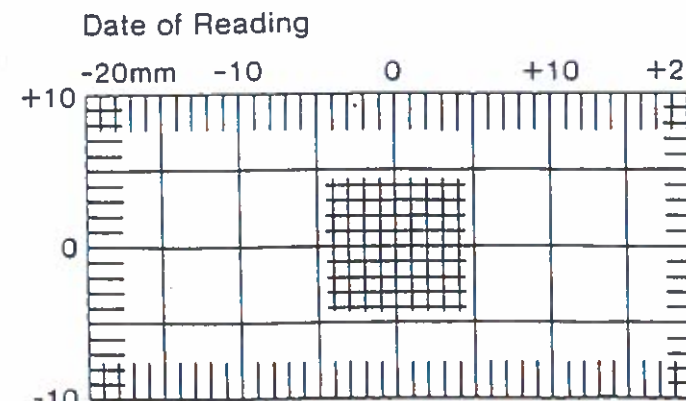
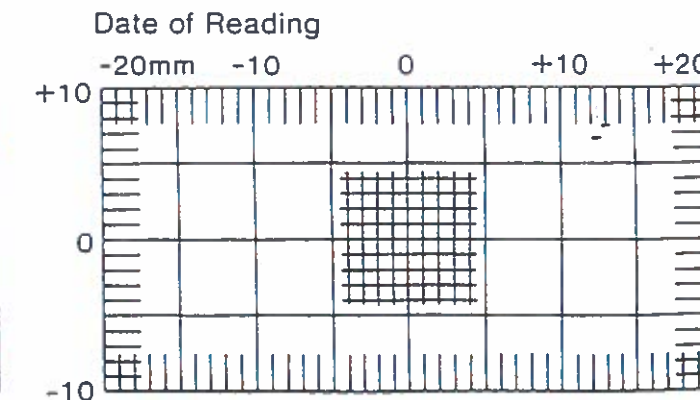
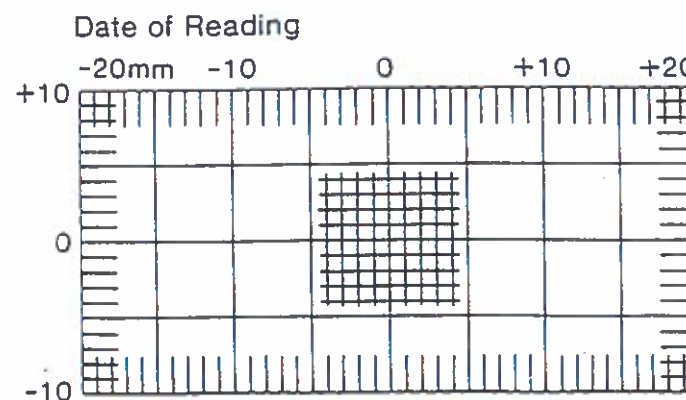
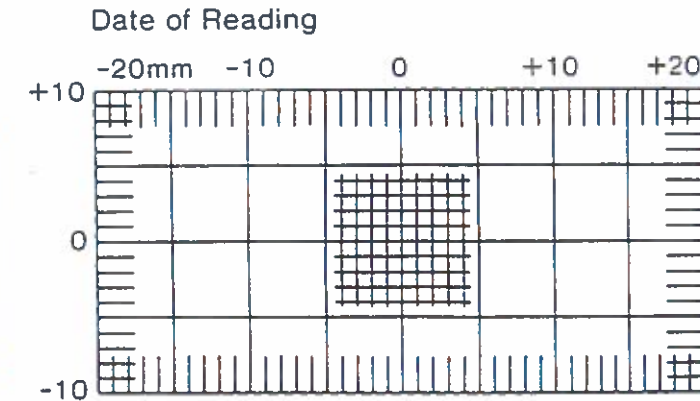
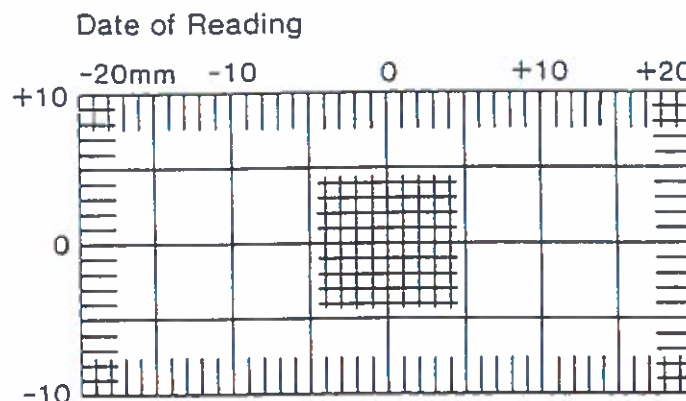
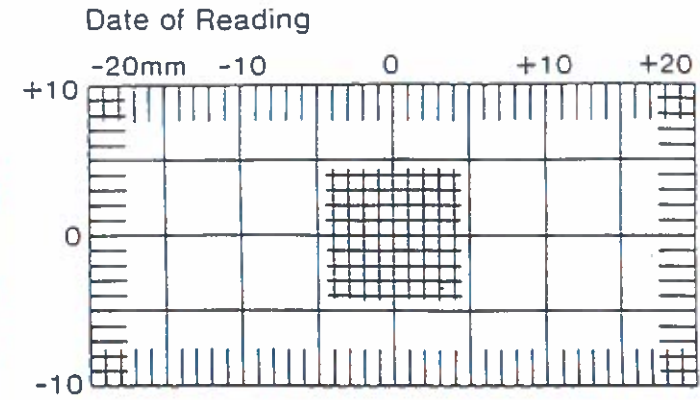
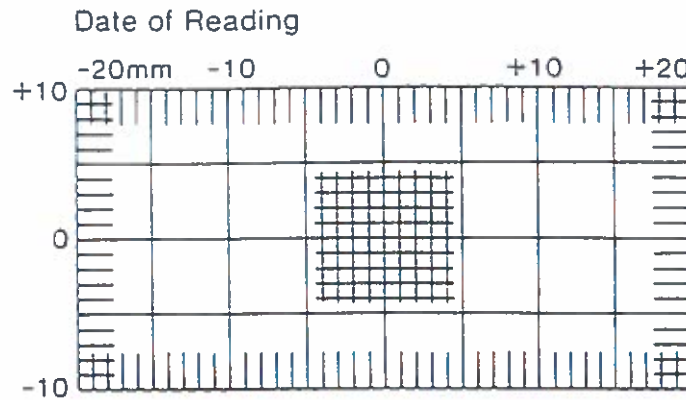
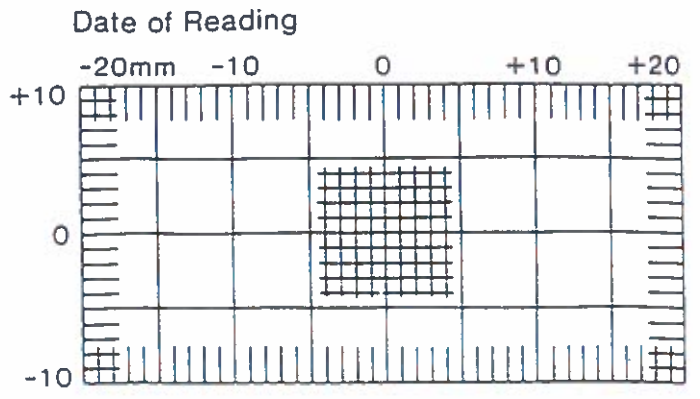
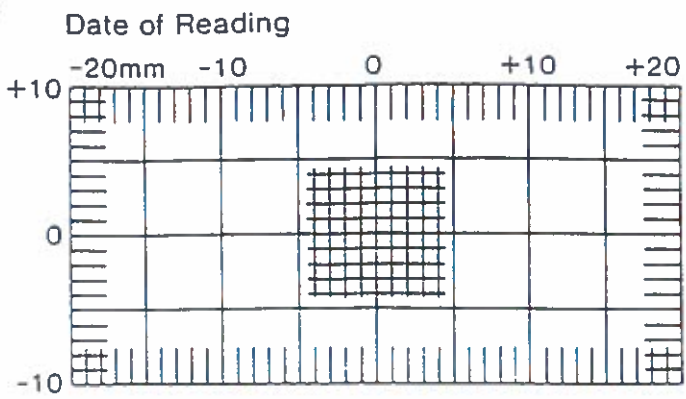
CRACK MONITORING RECORD FOR THE STANDARD AND CORNER TELL-TALE

PROJECT LOCHSIDE LEISURE CENTRE, FORFAR

LOCATION OF TELL-TALE DRAMA STORE - No. 8

Indicate on the diagrams below the TELL-TALE movement at each reading
+ represents crack opening - represents crack closing

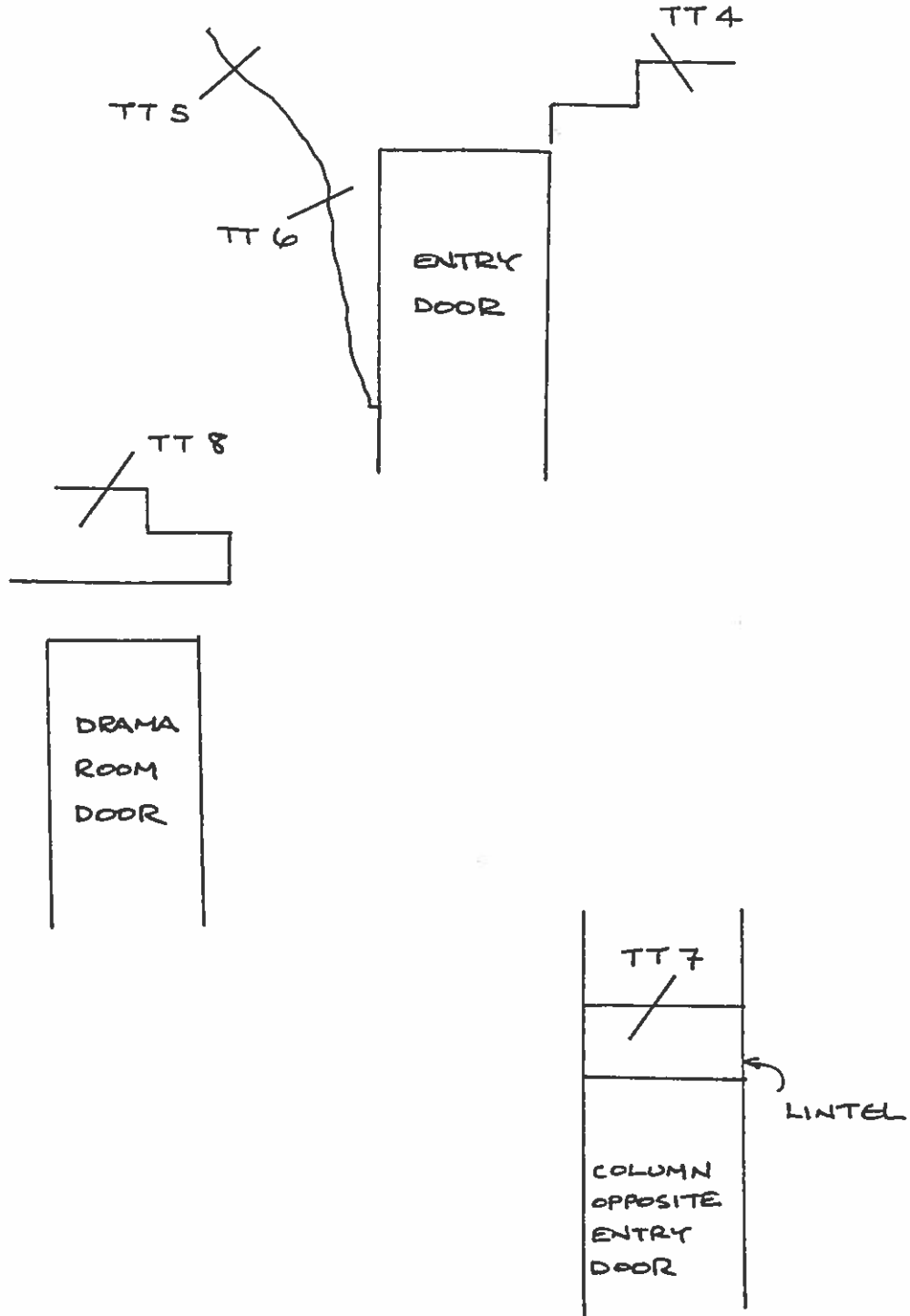




APPENDIX 7

Wall 8 - Drama Store Wall

Diagrammatic Representation of Cracks





**APPENDIX A4 - SPORTS HALL STORES - REMEDIAL WORKS - DESIGNERS METHOD
STATEMENT AND HIGHLIGHTED HAZARDS**



APPENDIX A4 - SPORTS HALL STORES - REMEDIAL WORKS - DESIGNERS METHOD STATEMENT AND HIGHLIGHTED RISKS

In accordance with Construction (Design and Management) Regulations 1994 the following method statement and highlighted risks are for incorporation into the pre-tender health and safety plan. I would recommend that a health and safety meeting be arranged to discuss the following details with the planning supervisor and any other members of the design team prior to preparation of the pre-tender health and safety plan.

Designers Method Statement

- 1) Install underpinning as per sub-contractors method statement (once approved).
- 2) Remove suspended ceiling and lighting in polygym area affected by the works
- 3) Erect edge restraint scaffolding to allow access to roof / demolition of wall.
- 4) Remove upper 3.5m of timber and glass fire exit to polygym (manual techniques)
- 5) Prop ends of fingered joists on partition wall to slab - allow 1m working space each side of wall.
- 6) Prop end of existing roof support beam (spanning onto rear external wall of sports hall store) to slab.
- 7) Remove roof covering and joist adjacent to rear external wall.
- 8) Take down upper 3.5m of rear external wall from existing movement joint to fire exit in polygym (manual techniques).
- 9) Re-build rear external wall incorporating padstones for the existing and proposed beams.
- 10) Erect scaffold to facilitate access to beam bearings, splice connections, roof joists, and demolition of partition wall.
- 11) Open top van with drop down tailgate at waist height to transport beams to site.
- 12) Manual handling of 3m long sections of 203 x 102 x 23 UB : 69kg / section - three man lift - lift from van through fire exits and lay on slab.
- 13) Attach chain hoist to joists (consult engineer prior to carrying this out), and lift two beam sections simultaneously and manoeuvre into position for shimming and connection at splice, ensure 100mm bearing at padstones.
- 14) Insert bolts and tighten nuts loosely.
- 15) Prop to scaffold either side of splice and manoeuvre beam until level, ensure 100mm bearing at padstones.
- 16) Tighten nuts in splice, and steel shim tight to bearings and joist soffits.
- 17) Repeat steps 11-15 for opposite side of partition wall.
- 18) Remove props and scaffold.
- 19) Reinstall joist adjacent to rear external wall and re-cover roof.
- 20) Demolish partition wall using manual techniques to top of slab level, and remove debris.
- 21) Remove scaffolding to wall.
- 22) Replace partition wall with timber partition.

Designers Highlighted Risks

The following pages contain details which are considered significant or unusual enough to warrant inclusion in the pre-tender health and safety plan:

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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**



PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*
TASK/ACTIVITY: *INSTALLATION OF UNDERPINNING*
TASK NO: *1*

IDENTIFIED HAZARD

EXPOSURE TO HYDRO CARBONS WITHIN LANDFILL

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 33.33%; height: 30px;">H</td> <td style="width: 33.33%; height: 30px;">H</td> <td style="width: 33.33%; height: 30px;">H</td> </tr> <tr> <td style="width: 33.33%; height: 30px;">M</td> <td style="width: 33.33%; height: 30px;">M</td> <td style="width: 33.33%; height: 30px;">M</td> </tr> <tr> <td style="width: 33.33%; height: 30px;">L</td> <td style="width: 33.33%; height: 30px;">L</td> <td style="width: 33.33%; height: 30px;">L</td> </tr> </table> <p style="text-align: right;">SEVERITY</p> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	M	M	M	L	L	L
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PRINCIPAL CONTRACTOR TO DESCRIBE METHODS OF CONTROLLING HAZARD

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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**



PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*
TASK/ACTIVITY: *INSTALLATION OF UNDERPINNING*
TASK NO: *1*

IDENTIFIED HAZARD

EXPOSURE TO GLASS, FRACTURED WOOD, SHARP METAL IN LANDFILL

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td>H</td><td>H</td><td>H</td> </tr> <tr> <td>M</td><td>M</td><td>M</td> </tr> <tr> <td>L</td><td>L</td><td>L</td> </tr> </table> <p style="text-align: right;">SEVERITY</p> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	M	M	M	L	L	L
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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**

PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*

TASK/ACTIVITY: *DEMOLITION OF EXTERIOR REAR WALL*
TASK NO: *8*



IDENTIFIED HAZARD

DEMOLITION OF EXTERIOR REAR WALL - INJURIES FROM PLANT / FALLING DEBRIS

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="margin: 0 auto; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 2px;">H</td><td style="padding: 2px;">H</td><td style="padding: 2px;">H</td> </tr> <tr> <td style="padding: 2px;">M</td><td style="padding: 2px;">M</td><td style="padding: 2px;">M</td> </tr> <tr> <td style="padding: 2px;">L</td><td style="padding: 2px;">L</td><td style="padding: 2px;">L</td> </tr> </table> <p style="text-align: right; margin-top: 5px;">SEVERITY</p> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	M	M	M	L	L	L
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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**



PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*

TASK/ACTIVITY: *DEMOLITION OF REAR EXTERIOR WALL &
TASK NO: 8, 20 PARTITION WALL*

IDENTIFIED HAZARD

*DEMOLITION OF WALL - FALLING FROM SCAFFOLD OVER WALL AS WALL IS
LOWERED IN HEIGHT.*

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 33.33%; height: 30px;">H</td> <td style="width: 33.33%; height: 30px;">H</td> <td style="width: 33.33%; height: 30px;">H</td> </tr> <tr> <td style="width: 33.33%; height: 30px;">M</td> <td style="width: 33.33%; height: 30px;">M</td> <td style="width: 33.33%; height: 30px;">M</td> </tr> <tr> <td style="width: 33.33%; height: 30px;">L</td> <td style="width: 33.33%; height: 30px;">L</td> <td style="width: 33.33%; height: 30px;">L</td> </tr> </table> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	M	M	M	L	L	L
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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**



PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*
TASK/ACTIVITY: *ERECTION OF SCAFFOLDING & REMOVAL*
TASK NO: *3, 10, 18, 20*

IDENTIFIED HAZARD

MANUAL HANDLING, FALLS.

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">H</td> <td style="padding: 2px;">H</td> <td style="padding: 2px;">H</td> <td style="padding: 2px;">H</td> </tr> <tr> <td style="padding: 2px;">M</td> <td style="padding: 2px;">H</td> <td style="padding: 2px;">M</td> <td style="padding: 2px;">M</td> </tr> <tr> <td style="padding: 2px;">L</td> <td style="padding: 2px;">H</td> <td style="padding: 2px;">L</td> <td style="padding: 2px;">L</td> </tr> <tr> <td style="padding: 2px;">L</td> <td style="padding: 2px;">H</td> <td style="padding: 2px;">L</td> <td style="padding: 2px;">L</td> </tr> </table> <p style="text-align: right; margin-top: 5px;">SEVERITY</p> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	H	M	H	M	M	L	H	L	L	L	H	L	L
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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**

PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*
TASK/ACTIVITY: *DEMOLITION OF PARTITION WALL*
TASK NO: *20*



IDENTIFIED HAZARD

USE OF MANUAL DEMOLITION TECHNIQUES - BROKEN LIMBS, CUTS, BRUISES, HEAD INJURIES.

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>		<p>PROBABILITY</p> <table border="1"> <tr> <td>H</td> <td>H</td> <td>H</td> <td>L</td> </tr> <tr> <td>M</td> <td>M</td> <td>M</td> <td>L</td> </tr> <tr> <td>L</td> <td>L</td> <td>L</td> <td>L</td> </tr> </table> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>		H	H	H	L	M	M	M	L	L	L	L	L
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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**



PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*
TASK/ACTIVITY: *MANUAL HANDLING OF BEAMS .*
TASK NO: *12*

IDENTIFIED HAZARD

*INJURIES TO BACK, HANDS, TOES ETC FROM FALLING BEAM,
OR INCORRECTLY LIFTED BEAM.*

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="margin: 0 auto; border-collapse: collapse; text-align: center;"> <tr><td>H</td><td>H</td><td>H</td></tr> <tr><td>M</td><td>M</td><td>M</td></tr> <tr><td>L</td><td>L</td><td>L</td></tr> </table> <p style="text-align: right; margin-top: 5px;">SEVERITY</p> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	M	M	M	L	L	L
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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**



PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*

TASK/ACTIVITY: *13*

TASK NO:

IDENTIFIED HAZARD

LIFTING BEAM INTO POSITION - BEAM FALLS AND HITS PERSONNEL.

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="margin: 0 auto; text-align: center;"> <tr> <td style="border: none;">H</td> <td style="border: none;">H</td> <td style="border: none;">H</td> <td style="border: none;">L</td> <td style="border: none;"></td> </tr> <tr> <td style="border: none;">H</td> <td style="border: none;">M</td> <td style="border: none;">M</td> <td style="border: none;">L</td> <td style="border: none;"></td> </tr> <tr> <td style="border: none;">M</td> <td style="border: none;">H</td> <td style="border: none;">M</td> <td style="border: none;">L</td> <td style="border: none;"></td> </tr> <tr> <td style="border: none;">L</td> <td style="border: none;">L</td> <td style="border: none;">M</td> <td style="border: none;">L</td> <td style="border: none;"></td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;"></td> <td style="border: none;">SEVERITY</td> </tr> </table> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	L		H	M	M	L		M	H	M	L		L	L	M	L						SEVERITY
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PRINCIPAL CONTRACTOR TO DESCRIBE METHODS OF CONTROLLING HAZARD

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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**



PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*

TASK/ACTIVITY: *DEMOLITION OF FIRE EXIT DOOR AND REAR WALL
AND PARTITION WALL*

TASK NO: *4, 8, 20*

IDENTIFIED HAZARD

FALLING DEBRIS

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 33.33%; height: 30px;">H</td> <td style="width: 33.33%; height: 30px;">H</td> <td style="width: 33.33%; height: 30px;">H</td> </tr> <tr> <td style="width: 33.33%; height: 30px;">M</td> <td style="width: 33.33%; height: 30px;">M</td> <td style="width: 33.33%; height: 30px;">M</td> </tr> <tr> <td style="width: 33.33%; height: 30px;">L</td> <td style="width: 33.33%; height: 30px;">L</td> <td style="width: 33.33%; height: 30px;">L</td> </tr> </table> <p style="text-align: right; margin-top: -10px;">SEVERITY</p> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	M	M	M	L	L	L
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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**



PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*
TASK/ACTIVITY: *DEMOLITION OF FIRE EXIT DOOR AND REAR WALL
AND PARTITION WALL .*
TASK NO: *4, 8, 20*

IDENTIFIED HAZARD

FALLING GLASS

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 33.33%; height: 33.33%;">H</td> <td style="width: 33.33%; height: 33.33%;">H</td> <td style="width: 33.33%; height: 33.33%;">H</td> </tr> <tr> <td style="width: 33.33%; height: 33.33%;">M</td> <td style="width: 33.33%; height: 33.33%;">M</td> <td style="width: 33.33%; height: 33.33%;">M</td> </tr> <tr> <td style="width: 33.33%; height: 33.33%;">L</td> <td style="width: 33.33%; height: 33.33%;">L</td> <td style="width: 33.33%; height: 33.33%;">L</td> </tr> </table> <p style="text-align: right; margin-top: 5px;">SEVERITY</p> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	M	M	M	L	L	L
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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**



PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*
TASK/ACTIVITY: *MANUAL HANDLING OF 3m SECTIONS OF 203x102x23UB*
TASK NO: *12*

IDENTIFIED HAZARD

DROPPED UB ON TOES, FINGERS

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 33.33%; height: 30px;">H H</td> <td style="width: 33.33%; height: 30px;">H M</td> <td style="width: 33.33%; height: 30px;">H L</td> </tr> <tr> <td style="width: 33.33%; height: 30px;">M H</td> <td style="width: 33.33%; height: 30px;">M M</td> <td style="width: 33.33%; height: 30px;">M L</td> </tr> <tr> <td style="width: 33.33%; height: 30px;">L H</td> <td style="width: 33.33%; height: 30px;">L M</td> <td style="width: 33.33%; height: 30px;">L L</td> </tr> </table> <p style="text-align: right; margin-top: 5px;">SEVERITY</p> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H H	H M	H L	M H	M M	M L	L H	L M	L L
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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**



PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*

TASK/ACTIVITY: *ATTACH CHAIN HOISTS TO JOISTS AND LIFT BEAMS.*
TASK NO: *13*

IDENTIFIED HAZARD

FALLING BEAMS

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="margin-left: auto; margin-right: auto; text-align: center;"> <tr> <td style="border: none;">H</td> <td style="border: none;">H</td> <td style="border: none;">H</td> <td style="border: none;">L</td> </tr> <tr> <td style="border: none;">H</td> <td style="border: none;">M</td> <td style="border: none;">M</td> <td style="border: none;">L</td> </tr> <tr> <td style="border: none;">M</td> <td style="border: none;">H</td> <td style="border: none;">M</td> <td style="border: none;">L</td> </tr> <tr> <td style="border: none;">L</td> <td style="border: none;">L</td> <td style="border: none;">M</td> <td style="border: none;">L</td> </tr> </table> <p style="text-align: right; margin-right: 20px;">SEVERITY</p> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	L	H	M	M	L	M	H	M	L	L	L	M	L
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**RISK ASSESSMENT SHEET
RELATING TO CDM PROJECT PLAN DATED**

PROJECT: *LOCHSIDE LEISURE CENTRE SPORTS HALL STONE
REMEDIAL WORKS*

TASK/ACTIVITY: *REMOVE ROOF COVERING AND JOIST & RE-COVER*
TASK NO: *7, 19*



IDENTIFIED HAZARD

FALLING FROM ROOF

RISK ASSESSMENT (Tick relevant box)

<p>SEVERITY</p> <p>H <input type="checkbox"/> Severe - Fatality, major long term injury or illness</p> <p>M <input type="checkbox"/> Moderate - Short term injury or illness</p> <p>L <input type="checkbox"/> Minor - Other injury or illness</p> <p>PROBABILITY</p> <p>H <input type="checkbox"/> Certain or near certain to occur</p> <p>M <input type="checkbox"/> Reasonably likely to occur</p> <p>L <input type="checkbox"/> Very Seldom occurrence or never</p>	<p>PROBABILITY</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 33.33%; height: 33.33%;">H</td> <td style="width: 33.33%; height: 33.33%;">H</td> <td style="width: 33.33%; height: 33.33%;">H</td> </tr> <tr> <td style="width: 33.33%; height: 33.33%;">M</td> <td style="width: 33.33%; height: 33.33%;">M</td> <td style="width: 33.33%; height: 33.33%;">M</td> </tr> <tr> <td style="width: 33.33%; height: 33.33%;">L</td> <td style="width: 33.33%; height: 33.33%;">L</td> <td style="width: 33.33%; height: 33.33%;">L</td> </tr> </table> <p style="text-align: right; margin-top: -10px;">SEVERITY</p> <p>H/H Avoid Wherever Possible L/L Maybe ignored</p> <p>OTHER VALUES Control or Minimise Risk</p>	H	H	H	M	M	M	L	L	L
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PRINCIPAL CONTRACTOR TO DESCRIBE METHODS OF CONTROLLING HAZARD

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APPENDIX A5 - REFERENCES



APPENDIX A5 - REFERENCES

Reference	Description
1	<p><i>"Simple measuring and monitoring of movement in low-rise buildings"</i> <i>"BRE Digest - Concise reviews of building technology"</i> Digests 343, 344 Building Research Department Advisory Service Garston, Watford, WD2 7JR</p>
2	<p><i>"Simple measuring and monitoring of movement in low-rise buildings Part 2: settlement, heave and out-of-plumb"</i> <i>"BRE Digest - Concise reviews of building technology"</i> Digest 344 Revised 1995 Building Research Department Advisory Service Garston, Watford, WD2 7JR</p>
3	<p><i>"Monitoring building and ground movement by precise levelling"</i> August 1993 Building Research Department Garston, Watford, WD2 7JR <i>"BRE Digest - Concise reviews of building technology"</i></p>
4	<p><i>"Why do Buildings Crack?"</i> May 1991 Building Research Department Garston, Watford, WD2 7JR BRE Digest 361</p>
5	<p><i>"Mini-Piling for Low Rise Buildings"</i> September 1986 Department of the Environment Building Research Establishment Digest 313 Building Research Station Garston, Watford, WD2 7JR</p>

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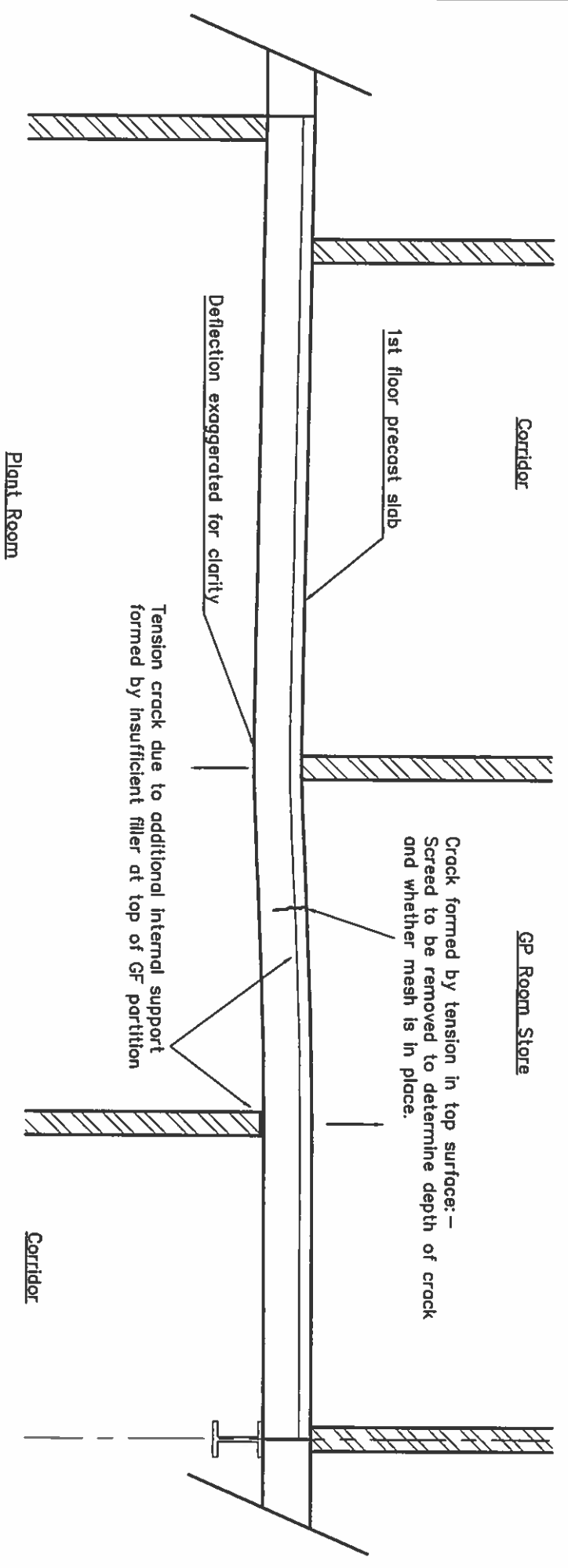
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APPENDIX A6 - DRAWINGS





**SECTION A-A SHOWING FIRST FLOOR SLAB
ABOVE PLANT ROOM 1:25**

AMENDMENTS		
 Angus Council ROADS DEPARTMENT DESIGN - DR. J. MURPHY ISE, P.M., C.E.M., M.I.C.E. MAPS, SURV. UNIT, I.C.S.M.S.		
LOCHSIDE LEISURE CENTRE, FORFAR STRUCTURAL SURVEY REPORT - JUNE 1998 SECTION A-A SHOWING CRACK TO 1ST FLOOR ABOVE PLANT ROOM		
Drawn by: 00	Date: JULY 1998	Project No. 115030005
	Scales: 1:50	Drawing No. CP2.3.181/002

