11 APPENDICES

11.1 Structural Report by Northrop Engineers

NORTHROP Bringing people, ideas & engineering together

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CR140212e01
12th August 2014

David Hobbes
Associate ARAIA
PHILIPLEESONARCHITECTS
4/9 McKay Street, Turner ACT 2612

Dear David

St Johns Reid – Structural Audit

We have visited the above building with a view to providing comment on the structural condition of the various buildings and minor structures on the site. Our report addresses the following structures:

- Church
- School house
- Rectory
- Lichgates

We have also relied on the following previous reports and associated details as background information when preparing this assessment.

- RD Rodgers Engineers Pty Ltd 21st July 1998
- Rodgers and Jefferis Pty Ltd 3rd March 2002

Our observations are set out below.

School House

This is a stone building supported by footings. It is not known whether the footings are concrete or stone. We would suspect they are stone.

The building has been stabilised in the past by the installation of a concrete "skirt" that seems only to extend part way around the perimeter. This was partially successful with underpinning required within the skirted area about 10 years after the installation of the skirt. Refer appendix A.

Our observations are:

- The building exhibits numerous examples of cracking due to foundation movement. Judging by the records this movement is clearly less than has occurred in the past.
- The current cracking is dispersed reasonably evenly around the building and is predominantly on the inside of the walls. The cracking

is generally minor however one crack above the southern window in the south western room is approximately 10mm wide. This is in the region that is within the "skirted" and stabilised zone.

- The roof framing was sighted from the top of a ladder. We did not enter the roof space. The framing was sound and dry. It was comprised of hand adzed timbers. Some modern framing had been loosely added to nominally partition the ceiling space. Boarding had been laid on the ceiling joists to provide nominal useable space.
- The roof cladding is timber shingles.
- There is apparent rising damp with peeling paint predominantly around the base of the chimney in the living room at the eastern end of the building; however it is also evident in the dining room and the utility room.
- There are localised areas of drummy render.
- Areas of flooring are bouncy in the room to the right of the entry.
- There is one split floor board in a corner in the south western room.

Our recommendations are:

- Continue to monitor the progress of cracking and repair on an ongoing basis.
- Consider extending the "skirt" around the entire building.
- Repair and underpinning may be required to 10mm crack mentioned above. Monitor closely before committing to underpinning.
- Monitor extent of rising damp. Repair may be required in time. Repair could involve the installation of an injected or retrofitted damp proof membrane. Options are shown in appendix F
- If the source of the moisture cannot be identified and remediated it may be worth considering the installation of sacrificial render. This is a low intervention approach which involves the application of a lime rich mortar "poultice" over the face of the affected zones. The rising damp slowly penetrates the poultice and will slowly erode its surface away. This preserves the underlying wall face until a more permanent solution can be found. Repair of the sacrificial face will be required from time to time.
- Investigate under bouncy floor to determine if timber rot is occurring. Improved ventilation to subfloor may be required. This will most likely need to be mechanical ventilation as the floors are very close to the ground.
- Monitor extent of drummy render. Repair may be required in time.
- Replace damaged floor board.

The Rectory

The rectory is a full brick, residential building with a conventionally framed timber roof, clad with concrete roof tiles. The floor is timber framed.

The house was extended and altered about 30 years ago. At the same time underpinning was carried out to some of the walls. Drawings showing these works are attached as appendix B

Our observations are:

- The roof framing timbers are Oregon. The roof is sparsely framed but appears adequate. Nevertheless there are several examples of split, cracked and warped timbers. This is not uncommon with Oregon. There is evidence of previous repair.
- When viewed from outside there is an obvious sag in the roof in some places but this is most pronounced near the brick chimney.
- Some sections of ceiling have sagged. It is not clear whether this is due to someone having stepped on the battens or previous moisture damage.
- The ceiling in the dining room on the western side of the house is lined in part with timber boarding. This section of the roof is a low pitched metal deck roof. Material which seems to be the result of birds nesting is visible between the boards.
- The floor undulates as would be expected of a building of this age. Access to the subfloor was difficult, but what we did see on the western side of the house appeared dry and well ventilated.
- There are numerous examples of cracking in the walls inside the residence.
- The cracking is generally the result of foundation movement and is minor but extensive.
- The perimeter walls are rendered with a stucco finish and are in good condition.
- The garden is lush and very close to the house.
- The house was underpinned along the north eastern and western walls in 1981. This work seems to have been successful.

Our recommendations are:

- The roof framing should be further investigated and repaired as necessary.
- The bird nesting in the flat roofed portions should be removed.
- Internal cracking needs to be either treated as part of ongoing maintenance or more permanently rectified. The choice of approach

depends on the available budget; tolerance to inconvenience during repair works and also whether the presence of the cracking is of concern to the occupants. The cracking is only aesthetic and does not impair the structural performance of the building. Obviously rectification is difficult but could entail

  - Underpinning – This needs to be extensive to be effective. In this case it will be required under internal walls and will be very inconvenient to the occupants.
  - Removal and repair of strategic sections of brickwork or installation of control joints in the internal walls – This involves removing damaged brickwork and then rebuilding it between two newly formed control joints. Alternatively joints can be cut into the existing walls and the brickwork spot repaired.
  - Installation of a concrete skirt and path all around the building similar to what has been done on the church and the school house – This process involves excavation and placement of a concrete skirt and path around the house to effectively seal the moisture content around the house foundations. It has the effect of stabilizing foundation movement. It is often used in conjunction with brick crack repair to avoid underpinning. It is disruptive to the landscaping and gardens.

- Given the extent of damage in this instance and the fact that it is generally not structurally detrimental a simple patch and paint on an ongoing basis could be effective. Sample details are shown in appendix C. From a maintenance perspective the cracks would need to filled and painted on a regular basis.
- Consideration could also be given to clearing the garden away from the house and improving general site drainage. This could improve the performance of the footings.

The Church

The church is a stone building. The roof is timber framed and clad with asbestos cement shingles. The ceiling is timber lined. The building has been stabilised in the past by the installation of a full surround concrete "skirt". This work seems to have been very effective.

Our observations are:

- The current roof is a thin asbestos shingle. This would equate roughly in weight to the original timber shingle roof.
- The roof frame is performing very well and we would recommend that if it was ever proposed to remove the asbestos cement and renew the roof cladding, considerable investigation into the effect of changing the weight of the roof cladding be undertaken. The roof framing on

churches such as this can perform quite badly if the roof weight is increased.

- Cacking still exists around the internal walls of the church. This is most likely still due to minor foundation movements but it appears to be progressing slowly. It is all quite minor in a structural sense.
- At the time of our initial site visits in late April and early May some areas of rising damp was apparent on internal walls. This was particularly apparent in the side chapel to the north and the south porch window sills. In this location the render showed signs of efflorescence or white powder on the walls but the render was largely intact.
- At a subsequent visit in July there was a distinct dampness in the lower part of the church walls. The dampness was not associated with damage, rather it simply appeared as a "tide mark"
- Rising damp is not causing widespread damage at the moment. Deterioration of stonework is dispersed and occurs at various heights in the walls. The damp appearance in stonework appears to be cyclical and possibly becomes more evident in the colder weather in winter.
- The concrete apron and skirt that was installed around the church to stabilise the footings is helping to maintain more constant moisture content in the ground. This is a good thing as is evidenced by the performance of the stonework. The skirt lessens dramatic fluctuation in ground moisture but does have the effect of keeping the ground constantly moist. This helps footing performance but may have the compromise of keeping moisture in the soil. This moisture level has not been enough to cause rising damp appearing in the warmer months. Rising damp can be more obvious in winter because the atmosphere and the ground are generally wetter.
- Moisture levels in the soil under the skirt could be confirmed by testing over a period of 12 months however it is probably better to put effort into a moisture barrier in the wall.
- The external stonework to the building is performing quite well and it is apparent that the previous installation of the concrete skirt has been very successful. That said there are still some areas of minor cracking in the stonework.
- There is some recent repair work to the stone that has been very poorly executed in that it uses what seems to be a cement rich mortar. This is both elastically wrong and could in time have a detrimental effect on the performance of these sections of wall.
- There is evidence of localised deterioration of some individual stones in the façade. This is most likely the result of decay of softer stone rather than a rising damp problem. They occur at all levels and in some cases quite high in the façade.
- The paving around the church appears well graded and falls away from the building. There is however some moss developing in the shady areas of pavement.

- Sections of stone corbels are missing from around some windows particularly around the higher windows to the bell tower.
- The crypt is dry and performing well.

Our recommendations are:

- Consider the relative weight compared to the original timber shingle of any future roofing material proposed for the building.
- Replace missing stone corbels when appropriate. In the meantime inspect these areas closely to ensure the remaining pieces are sound and not likely to fall.
- Remove cement rich mortar.
- Replace any isolated deteriorated stonework using lime rich mortar to match the original stone construction.
- Whilst rising damp is not causing widespread damage at the moment it is becoming more apparent in the colder months and should not be left unaddressed. A considered approach to mitigating dampness should be investigated. Options include:
    - Monitor the dampness for evidence that it may be causing damage.
    - Consider the installation of a new damp proof membrane. This can be by way of an injected chemical membrane or an electronic form of protection. There are many products and systems available and these should be thoroughly investigated before a system is chosen. Some options are shown in appendix D.
- Minor cracking in the walls should be monitored and localised repair and replacement undertaken as required. Monitoring should be formal with measurements taken and recorded on a regular basis for future scrutiny.

Lichgates

These are timber framed structures with timber shingle roofs. They are performing well but need some maintenance.

- The roof of the lichgate at the Constitution Avenue entrance is performing particular well. Some timber shingles are loosed and displaced in places.
- The lichgate to the Amaroo Street entrance is performing reasonably well however there is sign of foundation movement causing cracking in the stone plinths.

Our recommendations are:

- The timber shingles require maintenance and refixing in places.

- The damage stonework to the Amaroo Street Lichgate will need repair to stop deterioration accelerating in time. Given its scale underpinning is most likely not warranted. Rather careful removal and repair of damaged stone will be required. Improved footings could be considered as part of the reconstruction.

Detailed photographs are included in appendix E

If we can help you further with this advice do not hesitate to contact us.

Regards,

Bryan Cossart
Principal

reviewed by,

Scott Bland
Principal

Appendix A

ROGERS +JEFFERIS
CONSULTING ENGINEERS

Rogers + Jefferis Pty Ltd
ABN 27 083 523 479

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Fax 02 6281 6344
E-mail rjeng@rjeng.com.au

3 March 2002

Robert Brooks
Robert Brooks & Associates
41 Jacka Crescent
CAMPBELL ACT 2612

Dear Robert,

St John's Schoolhouse Museum
Structural inspection of cracking to walls

An inspection of the above mentioned building was undertaken on 18 December 2001.

The purpose of the inspection was assess the structural condition of the walls exhibiting the cracking, to determine the likely cause of the movements and propose any remedial action required to address the observed problems.

The inspection was in the form of a visual survey. This survey was carried out to both the interior and exterior areas of the building. The ceiling spaces and sub floor spaces were not accessed.

Reports regarding involving investigations and remedial restoration dated 13 March 1968 and 1992-1993 were read by our office.

No testing of materials or elements was undertaken.

No excavations were carried out adjacent to the building.

This report should only be reproduced in full.

Findings

The 100 plus year old stone building was found to be in good condition and very well maintained.

All walls other than the eastern sector of the building are in a sound condition, with no perceptible cracking other than the usual non-consequential hairline cracks.

The eastern newer section of the building contains walls that are cracked – cracking characteristic of those caused by foundation movements. This section of the building is approximately 5000mm in length by the full width of the building.

The cracks in this area emanate from door and window openings, and also at the junctions of the internal and external walls.

The cracking observed is not at present threatening the structural integrity or stability of the walls in question. The cracking is however bad enough to require remedial action – firstly to arrest future movements, and secondly to repair visible damage to the walls to enhance the aesthetics of the building and to restore "peace of mind" for the occupants.

The perimeter of the building has been paved with concrete to ensure surface water does not soak into the ground against the building, affecting the founding material and hence the performance of the footings.

Large conifer trees, approximately 16 metres in height are within 10 metres from the SE corner of the building. It is a good rule of thumb that the possible "zone of influence" of the tree roots on foundations is equal to a circle with a radius equal to the height of the tree. This would mean anything closer than 16 metres could be adversely affected by the tree. The effect of the roots would diminish as one moved out from the centre of the zone of influence.

The cause of the cracking is most likely due to the following: -

- Footings being founded upon poorly consolidated ground which may have at some stage been disturbed prior to construction. The combination of the superimposed loads of the building plus possibly ingress of water may have caused the material to consolidate and the footings and wall to drop.

- Footings founded upon reactive clays that expand and contract with the changes in the moisture content of the ground. These moisture changes may be attributed to both wet and dry weather periods and also as a result of the trees drawing moisture from the ground under the building's footings.

  It must be pointed out that some efforts have been undertaken in 1990 to stabilise the moisture content in the ground immediately outside the school house. This was achieved by providing a 1500mm deep x 200mm wide concrete cut-off skirt around the eastern half of the building. Impervious paving was then poured between this skirt and the external walls to the building.

  The skirt probably has worked to a fair degree, minimising moisture induced movements and hence cracking to the walls. Unfortunately further movements indicate that additional remedial work is required.

In either case the footings would probably not be stiff (deep) enough to accommodate the differential movements within the founding material.

Recommendations

We recommend the following remedial work to stabilise or at least dramatically reduce the amount of movements occurring in the wall.

1. The moisture content of the ground should be stabilised as much as possible. To this end the stormwater system should be checked to ensure all stormwater is carried away from the building plus gutters and downpipes should be maintained in a clean condition. Otherwise this item has been attended to with the cut-off skirt, installed in 1990.

2. Having already endeavoured to stabilise the moisture in the ground, the ongoing cracking indicates that further remedial work is required – underpinning the east wall with four underpins down to a more stable and less reactive material. A detail of this work is attached. Please note that the actual depth of the underpinning required is unknown and is dictated by the depth at which stable material can be found. To found the underpins on anything less than firm stable ground will be a waste of time and money.

   A geotechnical survey was carried out by Coffey Partners in August 1990 with a hand auger. The auger could only reach a depth of 700mm due to refusal on a layer of cobbles and gravel. This could possibly be fill material overlying reactive slope wash clays – we will only know the true profile of the ground when we start drilling the underpins.

   The cost of the four underpins will probably be in the order of $ 4000.00, with an additional $ 3000.00 to cut away paving to facilitate the underpinning, and then reinstating it once the underpinning has been completed.

3. Once the underpinning work is completed the wall should be left for several months before the cracks and gaps are repaired. This will allow the footings and wall to stabilise to the new conditions. The cracks and damaged jointing should then be raked out for at least 100mm depth of the wall on either side and filled with a cement or epoxy mortar and then re-rendered and painted.

Summary

The cracking to the walls in the eastern end of the Schoolhouse is due to localised minor movements within the footings. Remedial work in the 1990's has more than likely reduced the variations in the moisture content of the ground. Apparently this work was not enough to arrest the movements to the eastern end of the building.

Although the cracking has not impaired the structural stability of the walls, we recommend that the remedial work be undertaken to stabilise the footings and minimise further damage. We believe that this remedial work is a very important in helping with the preservation of this wonderful historic building.

We note that we have successfully undertaken similar underpinning work the eastern wall of All Saints Church, Ainslie and to the western side of the main building at the Mittagong Railway Station. Both buildings were constructed of stone walls and footings.

The stiffness of the stone walls in these two projects were more than sufficient to span between the underpins. It must also be noted that the underpinning dramatically reduced the movements that were occurring within the walls of these buildings.

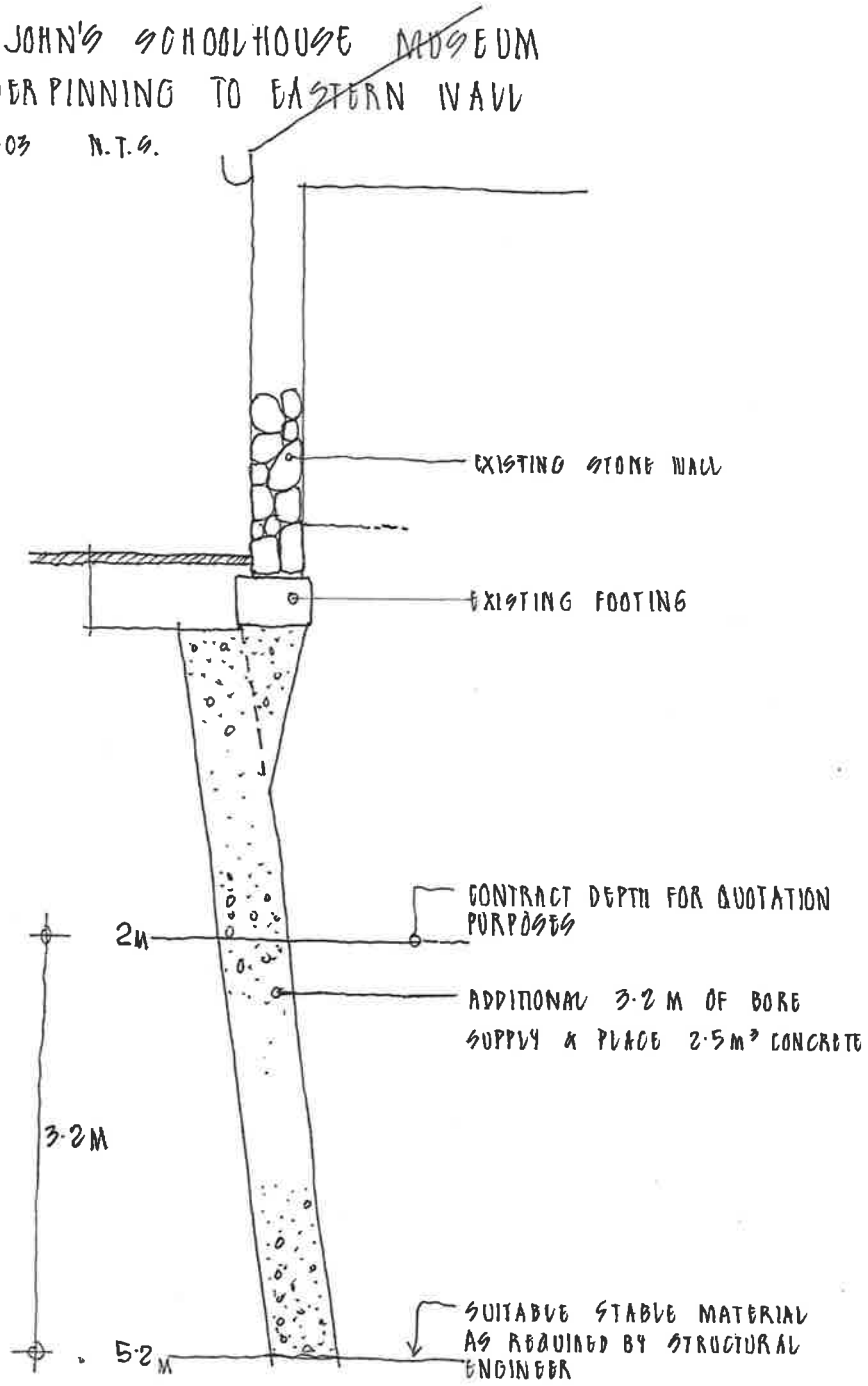
We have no reason to doubt that similar underpinning will also significantly arrest movements to the walls in the Old School House.

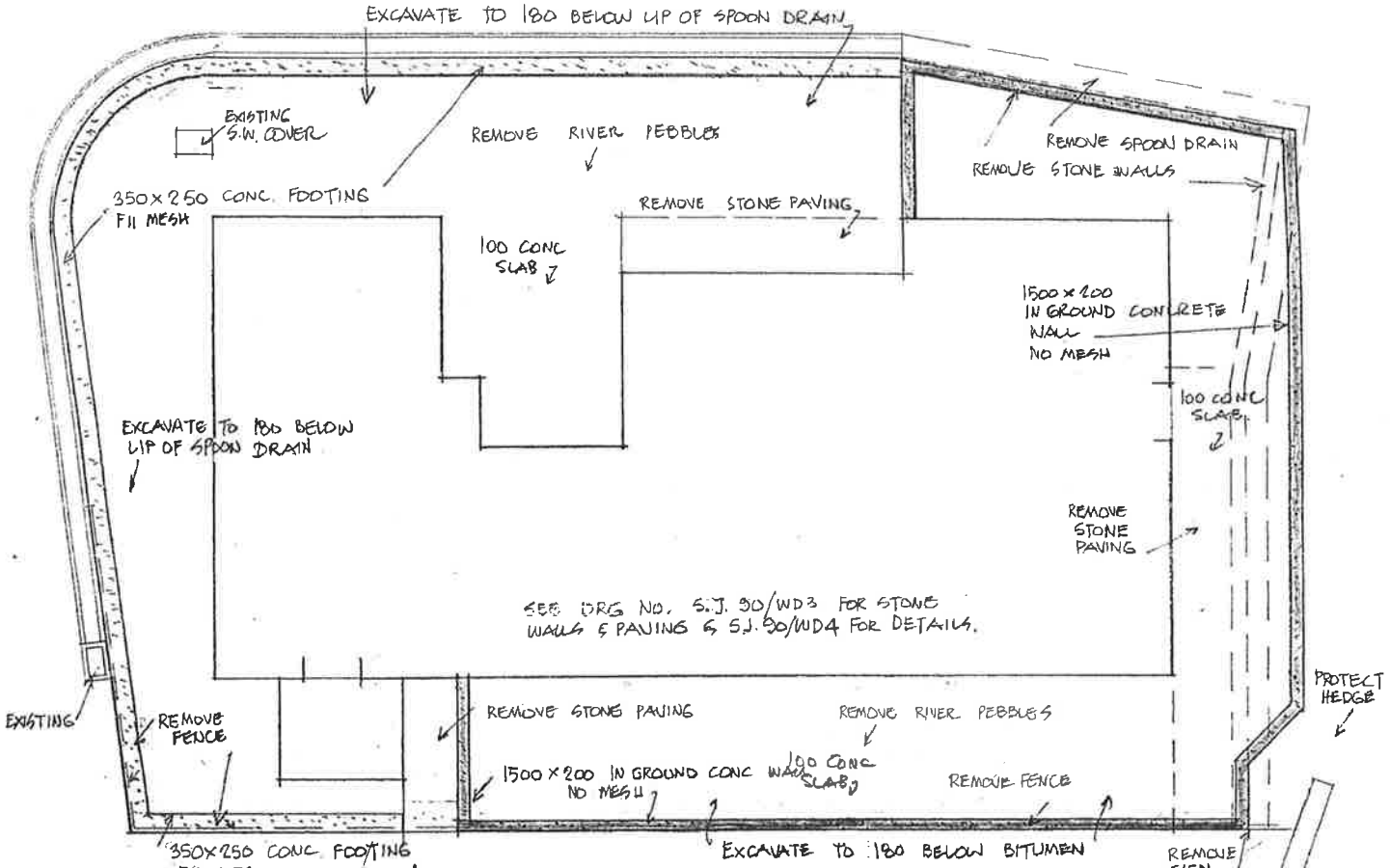
Should you wish to discuss any aspects of this report please don not hesitate to contact us,

Yours faithfully

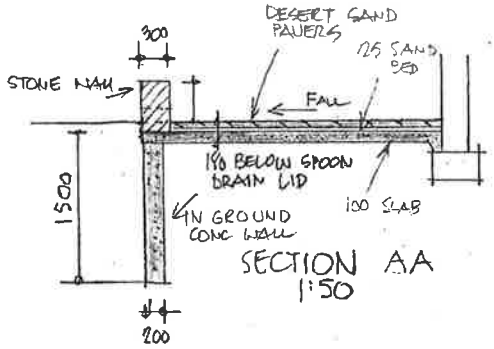
Ron Rogers
Rogers + Jefferis Pty Ltd

ST JOHN'S SCHOOLHOUSE MUSEUM
UNDERPINNING TO EASTERN WALL
10·2·03 N.T.S.

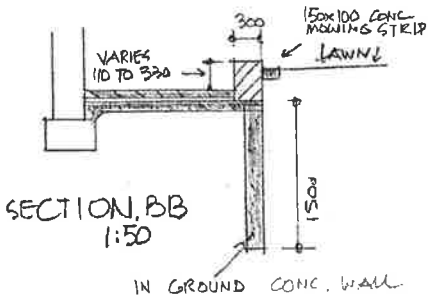




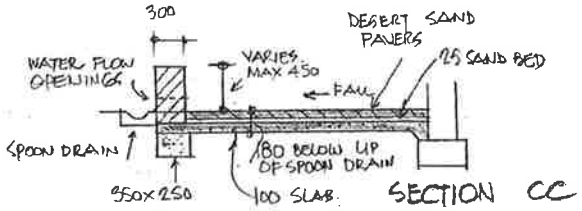
ST. JOHN'S CHURCH OLD SCHOOL HOUSE MUSEUM, REID, ACT
BUILDING STABILISATION. 1:100
EXCAVATION & CONCRETE PLAN. 1:100 JG
DRG NO SJ 90/WD2
17.2.93



SECTION AA
1:50



SECTION BB
1:50

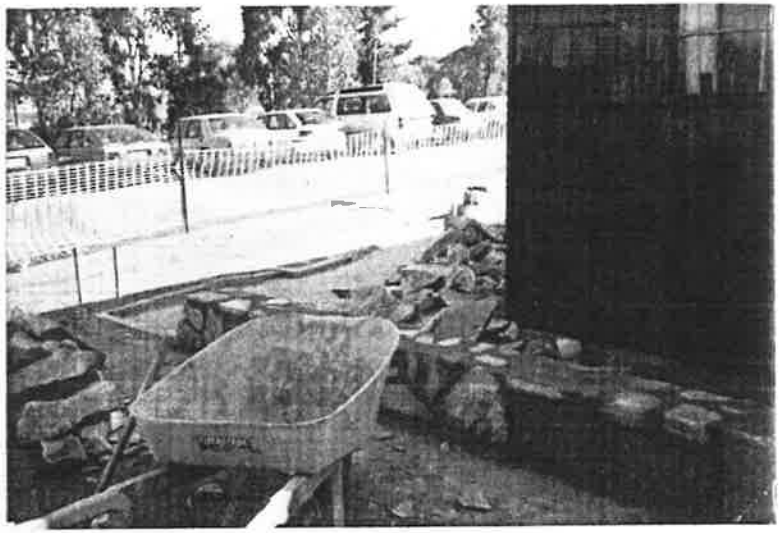


SECTION CC

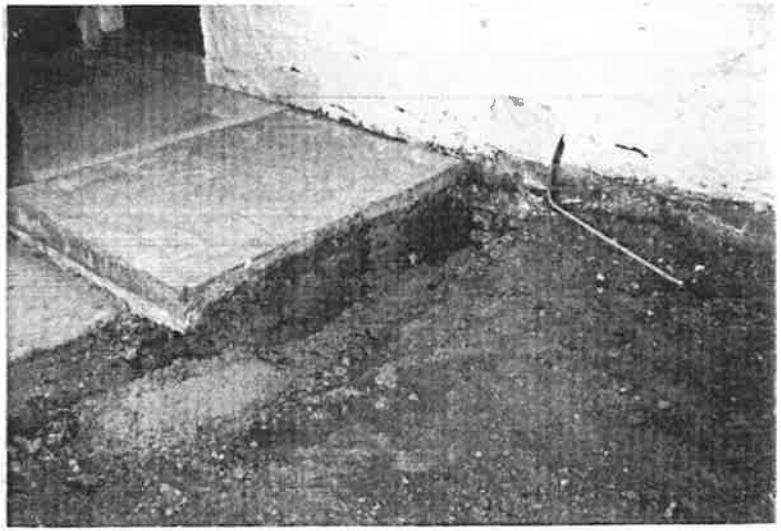
ST. JOHN'S CHURCH OLD SCHOOL HOUSE MUSEUM, REID, ACT.
BUILDING STABILISATION:
DETAILS

1:50 JG

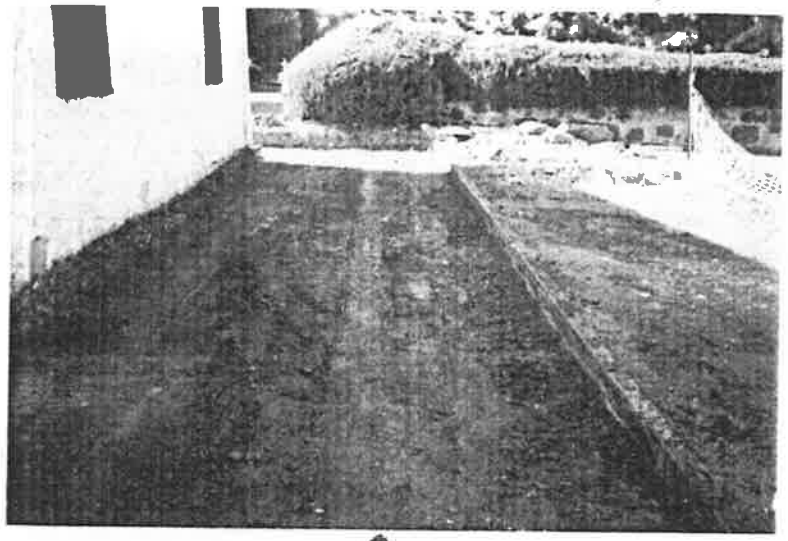
DRG NO
ST 50/WD 4
17.2.93



N.W CORNER OF SCHOOLHOUSE NEAR FRONT PORCH

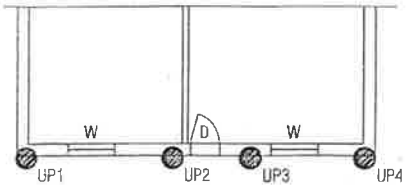


START OF THE 1 METRE DEEP MOISTURE RETAINING WALL RUNNING N TO S AT FRONT DOOR OF SCHOOLHOUSE AND CONTINUING AROUND BUILDING



CONTINUATION OF INGROUND CONCRETE MOISTURE STABILISING WALL ALONG SOUTH WALL OF SCHOOL-HOUSE

CONTINUATION OF 1 METRE DEEP INGROUND CONCRETE MOISTURE STABILISING WALL ALONG EAST WALL OF SCHOOLHOUSE



Part plan proposed underpinning (Eastern End Building)

The builder shall at all times provide protection to the building being underpinned to ensure no damage occurs during construction or after completion of the underpinning.

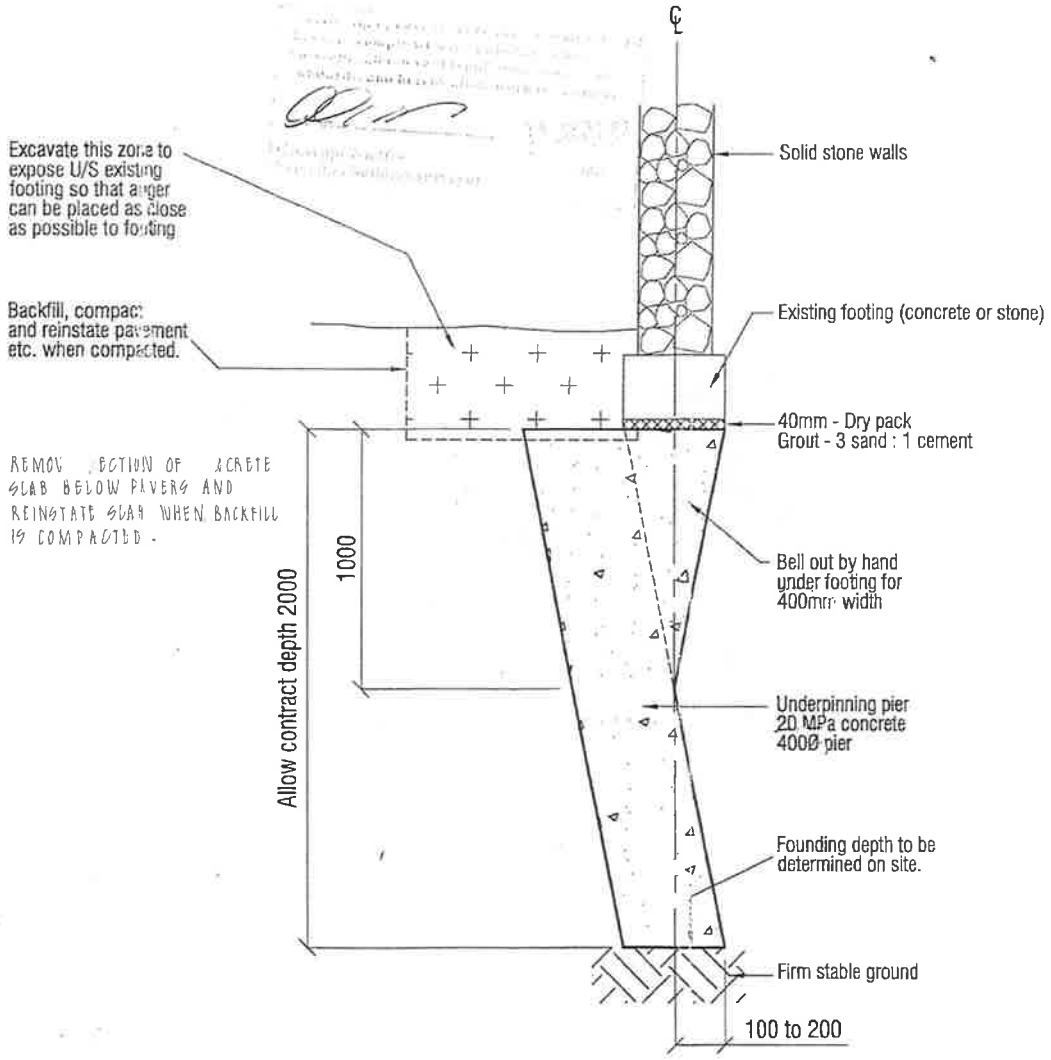
Underpins can be excavated and constructed at the same time.

The footing to be underpinned shall be exposed only for the width of the pin. Sections shall be poured up to within 40mm of the underside of the existing footing and left 24 hrs minimum before grouting commences.

Caulking mix shall be 3:1 graded coarse sand to cement. This mix shall be placed near dry and thoroughly rammed into place.

Concrete in each underpinning section shall be placed against natural ground except possibly the top external face which shall be formed to a tolerance of + or - 20mm of a vertical line from the front face of the existing wall. The inner face need not be formed if the excavated earth stands satisfactorily. Otherwise rough formwork shall be used and voids behind the form properly backfilled with compacted cement stabilized sand or cement.

The bottom 300mm of the underpinning shall be embedded all round in undisturbed material unless otherwise noted. Safe bearing capacity of the ground at the bottom of the underpins shall be 200KPa min.



Detail Bored Underpin

NO.	ISSUE / AMENDMENT	DATE	BY
A	FSP	11.02.02	

0 1 2 3

ROGERS + JEFFERIS CONSULTING ENGINEERS
Rogers + Jefferis Pty Ltd
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61 Dundas Crt Phillip ACT 2606
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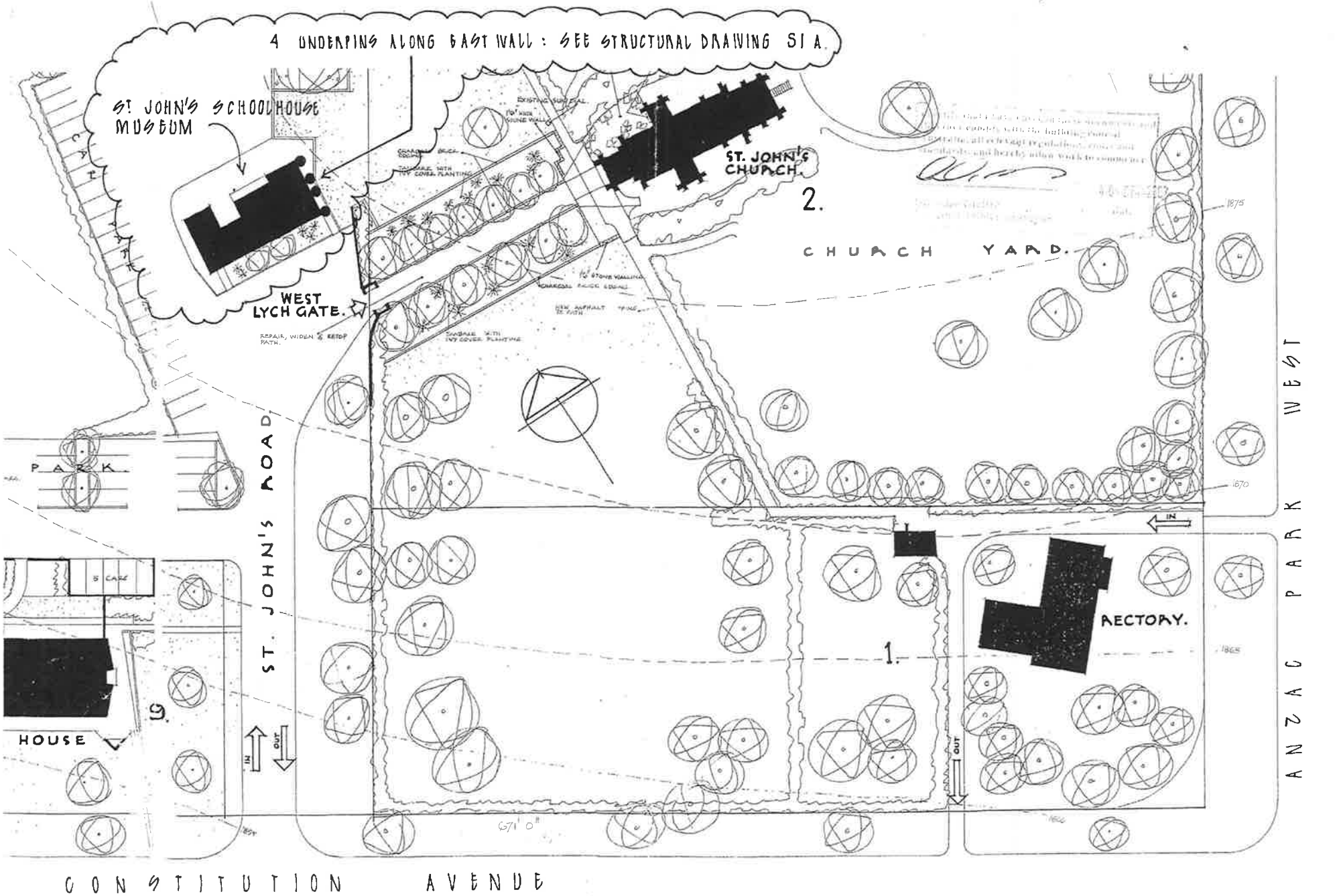
Fax 02 6281 6344
Email rjeng@rjeng.com.au

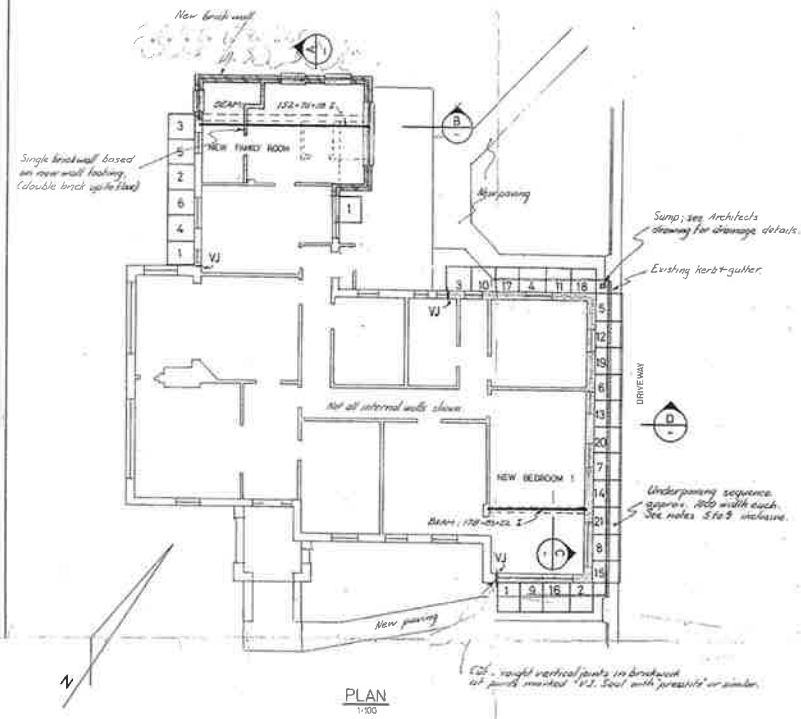
PROJECT
St. John's School House Museum
BLOCK 10 SECTION 33 . . REID

DRAWING
Underpinning To Eastern Wall

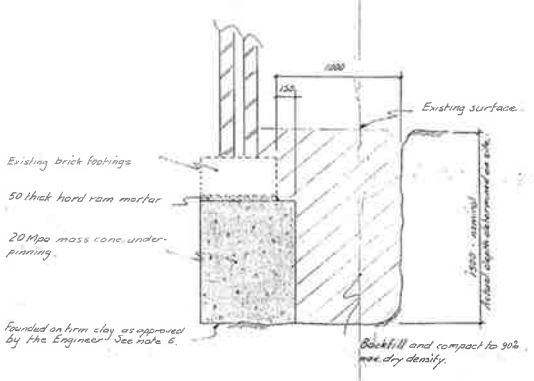
DATE	
Feb 2002	
DESIGN	DRAWN
RR	JC
JOB NO.	DWG NO.
02125	S1 A


4 UNDERPINS ALONG EAST WALL : SEE STRUCTURAL DRAWING S1 A.
ST. JOHN'S SCHOOLHOUSE MUSEUM
ST. JOHN'S CHURCH.
2.
CHURCH YARD.
WEST LYCH GATE.
REPAIR, WIDEN & RETOP PATH.
PARK
ST. JOHN'S ROAD
RECTORY.
1.
HOUSE
9.
IN
OUT
IN
OUT
ANZAC PARK WEST
CONSTITUTION AVENUE
1875
1870
1865
G71' 0"

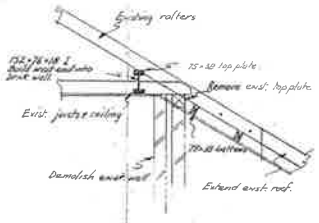
Appendix B



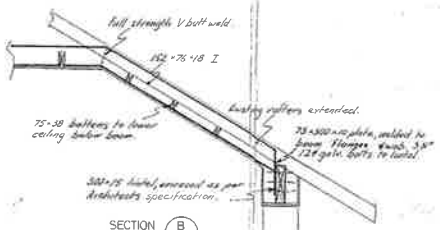
PLAN
1:100



UNDERPINNING DETAIL
1:20

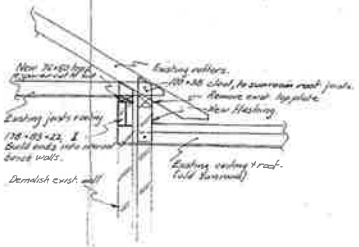


SECTION A



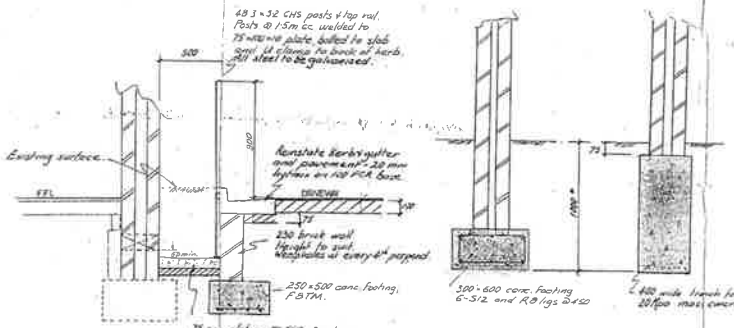
SECTION B

NOTES 1. Roof tiles & battens not shown.
2. Actual location of joists, rafters etc. to be determined on site prior to welding & cutting beams.
3. Beams to be bedded on brick walls, bearing length 100 min.
4. Extended rafters to be lapped as with 3 off equally spaced 12 ø galv. bolts.
5. Refer to Architects drawing for details not shown.



SECTION C

BEAM DETAILS
1:20



SECTION D
1:20
Similar detail adjacent with at N.E. & S.E. corners.

NEW WALL FOOTING
1:20
* Footing depth to be nominally 1000 below natural surface. Actual depth to be determined on site.

APPROVED FOR CONSTRUCTION BY THE HOLDER OF A * - CLASS LICENCE.
TYPE OF CONSTRUCTION APPROVED:
DATE OF APPROVAL: 5 JUL 1981
DEPUTY BUILDING CONTROLLER UNDER BUILDING ORDINANCE 1972

BUILDINGS (DESIGN AND SITING) ORDINANCE 1964 AS AMENDED
APPROVAL GRANTED 4.8.81
DELEGATE
NATIONAL CAPITAL DEVELOPMENT COMMISSION

GENERAL NOTES:

1. This drawing is to be read in conjunction with the Architects drawing No. SJ 1981/1. Do not scale from this plan. All dimensions are to be verified on site prior to construction.

2. Initial soil survey results:
   0-900mm depth, alluvium of red brown sandy silty clay and quartz gravel.
   over 900mm depth, alluvium of yellow brown highly plastic clay interbedded with red sandy clay and gravel.

3. The Contractor shall familiarise himself with the location of existing services and to take care to ensure that they are maintained in an operating condition during construction and on completion of the works. Particular care is to be taken to ensure foundations are not undermined at excavations due to ingress of water and/or collapse of the sides of excavations.

4. All concrete to have the following properties; characteristic compressive strength 20MPa, slump 80mm, max. aggregate 20mm.

5. Hard ram mortar shall be a homogeneous mixture of sand and cement (2:1 by volume) with water content such that it will produce a mixture of the consistency of "damp earth" and shall be to the Engineers approval.

6. Excavation and underpinning is to be carried out in the sequence shown. The excavation shall be free from loose earth and water at the time of placing concrete. Levels of the bottoms of excavations shall be determined by the Engineer following excavation of the first sections.

7. The depth of driveway sections 1,9,18,3,10,16 and front side sections 1 and 4 are to be transitions from 300mm below existing foundation level to full depth of underpinning.

8. No more than 2 No. excavations are to be open at any time on each side except on the driveway side 5 No. may be open.

9. Allow a minimum of 48 hours after concreting before placing hard ram mortar and a further 24 hours following hard ram mortar before excavating on either side of underpinning pier.

10. Demolition of walls and floors etc shall be carried out in a manner and sequence to the approval of the Engineer. Props for ceiling and roof members shall have adequate strength and stability for the expected dead loads and live loads due to construction.

11. Steel beams replacing demolished walls shall be coated with suitable red oxide zinc primer. Beams shall be built into walls and anchored in an approved manner. Rafter and ceiling joist connections to beams shall be as approved by the Engineer.

12. The Contractor shall supply and place adequate strutting and roof framing members to strengthen the existing roof structure in the areas of Bedrooms 1 & 3 and the new Family room. These works shall be to the approval of the Engineer and shall result in removing the sag from the roof at these locations.

05 AUG 1981

CLIENT: THE RECTOR AND CHURCH WARDENS OF ST. JOHNS ANGLICAN CHURCH REID ACT

W.P. Brown & Partners Pty. Ltd.
CONSULTING ENGINEERS
MELBOURNE CANBERRA SYDNEY

PROJECT: RECTORY - ST. JOHNS CHURCH REID ACT

DRAWING TITLE: PROPOSED UNDERPINNING AND ALTERATIONS - STRUCTURAL DETAILS

DESIGNED: CJS | DRAWN: CJS | CHECKED: | APPROVED: | DATE: 9 JUNE 1981

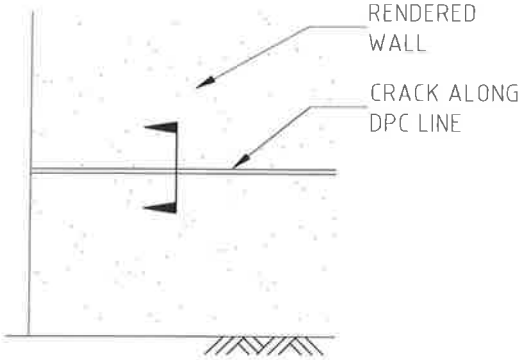
SCALE: as shown

DRAWING NUMBER: C 824/1

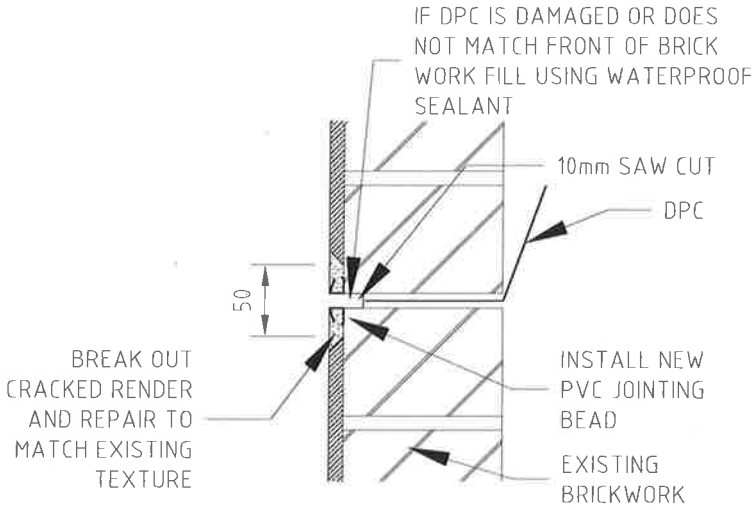
ISSUE:

Appendix C

NEW JOINT AT DPC IN EXISTING RENDERED WALL

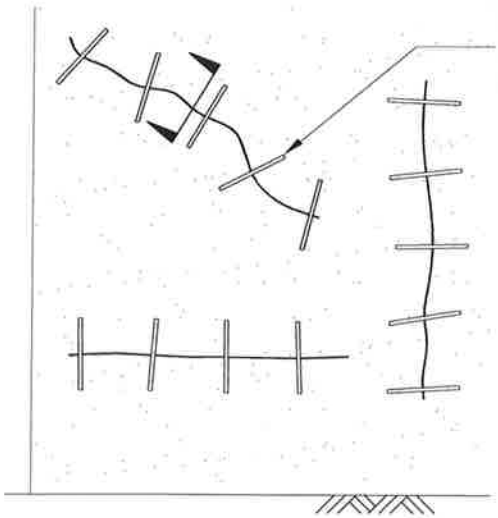


CRACK ALONG DPC IN RENDERED WALL
ELEVATION
SCALE: 1:20

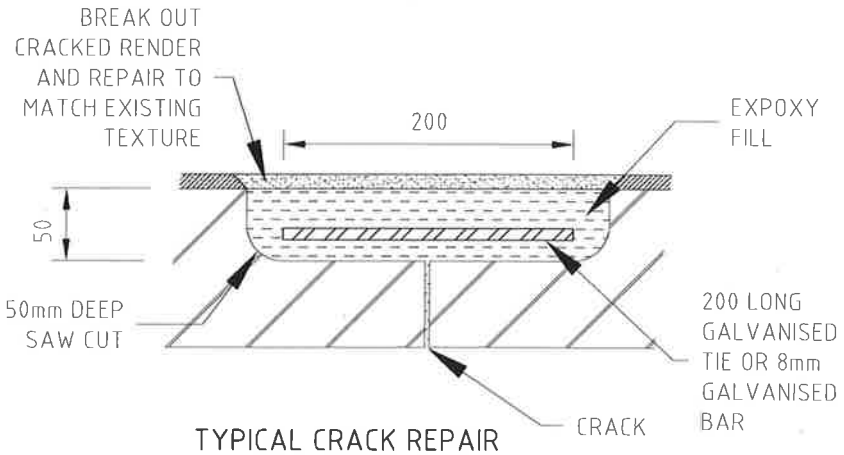


NEW JOINT DETAIL AT DPC IN RENDERED WALL
SECTION
SCALE: 1:5

DIAGONAL, VERTICAL & HORIZONTAL CRACK REPAIR IN RENDERED WALL



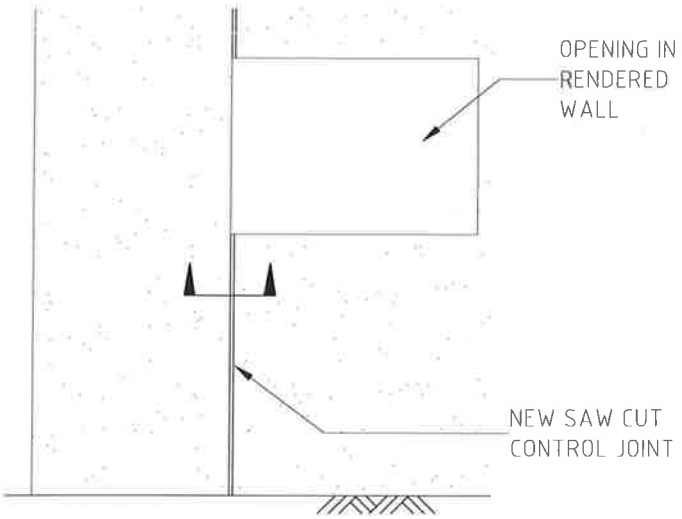
DIAGONAL CRACK REPAIR IN RENDERED WALL
ELEVATION
SCALE: 1:20



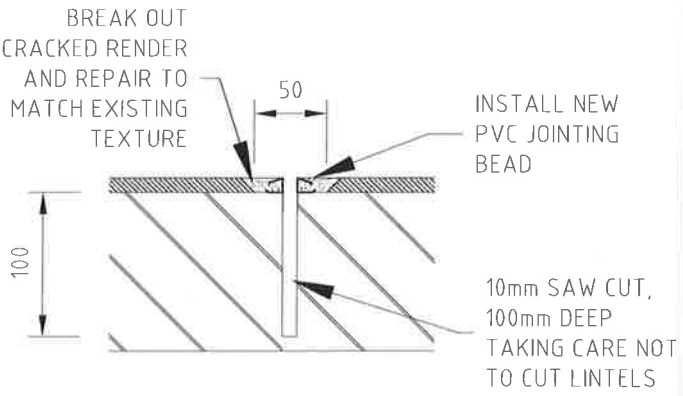
TYPICAL CRACK REPAIR DETAIL
SECTION
SCALE: 1:5

TYPICAL MASONRY REPAIR DETAILS	NORTHROP Bringing people, ideas & engineering together Canberra 15 Allree Court, Phillip ACT 2606 Ph (02) 6285 1822 Fax (02) 6285 1863 Email canberra@northrop.com.au ABN 81 094 433 100	DATE:	20.02.2014
RENDERED WALLS		DRAWN:	AS
		SCALE:	AS NOTED
		JOB NUMBER:	xxxxxxxx
		DRAWING NUMBER:	RBR – SD1

NEW CONTROL JOINT IN EXISTING RENDERED WALL

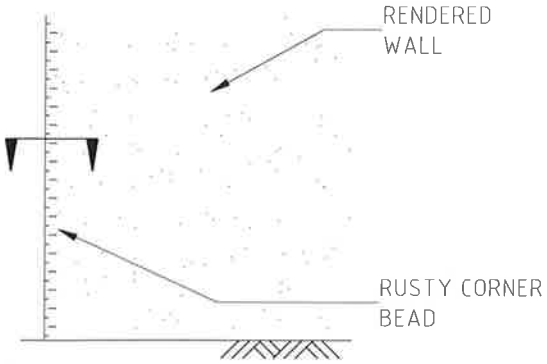


NEW CONTROL JOINT
INTO EXISTING RENDER WALL
ELEVATION
SCALE: 1:20

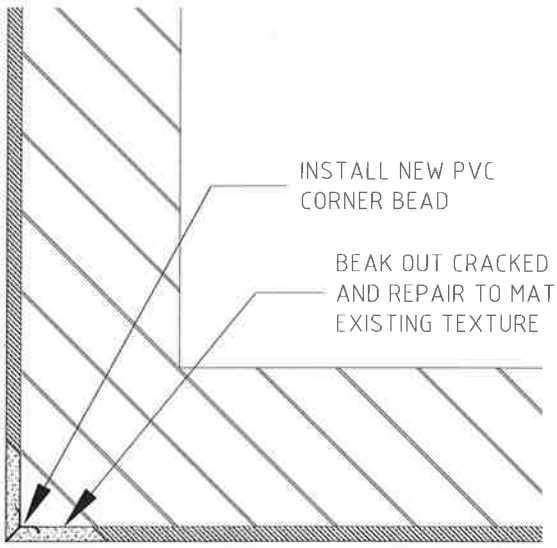


TYPICAL NEW CONTROL
JOINT DETAIL
SECTION
SCALE: 1:5

NEW CORNER BEADS TO REPLACE RUSTING BEADS IN EXISTING RENDERED WALL



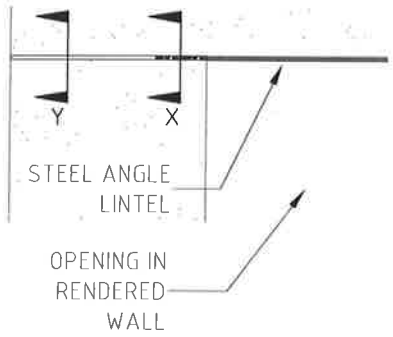
NEW CORNER BEADS TO REPLACE
RUSTY CORNER BEADS
ELEVATION
SCALE: 1:20



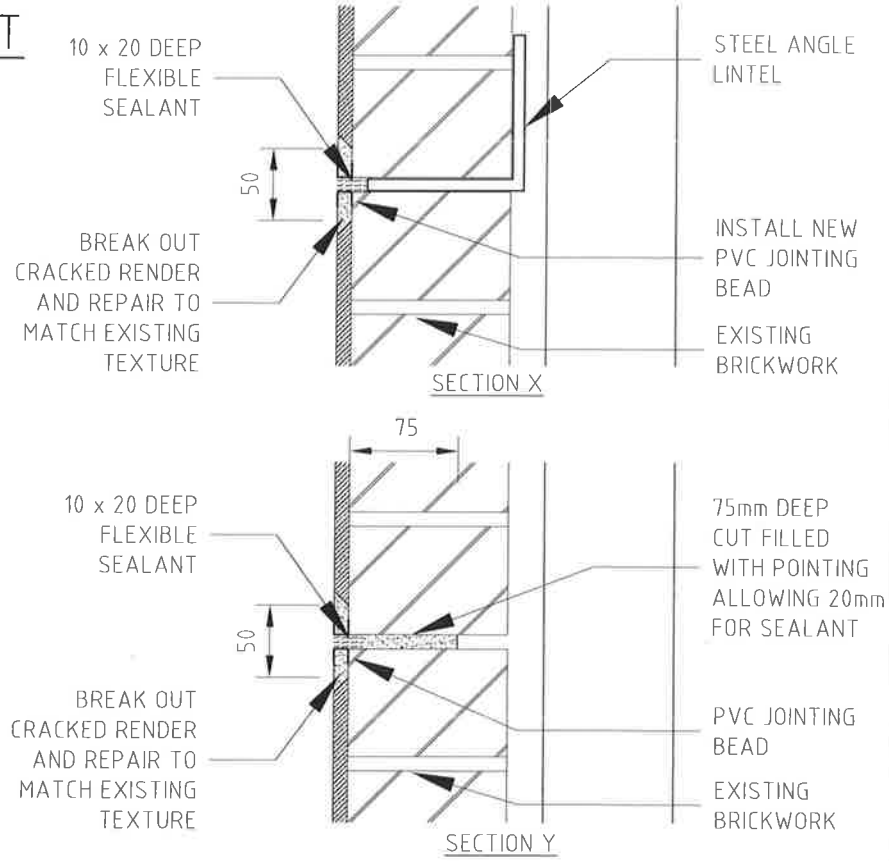
TYPICAL NEW CORNER
BEAD DETAIL
SECTION
SCALE: 1:5

TYPICAL MASONRY REPAIR DETAILS	NORTHROP Bringing people, ideas & engineering together Canberra 15 Altree Court Phillip ACT 2606 Ph (02) 6285 1822 Fax (02) 6285 1863 Email canberra@northrop.com.au ABN 81 094 433 100 24 of 71	DATE:	20.02.2014
		DRAWN:	AS
RENDERED WALLS		SCALE:	AS NOTED
		JOB NUMBER:	xxxxxxxx
		DRAWING NUMBER:	RBR – SD2

NEW HORIZONTAL JOINT AT LINTEL IN EXISTING RENDERED WALL



HORIZONTAL JOINT INTO EXISTING RENDER WALL
ELEVATION
SCALE: 1:20

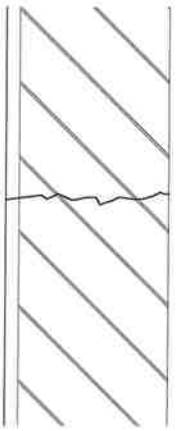


NEW JOINT DETAIL AT LINTEL IN RENDERED WALL
SCALE: 1:5

REPAIR/FILL ALL CRACKS, MATCHING RENDER TEXTURE AS BEST AS POSSIBLE.

PAINT RENDERED WALL WITH HIGH BUILD TEXTURED PAINT SUCH AS PARCHEM EMER-CLAD OR DULUX ACRATEX-ACRASKIN.

VARY THICKNESS OF PAINT DEPENDING ON EXTENT OF CRACKING. THE THICKER THE BETTER, TYPICALLY 350um-500um . MULTIPLE COATS MAY BE REQUIRED. APPLY WITH TEXTURED ROLLER IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.



TYPICAL MASONRY REPAIR DETAILS

RENDERED WALLS

NORTHROP
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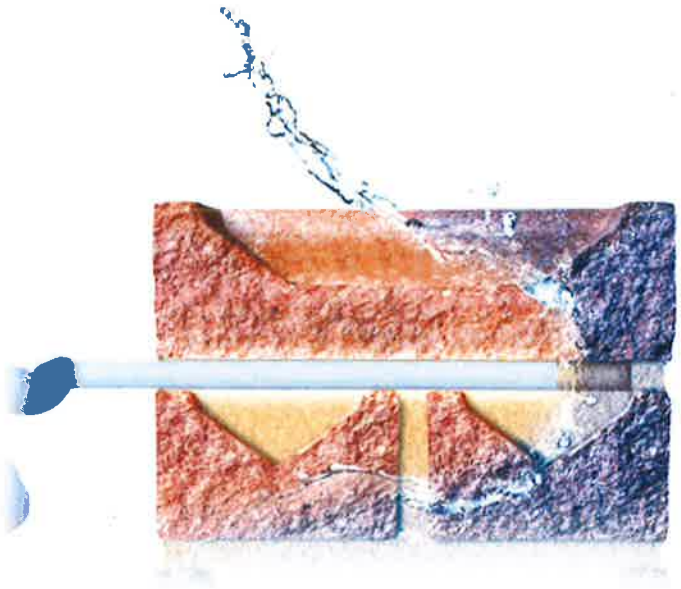
Email canberra@northrop.com.au ABN 81 094 433 100

DATE:	20.02.2014
DRAWN:	AS
SCALE:	AS NOTED
JOB NUMBER:	xxxxxxxx
DRAWING NUMBER:	RBR – SD3

Appendix D

DRYROD

What are Dryrod Damp-Proofing Rods?



Dryrod Damp-Proofing Rods are the next generation treatment for rising damp. They provide a higher level of performance and quicker installation speed than any other rising damp treatment currently available.

Dryrods are 12mm diameter, 180mm length, fibre rods that contain a powerful water repellent. The patented, and BBA Approved, Dryrod delivery system ensures the correct dose of active ingredient is delivered to the wall every time, permanently eradicating rising damp.

No fuss, no mess, no stress.

For detailed information visit www.dryrods.com

How to Install Dryrod Damp-Proofing Rods

The Dryrod Damp-Proofing Rods are simply introduced into a series of 12mm holes drilled into the lowest available continuous mortar course. No special equipment is required.

Once the damp-proofing rods are installed, they diffuse the active ingredient deep into the wall before it cures to form a water-repellent barrier. This prevents the damp from rising up the wall.

Prepare your drill

Drill holes at 12cm Intervals

Coverage

Number of rods required per 10m stretch of wall

Wall depth	4½" (110 mm)	9" (220 mm)	13½" (330 mm)	18" (440 mm)

SAFEGUARD
MAKING BUILDINGS DRY

Rising Damp & its Control

A guide to identifying the various forms of dampness encountered in buildings and control of rising damp through remedial action.

www.safeguardeurope.com

A publication by Safeguard Europe Ltd.

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Rising Damp and its Control

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Dryzone injection process and making good	13
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A publication by Safeguard Europe Ltd on the identification and control of rising damp, also available from www.safeguardeurope.com.

Preface

Rising damp is not the most common form of dampness encountered in buildings; this is left to condensation. However, it is very likely that a high proportion of older buildings are affected by rising damp to some degree or another, and it does cause problems with positive identification, appropriate remedial action and ancillary works.

This manual has been produced to enlighten and inform those who are in some way involved with the control of rising damp in buildings. It assumes the reader already possesses a basic knowledge of the subject and therefore hopes to expand upon this.

The manual deals with the most common situations encountered with regard to rising damp and remedial action. It does not cover structural waterproofing (tanking).

This manual outlines the identification of dampness problems in buildings and the use of Dryzone damp-proofing cream and ancillary works for the control of rising dampness. This book should be read thoroughly to become familiar with the system prior to undertaking any works.

It is also important that the user of Safeguard damp-proofing systems is thoroughly familiar with BS 6576:2005, "Code of practice for diagnosis of rising damp in walls of buildings and installation of chemical damp-proof courses" around which this publication is based.

Finally, the installer of any chemical damp-proof course system must be aware of any risk and hazards which the processes might cause, and therefore be aware of their duties under the COSHH Regulations. Also it is prudent to ensure that the property owners have complied with the Party Wall Act 1996 where appropriate.

Note on British Standards/Publications referred to in this document:

The following publications are referred to throughout this book:

BS 6576
BS CP102 1973
BRE Digest 245

Although these publications were produced in the UK, the techniques and methods described can be used in any country.

Rising Dampness

Rising damp in buildings may be defined as the vertical flow of water up through a permeable wall structure, the water being derived from ground water. The water rises through the pores (capillaries) in the masonry by a process loosely termed 'capillarity'. In other words the masonry acts like a wick.

The height to which the water will rise depends on several factors including pore structure and rate of evaporation. Masonry containing a high proportion of fine pores will allow the water to rise higher than a coarse pored material; basically the water is carried up the wall in the finer pores and not those of large diameter. The average size of pores in masonry gives a theoretical rise of around 1.5 meters but where evaporation is severely retarded, for example by the use of impervious membranes, moisture can sometimes rise in excess of 2 metres.

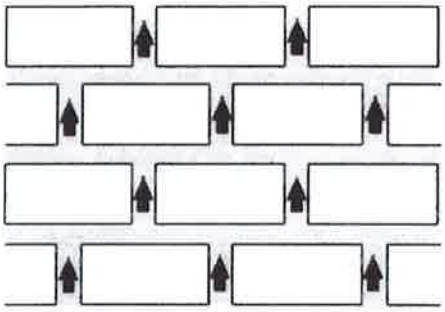


Figure 1: Water rising through mortar beds

The major paths through which the water rises are the mortar beds; this is illustrated in Figure 1. For water to rise through the bricks then it must cross a mortar bed. In effect the mortar beds form the only continuous pathways for water rising through the wall. If a house is built from impervious bricks then water can still rise through the mortar bed but if an impervious mortar is used then no water will rise even if the bricks are very porous. The mortar beds will form an important part in the chemical treatment for rising dampness.

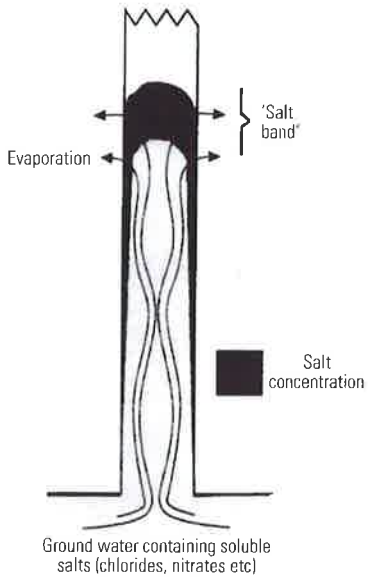


Figure 2: A rising damp complex

Ground Water

Ground water contains small amounts of soluble salts, the most significant of which are chlorides, nitrates and sulphates. These pass with the water up the wall and are left behind when the water evaporates. Over many years of active rising dampness large quantities of these salts accumulate within the masonry and decorative surface, most becoming concentrated in a general 'salt band' towards the maximum height of rise as illustrated in Figure 2. Frequently, the concentrations of these salts are very low towards the base of the wall.

Both chlorides and nitrates are usually hygroscopic, i.e., they can absorb moisture from the surrounding environment and, in general, the greater the amount of salts the greater the absorption of moisture especially under humid conditions. Thus, even though rising dampness may have been controlled by the insertion of a remedial damp-proof course these salts alone can cause the wall and any contaminated decorations to remain damp.

Damp-proofing

Therefore, to provide a 'dry' wall and a suitable surface to take new decorations the Safeguard Damp-proof Course Systems involve two fundamental processes:

1. The insertion of the chemical damp-proof course.
2. Removal of old contaminated plaster-work and decorations, and replacing with specialist replastering to prevent the passage of any residual moisture and contaminant salts from passing to the new surfaces from the underlying masonry.

Assessment of Dampness in Buildings

The Survey

It is essential when investigating the potential for rising dampness to eliminate other sources of water ingress. A guide to the approach to be adopted for a damp survey is as below. Care must be taken to eliminate other potential sources of moisture, especially condensation in the colder months, and it is therefore essential to ensure that a full investigation is always undertaken. If any other sources are identified then these must be first eliminated before a proper assessment of any rising dampness can be made as it can be very difficult to distinguish between two or more interfering sources of water ingress.

Should it be noted that previous damp-proofing works have been undertaken then it is essential to take great care ensuring that the evidence of dampness is correctly evaluated. The following gives a guide to onsite routine procedures for the survey:

1. External Examination:

   a. External rainwater goods, valleys, flat roofs.
   b. Condition of brickwork, stone, mortar, plinths, render, weatherproof finish, etc.
   c. Wall construction, cracks in masonry, copings, etc.
   d. External timbers including windows and doors.
   e. Air vents; their position and condition.
   f. Chimneys and flashings.
   g. Position of any remedial DPC installation including spacing and depth of holes where chemical systems have been used.
   h. High ground levels, abutting gardens walls, steps and position and integrity of any DPC system.

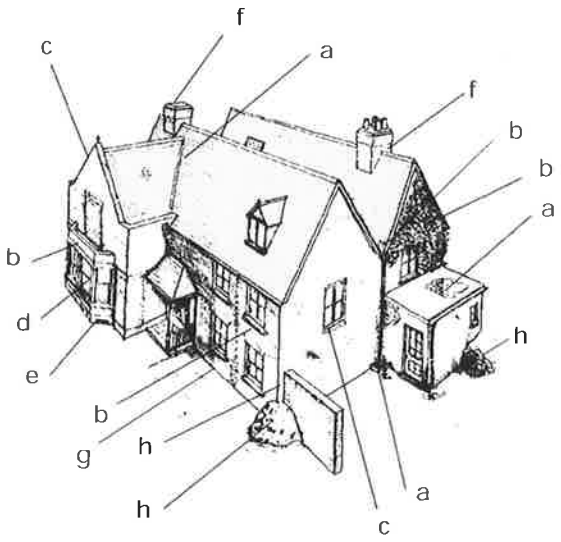


Figure 3: External examination

2. Primary Internal Examination: Visible Signs

   a. Fungal decay in skirting and/or other timbers.
   b. Peeling/blistering wallpaper, peeling/blistering paintwork.
   c. Efflorescence.
   d. Mould growth, staining.
   e. Damp/wet patches, water droplets, water runs.

3. Secondary Examination:

(assuming correct use of properly functioning and calibrated electrical moisture meter)

   a. Examine both perimeter and centre of solid/timber suspended floors.
   b. Check moisture content of timber skirting (top and base).
   c. Examine and check condition of the floor/wall junction, edge of DPM of floor.
   d. Check any remedial DPC installation including position and depth of holes (if inserted from inside).
   e. Note distribution of moisture meter readings both vertically and horizontally on the surface of walls.
   f. Check for efflorescence beneath wallpaper finishes.
   g. Note any use of polystyrene sheet/metal foil beneath wallpaper.
   h. Note any new plasterwork, height of replastering, its condition and if possible its type, e.g. renovating, sand/cement, lightweight premix gypsum, etc.
   i. Lift floorboards and thoroughly examine timbers and subsite.
   j. Check for suitable subfloor ventilation.
   k. Look for any internal plumbing defects and water dripping from cold pipes as the result of condensation.

4. Other:

   a. Check (if possible) on history and use of property.
   b. Evaluate 'lifestyle', e.g. use of central heating, paraffin or flueless gas heaters, drying, washing and cooking, degree of ventilation, etc.

Once any form of dampness has been identified then it is essential that the risk of decay to any timbers is assessed and appropriate remedial measures undertaken.
REMEMBER: a combination of dampness and wood leads to potential rot.

The primary task of the investigator is to correctly identify the source of dampness. This is best achieved by a process of investigation and elimination. Extreme care must be taken, for example, in the winter months to eliminate condensation as one of the potential causes of dampness. A basic guide to dampness problems is given in the following table.

Table 1: Guide to dampness

Observation	Possible defect
Decayed skirtings, damp base of wall, damp around edge of solid floor	1. Rising dampness 2. Rising dampness + defect in floor/wall junction 3. Faulty edge to dpm of floor 4. High ground level/failed tanking
Surface efflorescence just above skirting/floor	1. Gypsum finishing in direct contact with damp solid floor or damp masonry at base of wall 2. Gypsum finish/porous plasterwork taken below timber suspended floor and subfloor and condensation at floor/wall junction
Dampness at base of wall up to 1.5m* in horizontal band	1. Rising dampness 2. Low level rain penetration (splashback)
Stains, especially in horizontal band, noticeably damp in humid conditions.	1. Heavy contamination with hygroscopic salts
Damp patches on surface increasing in size during/following rain; sometimes heavy efflorescence	1. Rainwater penetration; external defect usually obvious
Stains/damp/efflorescence on chimney breast	1. Contaminated plasterwork from combustion products 2. Condensation in flue 3. Water running down chimney flue
Mould growth on cold surfaces, window reveals, ceiling/wall junction, etc	1. Condensation
Free surface water, water run marks, water droplets, dripping water	1. Condensation 2. Severe rainwater penetration 3. Severe plumbing leak
Damp timber floorboards around edge of floor but not in centre	1. Subfloor condensation at floor/wall junction 2. Floorboards in direct contact with damp masonry
Floorboards damp away from wall	1. Subfloor condensation
Damp at first floor level and above	1. Condensation 2. Rainwater penetration 3. Plumbing defects

*May rise higher depending on conditions

Note: disintegration of cementitious renders may be due to sulphate attack.

It is essential that the survey is carried out thoroughly and that all potential areas of dampness are noted. Special vigilance must be taken where dampness, and hence decay, may be unseen such as beneath timber suspended floors. Wherever timber and dampness coexist the risk of decay should always be reported and the client must be put on notice to that effect.

Comparisons of different types of dampness are given below. During the survey there may be several signs of dampness and it is important that they should be identified as far as possible.

Table 2: Comparing damp

Indicator	Rising Damp	Surface Condensation	Rain Penetration
Electrical moisture meter	Sharp change at top of damp	Gradual change	Usually sharp
Carbide meter	Declining gradient within wall	Dry within masonry	Probably patchy; declines away from point of ingress
Mould growth	Rarely	Yes; may be patchy	Sometimes; depends upon conditions
Water droplets/free flowing water on surface	Absent	Yes, but depends on surface and conditions	Depends upon severity
Hygroscopic salts (chloride/nitrate)	Present	Absent	Absent
Moisture in timber skirtings	High (if in direct contact with wall)	Low	Depends upon position of water ingress
Moisture above 1.5m	Sometimes	Depends upon conditions	Depends upon position of water ingress

Where there is more than one source of water ingress then it may be difficult to distinguish between their origins. Generally, the presence of active rising dampness is indicated by excessive moisture at the base of the wall which slowly declines on going up the wall. This moisture gradient is usually observed up to heights of 1.5 metres but, depending on conditions and the structure of the masonry, it may rise to greater heights. Sometimes, a 'tidemark' can be observed running almost horizontally along the wall and the area below it being obviously damp.

Masonry contamination with a 'band' of hygroscopic salts (Figure 2) will also confirm the presence of a rising damp but will not differentiate between an active or past complex.

The proper use of a surface electrical moisture meter can give a useful indication as to the existence of a rising damp complex but cannot give absolute proof, especially where remedial works have been previously carried out. (See British Wood Preserving and Damp-proofing Association DP1, 'The use of electrical moisture meters to establish the presence of rising dampness'). Generally, with an electrical moisture meter high surface readings are obtained followed by a sudden 'cut-off' at the top of the rise of moisture. This pattern of readings is typical of that resulting from active rising dampness.

However, other meter reading patterns can be obtained during investigations. Some possible interpretations are given in the below table. Please note that it is the pattern of the readings which are important, not the actual reading itself.

Table 3: Example moisture meter readings

Height	i	ii	iii	iv	v	vi	vii
2000mm	0	0	0	0	0	0	100
1750mm	0	0	25	0	0	0	100
1500mm	0	10	*90	0	*80	0	100
1250mm	10	*85	*90	0	*75	0	100
1000mm	85	*65	40	0	0	0	100
750mm	90	35	65	0	0	0	100
500mm	90	20	90	0	0	0	100
250mm	95	20	90	75	10	5	100

* = 'salt band'

i. Old or inadequate plasterwork, no effective DPC.
ii. Old contaminated plasterwork, effective DPC – readings increase due to hygroscopic salt band.
iii. Old or inadequate plasterwork, partially effective DPC – water at base and salt band towards maximum height.
iv. Defective construction of floor/wall junction.
v. New effective render following DPC insertion but dpc failed and rising above new work.
vi. No apparent problem.

For a precise evaluation of potential rising dampness then quantitative measurements of moisture are required and methods such as those described in Building Research Establishment Digest 245, 'Rising dampness in walls: diagnosis and treatment', should be used. Basically, this involves the use of drilled samples taken in a vertical series and determining the hygroscopic and capillary moisture content of each sample. The capillary moisture content represents water ingress and therefore its presence and distribution in the vertical profile will indicate whether rising damp is actually occurring or not. This technique will also identify dampness problems caused by heavy contamination with hygroscopic salts rather than water ingress.

Finally, it must be understood that dampness can rise to heights well in excess of 1 metre, a figure frequently quoted as the maximum height to which dampness can rise.

The British Wood Preserving and Damp-proofing Association leaflet DP9, 'Guidelines to Survey Report writing' should form the basis on which the report should be structured.

Chemical Damp-proofing

Suitability for Treatment

Most types of traditionally built masonry wall can be treated using Dryzone damp-proofing cream. However, some walls should not or cannot be suitably treated. Special procedures may be required for certain types of masonry, e.g. perforated brick and some types of blockwork. Extra care should be taken when used on rat trap bond.

Where a wall has been contaminated with a detergent or where a masonry sterilant containing a surfactant has been used a water repellent type chemical damp-proof course may be unsuitable.

Earth retaining walls can only be treated above external ground level. That area below ground must be suitably 'tanked' to prevent lateral moisture penetration (see Safeguard Structural Waterproofing Specification).

Damp-proofing Materials

Dryzone damp-proofing cream is designed to cause water repellency. The water repellent material lines the pores of the masonry (Figure 4) and on curing, the water repellent

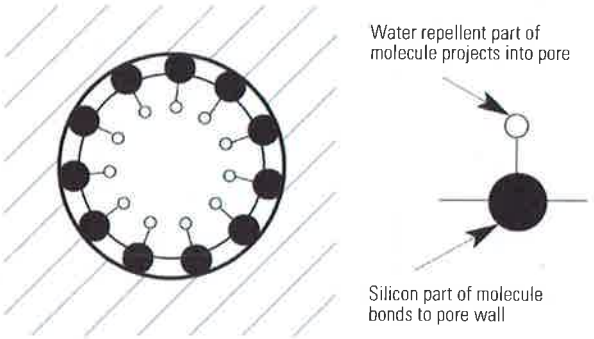


Figure 4: Water repellent lining pore

causes a modification of the interfacial tension between the wall of the pore and the water (Figure 5). In an untreated pore the 'contact angle' is less than 90° and the interfacial tension causes the water to rise. Following application of the water repellent the interfacial tension changes. The contact angle becomes greater than 90° and the resulting tensions now cause a slight downward 'pressure' so preventing the future rise of water. The Dryzone system does not block the pores.

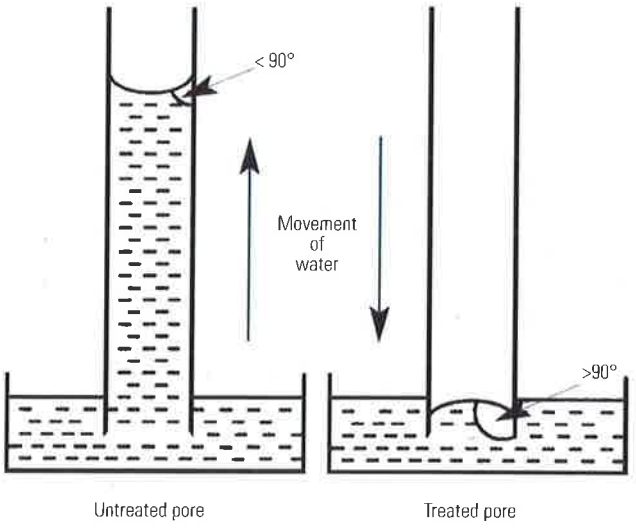


Figure 5: Water repellency

Effectiveness of Chemical Damp-proof Courses

Pressure Injected Systems

The effectiveness of any pressure injected chemical damp-proof course is governed by a number of factors; one of the most important technical features is 'viscous fingering'. When any fluid is injected under pressure into a heterogeneous porous material such as a masonry wall, it does not pass through the wall evenly, pushing out the resident moisture in front of it. Instead, it forms 'fingers' of fluid so leaving 'holes' which can contain resident moisture (Figure 6). Many of these are continuous, which leave complete

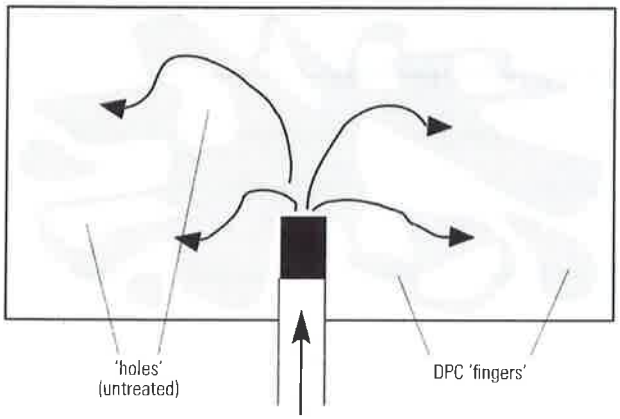


Figure 6: Fingering effect of pressure injected DPC fluid

paths through which water is still able to rise. In practice, therefore, it is unlikely that a chemical injection damp-proof course on its own will stop rising damp with a sudden cut off of rising water such as that brought about by a physical damp-proof course. Pressure injected systems are also heavily reliant upon good operative technique and furthermore up to 96% of a pressure injected fluid is just a carrier in the form of water or white spirit and all of this has to evaporate off. Solvent based systems are also fast curing and not water miscible and are therefore less likely to be as effective in the diffusion process, especially in very wet walls.

Dryzone Diffusion Cream

Dryzone is a revolutionary concept made possible by modern technology for the control of rising damp in masonry. The principle is very simple and requires no electrical pumps, high-pressure systems or excess fluids in the from of a water or white spirit carrier. Dryzone is a very high concentration of water miscible active ingredient in a cream formulation that cleverly utilises the moisture already in a damp wall to aid its distribution. This significantly minimises the occurrence of 'fingering' (Figure 7) associated with pressure

Figure 7: Diffusion of Dryzone through mortar greatly reduces 'fingering'

injected systems and Dryzone has the further advantage of an inherent slow curing process that ensures the maximum diffusion potential. Of further significant importance is the vapour phase of Dryzone, which imparts considerable water repellent properties into adjacent masonry. The combined effect is the most revolutionary and effective method of controlling rising damp by a chemical process to be introduced in over 40 years. Of further significant importance is the simplicity of the introduction process that makes it difficult to install 'incorrectly' and is therefore less reliant upon good operative technique.

Replastering

In order to complete an effective damp-proofing system it is extremely important that the new plasterwork which replaces the salt contaminated material resists the passage

of residual moisture and contaminant salts from passing from the underlying substrate through to the new decorative surface. This function is important because the underlying wall can take many months to dry down following damp-proofing, but more importantly, the base of the wall may always remain damp due to the inherent limitations of the actual injection damp-proof course. The importance of this function is described in Building Research Establishment Defect Action Sheet No. 86. A specification for replastering is contained in the appendix at the end of this manual on page 18.

Finally it is important to understand that chemical dampproofing is a system – (1) the injection of the DPC and (2) the replastering: they are inseparable.

Preparation for Dryzone Damp-proof Course Installation

Pre-installation Procedures:

Important: before undertaking any work it is essential to check the following:

1. Check all cavities, where present, for debris which may cause bridging of the damp-proof course.
2. Ensure sub-floor ventilation is adequate where timber suspended floors are installed.
3. Lower ground levels where necessary.
4. Remove perished/damaged external plinths and cut any external rendering back to above the height of the DPC line.
5. Remove all floor covering and furniture.
6. Remove floorboards if appropriate.
7. Remove timber skirtings and architraves. If they are to be re-fixed put to one side; remove all fixing grounds.
8. Remove all plasterwork to a minimum height of 1 metre or to 500mm above evidence of dampness/ contamination with hygroscopic salts.
9. Ensure that plants, paths and glass are protected from spillage.
10. Check level of any adjoining solid floor which may be present and ensure that proposed DPC line is not bridged.

Safety

Please note: In all cases where damp-proofing works are undertaken in the UK it will be necessary for the installer to undertake an assessment in accordance with the requirements for the Control of Substances Hazardous to Health (COSHH) regulations.

1. Install safety notices and advise other trades of risks.
2. When appropriate ensure that the property owners have complied with the Party Wall Act 1996. Advise interested parties of possible inconvenience of noise and vibration especially neighbours living in an adjoining property which shares a party wall to be treated.

Those conducting work in countries other than the UK should ensure that they comply with local regulations.

Operators note:

1. Should Dryzone cream come into contact with the eyes they should be flushed out immediately with cold water for 10-15 minutes, and medical attention should be sought.

The Drilling Programme

Line of the Damp-proof Course

All damp-proof courses should be installed in accordance with the recommendations given in BS CP102: 1973, "Protection of buildings against water from the ground" and especially in accordance with BS 6576: 2005, "Code of practice for diagnosis of rising damp in walls of buildings and installation of chemical damp-proof courses". They should therefore be installed not less than 150mm above external ground level.

The intended line for the damp-proof course should be exposed and clearly defined, taking into consideration internal and external ground levels, party and abutting walls, and changes in ground levels.

Internally, where a solid floor is present, the DPC should be inserted as close as possible to floor level. In all cases there should be continuity between the injected DPC and any damp-proof membrane of a solid floor, the latter being taken up the wall to overlap with the injected DPC as described in BS CP 102. Where suspended timber floors are encountered the DPC should, if possible, be inserted below the timbers (see Figure 15).

Drill Hole Size, Depth and Location

For treatment to be fully effective the correct volume of Dryzone must be introduced. The system requires 12mm diameter holes to be drilled at horizontal centres no greater than 120mm. The depth of hole required for various thickness of wall is shown in the table below. For all other walls the depth of hole should be to within 40mm of the opposite face. In all cases the most effective target site is to drill horizontally directly into the mortar course, preferably at the base of all perpends of selected course (see Figures 8 and 9).

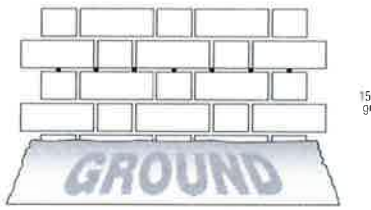


Figure 8: Drilling pattern for Double Flemish Bond

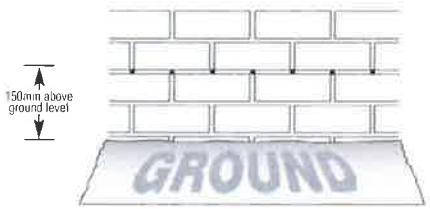


Figure 9: Drilling pattern for Stretching Bond

Drill Preparation

Measure the thickness of each wall to be treated. Set the depth gauge of the drill or apply tape to the drill bit in order to identify the correct drilling depth accordingly.

Drilling Cavity Walls

Cavity walls may be drilled/treated from one side in a single operation or if preferred each leaf may be treated seperately. When undertaking treatment from one side drill completely through the selected mortar course, allow the drill bit to pass across the cavity (see Figure 10) and then drill the other leaf of brickwork to a depth of 90mm. The viscosity of Dryzone is such that it is possible to treat each leaf from a single drilling operation. Always ensure that the cavity is clear before treatment.

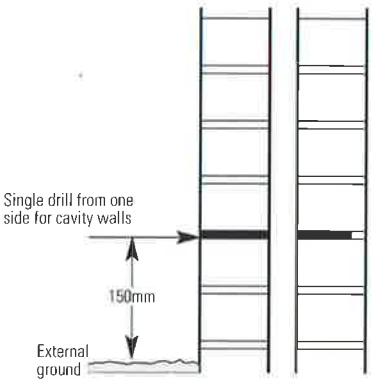


Figure 10

Table 4: Dryzone drill hole depths

	12mm drill hole depths required			
Wall thickness	4½" (110mm)	9" (220mm)	13½" (330mm)	18" (440mm)
Depth of hole required	100mm	190mm	310mm	430mm
Hole centres	120mm	120mm	120mm	120mm

Drilling Solid Brick Walls

In virtually all cases solid brick walls may be drilled/ treated from one side only in a single operation (see Figures 11, 12, and 13). Drill the selected mortar course at the prescribed centres to the appropriate depth in accordance with the table above.

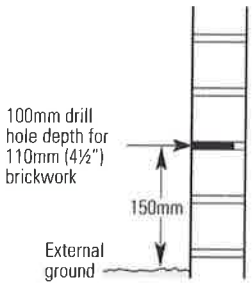


Figure 11

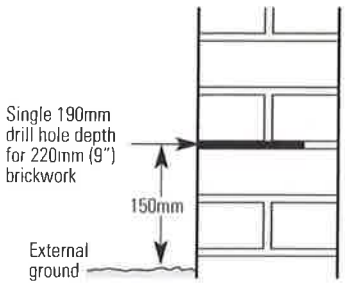


Figure 12

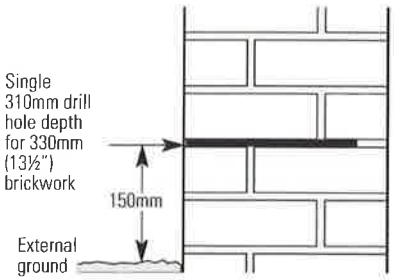


Figure 13

Drilling Random Stone and Rubble Infill Walls

As far as practically possible follow the mortar course at the appropriate selected level (see Figure 14). If the stone is of a porous type e.g. sandstone then there is no reason why this should not be drilled. The variable thickness of stone walls and the possibility of rubble infill dropping and blocking injection holes cause difficulties for any system. Should these difficulties occur it might be necessary to drill to 50% of the wall thickness, from both sides at a corresponding height. Alternatively drill additional holes, which do not become obstructed, adjacent to obstructed holes to ensure that an adequate or volume of Dryzone is introduced.

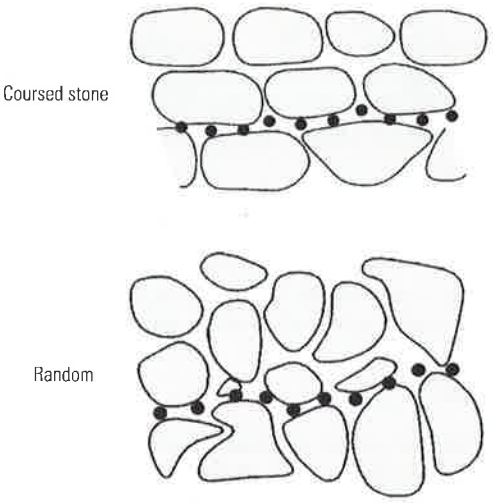


Figure 14: Drilling patterns for stonework

Dryzone Injection Process and Making Good

Dryzone Cartridge Preparation

1. Unscrew and remove the delivery tube end of the Dryzone application gun.
2. Retract plunger from the barrel and insert Dryzone cartridge into the barrel of the gun.

3. Cut or puncture the visble end of cartridge once in the barrel.

4. Replace delivery tube end of the application gun.

Dryzone Injection

Insert delivery tube of Dryzone application gun into the full depth of the pre-drilled hole. Gently squeeze the gun trigger and back-fill each hole fully with Dryzone to within one centimetre of the surface. Periodically wipe clean the outside of the delivery tube.

In order to prevent wastage when treating a cavity wall from one side, it is advisable to mark the delivery tube using tape to indicate the depth of the concealed hole and the width of the cavity.

Dispose of used cartridges in a plastic bag in accordance with local waste disposal regulations.

Making Good of Drill Holes

Holes drilled internally may be left uncapped. Externally drilled holes should either be plugged or pointed over.

Accidental Spillage

In the event of any accidental spillage of Dryzone, the spilt material should be wiped up immediately and the wipes placed in a plastic bag and disposed appropriately. Contaminated surfaces should be washed immediately with warm soapy water.

Equipment Cleaning

It is recommended that the application gun is washed regularly using warm water. If the gun is to be left unused for a period of time, then the inside of the gun barrel and delivery tube should be thoroughly flushed clean.

Injection Positions

The diagrams in Figure 15 illustrate the correct positions for injection into brick walls. The same principals also apply to stone walls.

Vertical Isolations

Where adjoining/abutting walls are present which are not to be treated, a vertical DPC must be installed. This should not be less than 1200mm high and extend not less than 500mm above the last evidence of dampness/salt contamination.

Vertical isolations are not capable of withstanding hydrostatic pressures which may be encountered with stepped properties, raised external ground levels, etc.

The Risk of Timber Decay

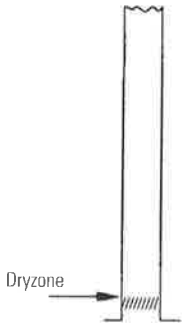
Where joist ends/timber wall plates are embedded on damp masonry these must be checked for the presence of fungal decay. Ideally, physically isolate the timbers from the masonry by a damp-proof membrane or joist hangers.

Where this is not possible and where timbers are damp and not decayed or just embedded in masonry, the ends should be given a thorough application of Safeguard ProBor 20 and/or ProBor 50 as described in the Safeguard publication, 'Dry Rot and its Control'. Any timber remaining damp will always be at risk to decay; proper treatment as described in the above publication will reduce the risk of rot.

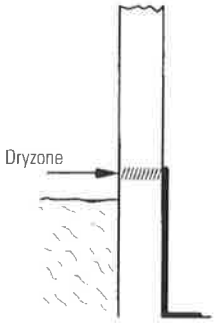
Should the DPC have to be above the floor timbers then measures must be taken to ensure that the timbers are not vulnerable to fungal decay. Precautions should be taken as described above especially with reference to the application of ProBor 50.

Examples of Injection Positions

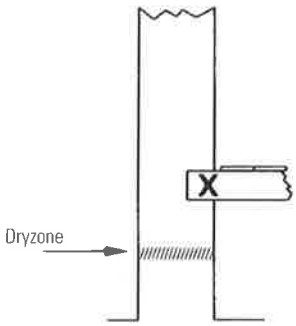
Please note: Ideally inject below timber suspended floors. Where timbers above and below injected damp-proof courses exist action must be taken to protect them from decay.



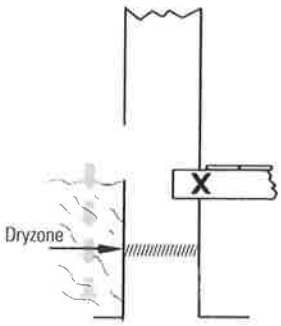
Internal dividing wall as close to a solid floor as possible



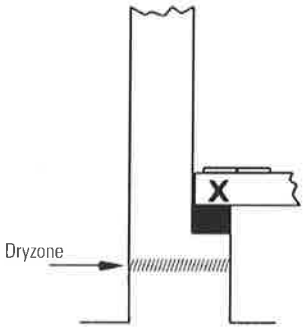
Inject 150mm above external ground level and tank (or lower external ground and inject)



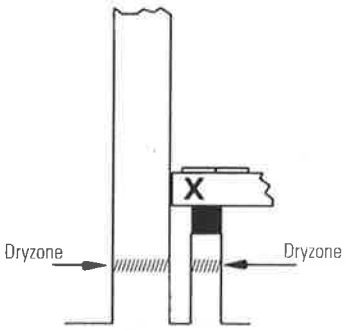
Inject below timber joists



Lower ground and inject below joists or inject and ensure joists ends are fully protected

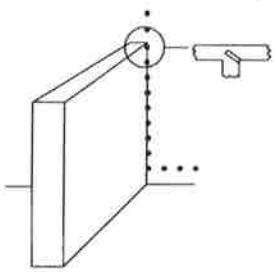


Inject below wallplate

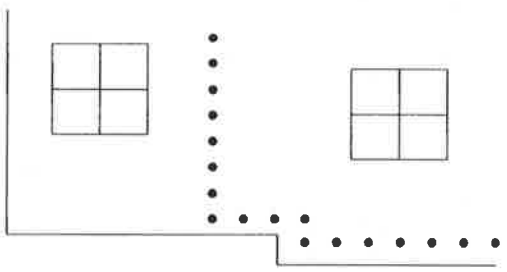


Inject below joist level and below wallplates on sleeper walls

'X' = all timber should be preferably physically isolated from any damp masonry in the vicinity of the DPC. Where this is not possible fully treat timbers with Safeguard ProBor 50 in accordance with the directions given in the Safeguard ' Dry Rot and its Control' publication, also available free from www.safeguardeurope.com.



Vertical DPC to isolate abutting walls, etc



DPC to accommodate slight changes in ground levels and adjacent untreated sections of wall

Figure 15: Examples of injection positions

Dryzone Material Requirement

Dryzone is packed in 600ml cartridges. The table below illustrates the number of Dryzone cartridges required to treat walls of various length and thickness. Different site conditions may cause slight variations. Drill holes to be 12mm deep and at 120mm centres, with one 600ml cartridge of Dryzone filling 5.31m of a continuous 12mm hole.

Table 5: Dryzone cartridges required for treatment

	Thickness of wall			
Length of wall	4½" (110mm)	9" (220mm)	13½" (330mm)	18" (440mm)
5m	0.7	1.5	2.5	3.5
10m	1.5	3.0	5.1	7.0
15m	2.3	4.5	7.6	10.5
20m	3.0	6.0	10.2	13.0
25m	3.8	7.5	12.7	17.5
30m	4.6	9.0	15.3	21.0
35m	5.3	10.6	17.8	24.5
40m	6.1	12.0	20.4	28.0
45m	6.9	13.6	22.9	31.5
50m	7.7	15.0	25.5	35.0
55m	8.5	16.6	28.0	38.5
60m	9.2	18.0	30.6	42.0

Length of wall one cartridge of Dryzone will treat in the following thickness of wall			
4½" (110mm)	9" (220mm)	13½" (330mm)	18" (440mm)
6.5m	3.3m	1.96m	1.43m

Making Good after Treatment

Important: The insertion of a chemical damp-proof course does not dry out already damp walls; it only controls the further vertical ingress of moisture from the ground. Therefore, if possible, delay the attendant works for as long as is feasible to facilitate the maximum possible period for drying.

1. Provide good ventilation to allow drying of the wall.
2. Ensure that the damp-proof membrane (DPM) of any new solid floor overlaps with the inserted damp-proof course (BS CP 102:1973). If necessary join the DPM with the DPC by the use of a pitch epoxy material or similar. If no DPM is present run Vandex BB75 out across the solid floor for 50-100mm and up the wall to overlap with the DPC (e.g. Figure 16).
3. Replaster strictly in accordance with the Safeguard Replastering Specification (see appendix).
4. Refix timber skirtings after applying a liberal coat of Safeguard ProBor 20 to their backs and base. Similarly, when dry apply two coats of bituminous paint to the backs and base. Fix using plastic grounds. If timber grounds are used these must be first worked to size then thoroughly treated with Safeguard ProBor 20 prior to fixing.

5. If required form a bell-mouthed casting with the external render and apply two coats of Safeguard Raincheck or Raindance below the bell cast or lower extremities of the wall.

6. Fill external holes with either plastic plugs or a 3:1 sand/cement mix incorporating Safeguard Renderguard Gold additive.

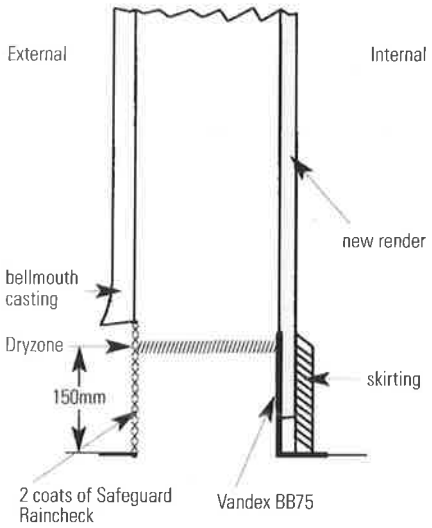


Figure 16: Suggested finishing work

Redecoration

A damp wall takes time to dry out. As a general guide, the drying rate is given as 1 month for every 25mm of wall thickness (BRE Digest 163, 'Drying out buildings'). Thus 230mm will take approximately 9 months to dry. However, the drying processes depend on conditions, ventilation and the type of masonry, so drying may take considerably longer.

Due to the potential prolonged drying of the wall, the following must be considered:

1. Delay any decoration for 4-6 weeks following replastering and allow for good natural ventilation to enhance drying. Do not apply heat or accelerated drying methods.

2. Do not use wallpaper for at least 12 months (longer on thick walls).

3. Redecorate using a non vinyl based emulsion.

4. Maintain good ventilation around walls.

Note: The initial decorations should be regarded as temporary, the final decorations not taking place for at least 12 months after completion of the damp proofing and ancillary work.

Health and Safety

Before using any material always read and understand the label, the relevant data sheet and Health and Safety information. Health and safety data sheet available on request.

Appendix

Replastering following Insertion of a Damp-proof Course

Important: It should be noted that the replastering is as important as the insertion of the damp-proof course and care must be exercised when carrying out the works.

Why Replaster?

As described in the earlier part of this manual, high levels of contaminant hygroscopic salts can build up in both the old plaster/underlying masonry over many years of active rising dampness. Even though the damp-proof course is effective the hygroscopic nature of the salts may cause moisture to be attracted to the wall so causing further dampness, decorative spoiling, and giving the impression that the damp-proof course has not been successful.

Removal of the old contaminated plasterwork will remove the contamination at the surface but underlying contamination may pass into new works unless it is designed to be resistant to the passage of residual moisture and these contaminant salts.

The design function of the new plasterwork must therefore be twofold:

1. It must prevent the passage of residual moisture reaching the decorative surface during the drying process which can take some considerable time as well as control the limitations of the injection system itself.

2. It must prevent the passage of hygroscopic salts from the underlying masonry to the new decorative surface to prevent further spoiling.

In order to perform these functions the replastering has to be carried out strictly in accordance with the following specification.

Safeguard Replastering Specification

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No 97/3363

Safeguard replastering specification as assessed by the British board of Agrément, certificate no. 97/3363.

Important: This specification must be strictly adhered to. Please ensure that the plasterer understands its importance.

Preparatory Work

i. Timber skirtings, architraves, etc., should be removed as outlined in the survey report/specification.

ii. Remove plaster back to masonry to the height outlined in the survey report/specification, but this should not be less than a height of 1 metre, or 500mm above the maximum level of the visual rising dampness and/or salt contaminated plaster.

iii. Rake out all mortar joints to a depth of 15mm (½") - this is important in order to help resist the natural shrinkage of new cement renders.

iv. Remove any timber fixing grounds that are present in the masonry.

First Coat

Note: All water to be used must be clean, free from oil, dirt or other injurious chemicals (water suitable for drinking if available).

i. Prepare 3 parts sand to 1 part cement using gauging water containing Safeguard Renderguard Gold at the recommended dilution. The sand should be specified as washed, sharp, concrete sand, loam free, which satisfies the requirements for the 'M' grading as laid down in British Standard 882:1992. The cement should be fresh and free flowing.

ii. Use minimum of water to ensure a dense coat; an approximate is not more than 8 litres per 50 kilos of dry mix.

iii. Compact mix well into raked out joints, and render to give an overall thickness of 12mm. Do not over trowel. When cement obtains it first set, scratch to form a key.

Second Coat

i. The mix is as for the first coat except that clean water only is used for gauging (no additive). This is applied as a further 12mm of render, giving an overall thickness of the render coat of 25mm. This coat should be applied before the first coat has finally set in order to obtain a satisfactory adhesion between the rendering coats. Scratch surface to form a key for finishing plaster. Do not over trowel.

Third Coat

i. This should be 3mm mix of multifinish or similar finish. Other finishes are acceptable provided they are porous. Do not polish.

Important Points to Note:

Important: Please ensure that you read the section 'Making good after injection' earlier within this manual.

Where walls are known to be excessively contaminated with hygroscopic salts (e.g. old barns, old kitchens, chimney flues, stables) then consideration should be given to tanking the walls prior to replastering as added protection for the decorative surface.

Where masonry is unstable, this must be made good prior to the application of the renderings. Where it is not possible to obtain a proper bond between the wall fabric and rendering, as in the case of cob walling for example, the rendering must be applied direct to the wall face but over expanded metal lath, previously fixed to the wall surface.

Renders and plasterwork should be cut short of finished solid floor level or at suspended timber floorboard level. This will prevent any damp which may be present within the solid floor from being transferred into the soft setting coat, or any subfloor condensation passing into the new work.

Gypsum plasters and lightweight premix plasters must not be used to bond metal angles to corners. Ideally, use plastic angles or, better still, form them.

It should be remembered that the walls will take a considerable time to dry out and it is possible that sufficient moisture could be absorbed by the new joinery to cause fungal decay.

It is important that the replastering specification is strictly adhered to and not varied in any way. No other additives must be added to the mix.

Lightweight gypsum premix backing or bonding plasters (e.g. Carlite) must not be used.

Safety

Safeguard Renderguard Gold is innocuous in normal use. However, it should not be swallowed or splashed into the eyes. If it is splashed, etc. eyes should be washed with copious quantities of clean water. Medical attention should then be obtained.

We cannot stress enough the importance of plastering strictly in accordance with the specification and it is essential that the plasterer realises the implications should this specification not be strictly adhered to. Experience has shown that whilst the damp proof course may be fully effective and no action has been taken to prevent the migration of hygroscopic salts reaching the new plasterwork, then problems do exist, often resulting in a situation where the property visually appears to be no drier than prior to the work being carried out. It is therefore essential to make sure all recommendations, as stated in the contractors report and recommended by Safeguard Europe Ltd, are strictly adhered to.

Further Reading

Safeguard Europe Ltd.:

Dry Rot and its Control
Published by Safeguard Europe Ltd., Redkiln Close, Redkiln Way, Horsham, Sussex RH13 5QL

British Wood Preserving and Damp-proofing Association:

DP 1: The use of moisture meters to establish the presence of rising dampness
DP 2: Plastering in association with damp-proof coursing
DP 9: Guidelines to Survey Report Writing
Code of practice for remedial treatments

British Standards:

BS CP102:1973 Protection of buildings against water from the ground
BS 6576:2005 Code of practice for diagnosis of rising damp in walls of buildings and installation of chemical damp-proof courses

Building Research Establishment:

Digest 18: Design of timber floors to prevent decay
Digest 163: Drying out buildings
Digest 180: Condensation in roofs
Digest 245: Rising damp in walls: diagnosis and treatment
Digest 297: Surface condensation and mould growth in traditionally built buildings
Digest 299: Dry rot: its recognition and control
Digest 345: Wet Rots: recognition and control
DAS 86: Brick walls: replastering following DPC injection

Coleman, G.R.:

Guide to Identification of Dampness in Buildings
Published by Surdaw Press, Gillingham, Dorset

Gratwick, R.T.:

Dampness in buildings
Published by Crosby Lockwood Staples, Frogmore, St. Albans, Herts

Marsh, P.:

Thermal insulation and Condensation
Published by The Construction Press Ltd., Hornby, Lancashire

Oliver, A.C.:

Dampness in buildings
Published by BSP Professional Books

Richardson, B.A.:

Remedial treatment of buildings
Published by The Construction Press Ltd., Hornby, Lancashire

Rising Damp & its Control

www.safeguardeurope.com

SAFEGUARD
MAKING BUILDINGS DRY

Redkiln Close . Redkiln Way . Horsham . Sussex . RH13 5QL . UK
T +44 (0) 1403 210204 F +44 (0) 1403 217529 E info@safeguardeurope.com

Wall depth	4½" (110 mm)	9" (220 mm)	13½" (330 mm)	18" (440 mm)
Rods per 10m	42	83	125	166

Full installation instructions can be found on www.dryrods.com. More information is contained in our guide to rising damp and it's control.

Why use Dryrod?

As the latest development in the treatment of rising damp, there are numerous advantages to using Dryrod Damp-Proofing Rods:

- **The most effective form of rising damp treatment available** – Dryrod outperforms all tested competitor products.
- **Extremely quick and simple to install** – Simply drill holes in a continuous mortar course and insert the required number of damp-proofing rods.
- **Permanent eradication of rising damp** – The active ingredient contained within the rods spreads through, and bonds with, the mortar in a wall, providing a permanent solution to rising damp.
- **No specialist equipment required** – No costly pumps or lances are needed and only standard tools are required.
- **No chemical mess to clean up** – Conveniently foil-wrapped packaging and a simple installation procedure means no spillages.
- **Delivers the correct dose every time** – Each rod is accurately dosed with exactly the correct amount of water-repellent.
- **Proven to work on highly-saturated walls (even up to 95% saturation)** – Tests show that Dryrod Damp-Proofing Rods outperform even premium damp-proofing creams at high saturation levels.
- **Low-hazard** – Dryrod Damp-Proofing Rods are solvent free, odour free and non-caustic.

Where to Buy Dryrod Products

Dryrod products can be obtained from the following websites:

www.safeguardstore.com

www.amazon.co.uk

If you wish to order over the phone or ask for technical advice, call us directly on 01403 210204.

Select builders merchants, such as Travis Perkins or Jewson, should be able to order Dryrod products in to their branches. Ask in store for details.

The Importance of Effective Damp-Proofing

Naturally, homeowners want the most effective products available to be used to treat rising damp in their properties. Creating the best possible barrier to rising damp minimises moisture in the wall, blocks the build-up of ground salts, and

Insert Rods

Technical Support

The following technical support features are available through this website:

- **Datasheet Downloads**
- **Case Studies**
- **CAD Drawings**
- **NBS Clauses**
- **Training Course Details**
- **CPD Seminar Details**
- **Technical Support Form**

To speak to a member of our technical team call 01403 210204 during office hours.

reduces heat-loss.

For this reason, Dryrod Damp-Proofing Rods have been designed to form an effective damp-proof course in walls of all types and have been tested under conditions of up to 95% saturation, where it has been shown to outperform all tested competitor products.

This is important because no two walls suffering from rising damp are the same. In particular the physical properties of the mortar used to construct walls can vary considerably and this can have a significant influence on the effectiveness of any rising damp treatment.

Dryrod Damp-Proofing Rods are effective in a wide range of conditions, including:

- Saturated walls (up to 95% saturation)
- Low alkalinity mortar
- High alkalinity mortar
- Low porosity mortar
- High porosity mortar
- Lime-based mortar
- Cement-based mortar

Replastering

As with all remedial damp-proofing systems, it is necessary to remove and replace any salt-contaminated plaster. The introduction of our plasterboard-based Dryzone System replastering method has greatly simplified this process. See our page on replastering as part of a rising damp treatment for details of replastering systems available.

For heritage projects, or where replastering needs to be minimised, please contact our technical department to discuss alternative replastering strategies.

RIBA-Approved CPD Seminars

Safeguard currently offer the following RIBA-Approved CPD Seminars free-of-charge to architects and specifiers on the UK mainland:

- Rising Damp: Causes and Treatment
- Waterproofing Existing Basements
- Waterproofing Basements and Underground Structures (Newbuild)
- Dealing with Dampness in Existing Properties (Above Ground)
- An Introduction to Green Roofs

[Site Map]

Lectros Australia Pty.Ltd.

PROVEN, CENTURIES OLD, SCIENTIFIC PRINCIPLE REVERSES RISING, (SALT), DAMP

30 Year Guarantee

Approaching 100,000 Projects Worldwide – since 1978

No Chemicals – No Odours

C.S.I.R.O. Appraisal – Technical Assessment #308

"DRIVES THE DAMP OUT OF YOUR WALLS"

Rising Damp, (Salt Damp), symptoms certainly catch the eye!

When moisture from the ground rises up a wall due to the capillary action in the masonry material, it's called rising damp or salt damp. It carries with it corrosive salts, and it causes a number of serious problems, including:

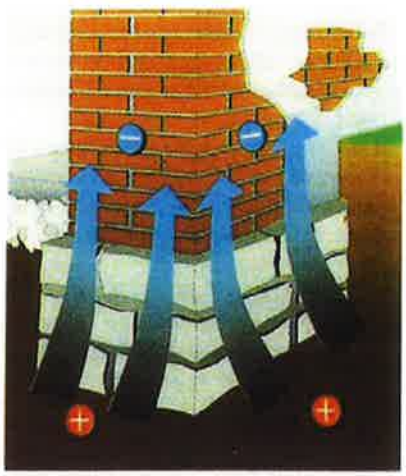
- ☑ Stained walls.
- ☑ Blistering, salt-ridden and flaky paint.
- ☑ Curled, stained and delaminating wallpaper.
- ☑ White salt powdered residue.
- ☑ Pitted and eroded brick and stonework.
- ☑ Powdery disintegrating mortar.
- ☑ Rotting timber skirtings and doorframes.

There's nothing as unsettling as the sight of damaged walls caused by rising damp. Your walls develop unsightly salt blisters and flaking paint, and as the problem gets worse, you're always sweeping up the droppings. Your rooms become more and more uncomfortable and unhealthy to live in.

There's absolutely no point in trying to conceal rising damp by re-pointing mortar or replastering and painting. In fact, this can make things worse. Rising damp will not go away unless we get right to the bottom of it and effectively reverse it before the damage to your premises reaches its full destructive potential.

What causes Rising Damp, (Salt Damp)?

Rising damp is found naturally in most masonry structures as the moisture in soil and masonry tries to achieve equilibrium. This equilibrium occurs in nature and is evident in many forms such as, temperature - where heat spreads from hot to cold, electricity - where a positive charge flows to the negative and in water - where dampness invades a dry area. That's why the Building Code of Australia requires that a dampcourse is installed to prevent "undue dampness or deterioration of building elements", and it's also why builders install a dampcourse below the timber floor bearers.



Wall without protection.

As moisture rises from the earth by capillary action through the walls pore structure it creates an electrical potential, (Zeta Potential), between the wall and the moisture. This "potential" causes more and more water molecules carrying damaging ground salts to travel from the positive, (the earth), towards the negative, (up the walls).

Rising damp can be caused by the absence of an effective dampcourse or by "bridging" of the dampcourse. During bricklaying excess mortar often falls down behind the brickwork, into cavities where it sticks to brick ties, and lands in the gaps between the floor joists, bearers and brickwork. These mortar droppings can create a moisture bridge - a direct path for moisture to creep from damp masonry to your floor bearers and joists, perimeter timber framing, plaster and timber trims.

As the moisture content varies within the masonry it induces a wetting/drying cycle causing the salts to expand and contract accordingly, hence the breakdown and deterioration of the plaster, brick/stonework and mortar. As excess moisture evaporates a surface salt residue is left behind.

How common is it?

Most masonry walls can exhibit rising damp symptoms up to the height of the dampcourse. Hence the Building Code of Australia requirement that a dampcourse be installed in a manner to prevent

"...undue dampness or deterioration of building elements".

That is why builders install a dampcourse **BELOW** the timber floor bearers. Although a dampcourse is intended to stop the upward movement of moisture into drier materials, rising damp may often be seen to rise higher than a metre on a wall in older houses where there is an ineffective or non-existent dampcourse. A "rendered" finish applied over a dampcourse creating a moisture "bridge" is a common cause often found in new or renovated structures. Factors contributing to rising damp may include the water bearing capacity of the soil, length and depth of masonry below ground level, wall thickness, and surface evaporation area.

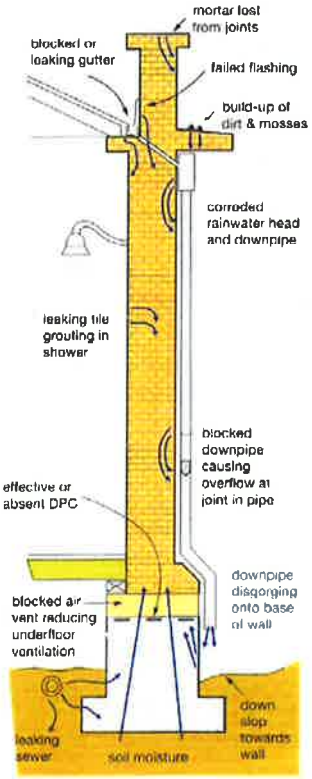
Rising damp may also appear to fluctuate as weather conditions change. Seasonal effects must be taken into account during diagnosis, as the rise and fall of the water table can cause rising damp to apparently disappear in summer but return in winter. Drier conditions with improved ventilation may temporarily increase evaporation rates, but **will not stop** "rising damp".

How symptoms can be misinterpreted

A damp wall does **not** necessarily mean "rising damp"! Visible moisture damage may be caused by rising damp, falling damp, lateral or penetrating damp, condensation, or saturation caused by poor sub-floor ventilation - a variety of factors. Skilful, intelligent analysis is vital as an incorrect diagnosis by an inexperienced investigator may lead to thousands of dollars worth of unnecessary expenditure.

As certain types of dampness inside a home are *not* related to rising damp, you can undertake a preliminary review to help ascertain whether your home is actually suffering solely from "rising damp", an alternative source, or a combination of sources.

Source of damp in walls



☐ **Rising Damp.** Rising damp is normally associated with surface salt deposits, crumbling fretting bricks, disintegrating mortar, bubbling flaking paint with visible surface salts, and deteriorating plaster. The source of true rising damp is capillary ground moisture climbing up through the internal pores of the masonry carrying damaging ground salts in solution.

☐ **Poor sub-floor ventilation.** As moisture evaporates from the sub-floor soil it will penetrate and saturate the floor timbers and in an attempt to escape, will permeate up behind skirting boards to evaporate from the plastered/masonry surface. Masonry walls exhibiting symptoms of dampness, such as blistering paint at skirting board level, but not much higher - with no surface salt deposits. Damp musty smells, rust stains around nail-heads and deteriorating stained and "cupped" floor timbers are good indicators of poor sub-floor ventilation. Powered sub-floor ventilation systems will assist in reducing moisture-laden air from under suspended timber flooring but **will not halt** capillary moisture rising deep inside the masonry.

☐ **Lateral or penetrating damp.** This can occur when external ground levels are higher than existing dampcourses and internal floor levels, and where damp internal concrete floors are not isolated from masonry walls. It's often common in split-level homes on sloping sites with internal supporting walls having "fill" higher on one side of the wall than the other. Footpaths constructed against an outside wall higher than the dampcourse can also create a bridging effect. Bridging of cavities by mortar droppings and other debris is another contributing factor. But leaking external plumbing, downpipes or gutters, and garden sprinklers are also possible sources of penetrating damp!

☐ **Condensation.** We've all seen the black mould that can sometimes form in poorly ventilated areas when warm moist air comes in contact with a cooler surface. Every building has some degree of moisture always present in the air, because people's breath, perspiration, warm washing water, clothes driers, showering and boiling water for tea or coffee are all sources of warm water vapour. Perimeter walls, windows and ceilings provide a temperature barrier, so when warm moist air meets cooler walls and windows, the water vapour cools and becomes liquid again, creating fine droplets. While it's readily seen on glass surfaces, porous materials such as wood and plaster become a haven, in which airborne mould spores can settle and flourish. The presence of mould high on wall surfaces, in corners, on an un-insulated ceiling, behind paintings, bed-heads, bookcases, entertainment units and poorly heated and ventilated perimeter rooms, all indicate condensation rather than rising damp.

How do traditional treatments work?

Prior to the availability of the Lectros Electro Osmotic System in Australia the two common methods of creating a new dampcourse were, chemically, or by the insertion of a new waterproof membrane. Let's take a look at these methods to fully appreciate the outstanding Lectros system.

Chemical treatments. (The Building Code of Australia prohibits the use of chemical dampcourses in new construction). These treatments attempt to create a dampcourse by impregnating the masonry's pores/capillaries with hydrophobic (non-wettable) chemicals. The chemicals impregnate the masonry and line the pore/capillary walls to make them non-wettable to nullify the spread characteristics and lifting effects of moisture.

Pressure injection systems require a series of 10 to 12mm diameter holes drilled along the walls about 150mm apart (about 2 holes per standard brick). Generally, up to a 100mm radius of masonry is impregnated via each injection point.

Gravity-fed, (diffusion), systems use chemical reservoirs that drain into pre-drilled holes in the masonry. It's a slow process that may take up to 44 hours depending on the chemicals, masonry thickness and permeability. Leading manufacturers of gravity fed dampcourse fluids limit their achievable penetration depth to 100mm below the installation points.

If either method fails to impregnate the entire thickness of the wall, any untreated sections will provide a moisture "bridge". Manufacturers of these chemicals specify the correct installation height in relation to the structural floor timbers. So, if you consider chemical treatment, ask where chemicals are to be installed, and will the treatment arrest the damp under the timber floor bearers?

Undersetting (Physical Membrane Replacement).
This is normally achieved by removing a mortar bed-joint throughout the full thickness of the masonry wall with a modified "chain-saw", a section at a time, and inserting a flexible membrane or "pillow". The bed-joint is then packed with fresh mortar or, the "pillow" is pumped full of mortar or grout expanding to fill the bed-joint. The process may be extremely disruptive and expensive with the possibility of bricks dropping. Physical dampcourse membranes must be visible and not "bridged" by mortar, render or plaster.

Even if the chemical system or membrane replacement has been successful, the salt contamination already present will attract atmospheric moisture and give the impression of rising damp. These methods of rising damp repair should incorporate the removal of salt contaminated plaster, followed by replastering with a salt-retarder additive in the plaster mix. (This may hide dampcourse failure, even from an electrical moisture meter, until the height of internal rising damp exceeds the height of the new plaster!)

What to be wary of ...

Assessments by the C.S.I.R.O. or the B.B.A., Architects, Engineers, Building Surveyors or Builders will all confirm that every masonry dampcourse must be **effective below** any supported suspended timber floor components.

Chemical and membrane replacement treatments attempt to cap the height of the rising damp. The correct procedure for both methods requires installation below structural floor timbers around the outside of the house at about 150mm above ground level, or inside under the level of the existing floor bearers. With both treatments, the walls **below** the treated sections will **still be effected** by rising damp and **still remain subject** to mortar decay and brick fretting and when installation occurs above timber floor level, the bearers will be supported by damp masonry.

Common practice when treating brick cavity walls is to treat only the internal brickwork. So mortar droppings in the cavity may create a bridge to a still-damp outer leaf. Should only one leaf of a masonry wall be treated, removal of debris from the cavity is vital unless the contractor can confirm that the debris has also been treated.

Lectros is the best way to solve your Rising Damp Problem because:

The Lectros Electro Osmotic System is not a masonry capillary coating or blocker, but a proven active method of reversing the moisture's natural electric potential, which originates when water rises in a masonry wall.

Mandurah W.A.

Electro-Osmosis, like gravity, has been around since the "Big Bang" however the "principle" was not discovered until the 18th century by the German physicist Reuss. These days, this scientific principle is used by Lectros to provide an outstanding solution to the problem of rising damp. By tackling rising damp right at the root of the problem, the Lectros system is consistently successful.

Maryborough VIC

How does the Lectros system work?

Through a series of platinised titanium anodes inserted in the masonry about a metre apart, a very small and perfectly safe electric current is introduced into the wall just above ground level, (mA range). This current repels the rising moisture molecules and dissolved salts down the walls and harmlessly back into the ground. Just as "poles" of magnets repel or attract each other the positively charged mobile moisture molecules are repelled from the positive anode and attracted to the negative cathode. As long as this tiny positive charge is maintained, your walls are protected from rising damp. **Lectros is safe, simple and 100% effective!**

Northbridge W.A.

Geelong VIC

By repelling excess moisture below timber floor structures down into the soil, Lectros fulfils the true requirements of a dampcourse and costs less to operate than a doorbell.

Approaching 100,000 installations worldwide!

Used extensively since 1978, the Lectros system has more than 90,000 installations to its credit throughout England, Scotland, Ireland, France, Greece, Spain, South Africa, Oman, Romania, Italy to name but a few! Lectros is now gaining an excellent reputation for effectively reversing rising damp in Australian homes and commercial and industrial buildings. Lectros is regarded as the easiest, cleanest and safest system to control rising damp - and its performance is guaranteed for 30 years. **In striving for greener, safer products, Lectros leads the way: it's chemical-free, safe for the environment and has no health risks.**

Hobart TAS

A few solid reasons why the Lectros system is the best solution for your rising damp problems

The Lectros Electro Osmotic Remedial Dampcourse System employs a centuries old, proven scientific principle.

Brisbane QLD

The Lectros Electro Osmotic Remedial Dampcourse System works by repelling moisture, not by attempting to impregnate 100% of the wall thickness, (including any debris in a cavity).

Lectros is clean, free of odours, perfectly safe, environmentally friendly, and, being fume and chemical-free, it cannot stain or discolour masonry or plaster.

Bathurst N.S.W.

Lectros can be installed rapidly with minimal drilling, debris, dust or damage to your internal or external masonry finishes and once installed is the only dampcourse system that may be mortared, rendered or plastered over.

Lectros minimises the need to remove sound plaster or render as most dissolved hygroscopic ground salts are carried back down into the soil - (residual surface salt deposits may be neutralised and removed with clear household vinegar).

Lectros treats common or party walls, (without damaging your neighbours side of the wall), solid walls up to 600mm thick,and both sides of cavity brickwork walls from one side.

Lectros repels moisture down to soil level below timber joists and bearers even when installed behind or above skirting boards, (where access below suspended timber floors is restricted).

Hunters Hill N.S.W.

Lectros is suitable for any type of masonry, clay brick, sandstone, limestone, rubble filled, aerated concrete, precast concrete - even mud brick dwellings!

Lectros provides, observably, the fastest results as the damp is actively "driven" down out of the walls!

The Lectros Electro Osmotic Remedial Dampcourse System is the most cost-effective alternative to all other correctly installed methods.

Lectros installations enhance the walls structural integrity.

Gawler S.A.

Lectros is a true International system available in Australia exclusively through your local trained Specialist Lectros Installation Contractor.

Lectros has a fast "ACTIVE" drying characteristic, unlike other systems that rely solely on "passive" evaporation.

Lectros, although simple and quick to install, is the least contractor dependent remedial dampcourse system.

Lectros, being permanently "active", guards against new capillary moisture possible through fresh micro-cracking caused by continual masonry movement.

Ashburton VIC

Traceability - Should you wish to recommend the unique Lectros system to a friend or acquaintance in the future, or sell the property, your professional Lectros contractors' contact phone number and the Lectros label are displayed on the power control unit.

The Lectros Electro Osmotic Remedial Dampcourse System carries a 30-Year Guarantee backed by Lectros International Limited, (U.K.), – which is Registered to ISO 9002.

Key Considerations:

The Lectros Electro Osmotic System is the only system currently available in Australia which may be installed above a timber floor that will drive the excess moisture down to ground level, fulfilling the true requirements of a dampcourse.

The Building Code of Australia requires a "dampcourse" to be effective below timber floor components in all new dwellings!

British Standard 6576:
1985 Code of Practice for Installation of Chemical Damp-Proof Courses states –
".....it is important to create the dampcourse below the level of the timber....."

Quotations for chemical or membrane remedial treatments should include the removal and replacement costs of floor coverings and floorboards where necessary.

Independently "on-site" tested in Australia by AMDEL Ltd.

C.S.I.R.O. Appraisals Approved Assessment Extract.
The Lectros Electro Osmotic Dampcourse system as manufactured and distributed by Lectros Australia Pty. Ltd. (ABN 77 088 958 016), 2 Mayfair Court, Chirnside Park, Victoria, 3116, is suitable for counteracting rising damp in new and existing buildings in walls of masonry, constructed of, but not restricted to clay brick, sandstone, limestone, and other sedimentary materials, composite masonry walls, AAC, pre-cast and in-situ concrete, and mud brick when the conditions listed in C.S.I.R.O. Technical Assessment - #308 are fulfilled.

Call today to arrange a Free Quotation by a qualified Lectros professional.

Lectros Australia Pty.Ltd

ABN 77 088 958 016

PO Box 418, Bayswater, Victoria 3153
2 Mayfair Court, Chirnside Park, Victoria 3116
Tel. (03) 9727 5468 Fax. (03) 9726 4976 Mob. 0414 297 899

Your Australian Lectros Professionals are:

State	Location	Contractor	Contact No.
QLD.	Brisbane.	Lectros Qld.	(07) 3260 5990
N.S.W.	Sydney.	Lectros Sydney.	(02) 8714 7084
N.S.W.	Bathurst.	Lectros Central West N.S.W.	(02) 6332 3306
VIC.	Melbourne.	Absolute Lectros Contracting. P/L.	(03) 9727 5468
TAS.	Hobart.	Lectros Tas.	0408 102 166
S.A.	Adelaide.	Lectros S.A.	(08) 8362 6822
W.A.	Perth.	W.A. Lectros.	(08) 9367 9284

Appendix E

School house	
	
	Very minor brickwork cracking due to foundation movement
	Cracking and delaminating render
	Flaking paint and render, possible rising damp in the dining room.

	Flaking paint due to rising damp in the utility room.
	Flaking paint due to rising damp on the living room chimney at the north eastern corner of the building.
	Bubbling render due to rising damp at the base of the living room chimney.
	Diagonal cracking due to foundation movement
	Broken floor board

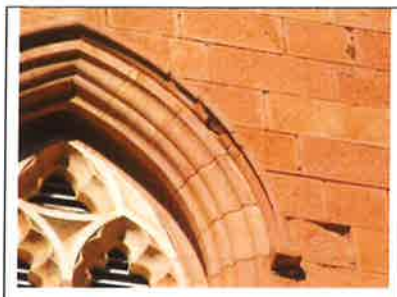
	Minor cracking in painted stone wall
	Crack in painted stone wall
	 Interestingly the crack in the right hand photo which is hanging on the wall in the School House was repaired many years ago. The fet hand photo shows the same wall today. There is no sign that the crack is reoccurring.
	Ceiling space is dry but has recent timber flooring and debris

Rectory	
	The rectory is a full brick residence with a timber floor and tiled roof
	Cracking in rendered walls over doorways
	Possible nesting material showing the through ceiling lining
	Wall cracks are minor but extensive

	Wall cracks
	Wall cracks
	Ceiling sag
	Obvious sag in roof tiles. The chimney also seems to lean.
	Kinked tiles directly over broken and repaired rafters

	Split rafters
	Sagging and damaged ceiling

Church	
	The church is a stone building that has been extended over several stages. It has a timber shingle roof and spire.
	The timber truss work is largely decorative
	Cracking in arch has previously been repaired
	Rising damp on window sill

	Isolated deteriorating stones and missing corbels
	Isolated deteriorating stones
	Cement rich mortar repair
	Cement rich mortar repair

	Minor cracking over arch
	Minor cracking over arch
	Ceiling space is dry and the timbers and connections appear to be performing well

Constituition Avenue Lichgate	
	The Lichgate is a timber framed structure with a timber shingle roof
	Loose timber shingle
	Roof timbers are performing well

Amaroo Street Lichgate	
	The Amaroo Street Lichgate is very similar in construction to the Constitution Avenue Lichgate
	Dislodged stonework
	Cracking in stonework behing seeting
	Bottom row of shingles is curling and warping

11.2 ACT Heritage Register Entry

ACT Heritage Council

Entry to the ACT Heritage Register

Heritage Act 2004

20019. St.John the Baptist Church and Churchyard

Section 33 Block 1(part) Block 2 Block 10 (part)

REID

This document has been prepared by the ACT Heritage Council.

This entry which was previously part of the old heritage places or the old heritage objects registers (as defined in the ***Heritage Act 2004***), as the case may be, is taken to be registered under the ***Heritage Act 2004***.

Conservation Requirements (including Specific Requirements), as defined under the ***Heritage Act 2004,*** that are contained within this document are taken to be Heritage Guidelines applying to this place or object, as the case may be.

Information restricted under ***the old heritage places register or old heritage objects register*** is restricted under the ***Heritage Act 2004***.

Contact: ***ACT Heritage Council*** ***c/o Secretary*** ***PO Box 144*** ***Lyneham ACT 2602***
Enquiries: ***phone 02 6207 2164*** ***fax 02 6207 5715*** ***e-mail heritage@act.gov.au***

building our city building our community
ACT Government

environment ACT

Helpline: 02 6207 9777
Website : www.cmd.act.gov.au
E-mail: EnvironmentACT@act.gov.au

19. St. John The Baptist Church and Churchyard, Reid [V56][1] [V145][2]

Location

District of Canberra Central, Division of Reid, Section 33 Block 1 part, Block 2 and Block 10 part and part of adjacent road reservations to the nature strip as identified in Figure 19 and indicated on the Territory Plan Map by the Heritage Register Overlay at H19.

Features Intrinsic To The Heritage Significance Of The Place

The place comprises:

a) St John the Baptist Church and Churchyard:

i) church building;
ii) rectory building;
iii) lychgates;
iv) tree planting surrounding the church and churchyard; and
v) graveyard.

b) St John's Schoolhouse Museum:

i) the schoolroom and residence building; and
ii) the surrounding open space

Statement Of Significance

St John's Church has been a focus for the religious and social life of the Canberra region since the 1840s, and enduring into the development years of the National Capital.

St John's Church has a strong association with the early pioneering pastoral families of the Canberra area. The church was valued by the local Anglican congregation and was seen by others as a feature of the landscape. It has particularly significant links with the Campbell family. Rev Alberto Dias Soares, who was engaged to design the extension to the nave and add the chancel and crypt, had a strong affiliation with the region through his design of local church buildings. The impact of the Rev Pierce Galliard Smith as the Rector for fifty years was significant, as are his tree plantings. They are still to be seen at St John's Church, Glebe Park and the site of the old Glebe House.

The prominent Victorian architect Edmund Blacket (1817-1883) is strongly associated with the church. He was a prolific designer of churches in New South Wales and an eminent architect of his time. Blacket was the designer of the tower and spire that was to become a familiar landmark in the Canberra region.

The Church building has grown with an increasing congregation, into a building of fine proportion. The many plaques on the internal walls are an historical testament to the local people through the years. The church reflects the strong links with the Campbell family, while the influence of Rev Pierce Galliard Smith can be seen in the tree planting.

Examples of the fabric of the church at various stages of construction are clearly evident and shows various materials and crafted finishes. The large stained glass east window represents an ambitious attempt considering the development of Australian technology at the time.

The graveyard is as old as the church itself with many members of pioneering families interred there. The headstones provide a valuable social history and are complementary not only to the life of the church, but also the early history of the Limestone Plains.

The East and West Lychgates at St John's are a rare example of this type of structure in Australia. These gates combined with the hedge, planted by the Federal Capital Commission in 1926, assist in retaining the early character of the church by visually shielding it from the encroaching development of urban Canberra.

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[1] [V56: Added to Heritage Places Register 27/09/1996 (Variation Number 56)]

[2] [V145: Amended 14/09/2000 (Variation Number 145)]

The grounds, including the Rectory and Horse Paddock contribute to the visual circumscription of the site, the trees and planting maintaining the serenity and distinctive character of the church within an otherwise busy part of the city.

St John's Schoolhouse was the first combined school and school teachers' residence built on the Limestone Plains. The school building and remnant open space to the west, which formed part of the school's playground, are tangible evidence of the education practices in the community life of early European settlement in the ACT. The place is important for the way it demonstrates the education practices for children of the families brought out from Scotland to work on the Duntroon estate, as well as for other pioneering rural families on the Limestone Plains. It is also demonstrative of the attitudes and social mores of the Campbells of 'Duntroon', as the benefactors of the school.

St John's Schoolhouse museum is important for its role as a teaching and research site for local and interstate schools, TAFE colleges and universities in local history and cultural and social values.

Specific Requirements

In the National Capital Plan, the land which comprises the St John the Baptist Precinct is specified as a Designated Area under the provisions of s. 10(1) of the *Australian Capital Territory (Planning and Land Management) Act* 1988 and work carried out is subject to the approval of the National Capital Authority. The land is not classified as National Land under the *National Land Ordinance 1989* or subsequent amendments. Consequently the land is Territory Land and Territory planning requirements may also apply. In accordance with s.54(1) of the *Land (Planning and Environment) Act* 1991, the following requirements are identified as essential to the conservation of the heritage significance of this place. These requirements apply to works undertaken by the Territory and in circumstances where the Territory is the approving authority. The Territory's conservation policy for the place is:

St John the Baptist Precinct, comprising the church and grounds, including the Rectory and associated garage and sheds, the Horse Paddock, the graveyard, the Schoolhouse Museum, the open areas of grass and mature trees as well as the hedges and pathways that link the outer grounds to the main church building and schoolhouse, is to be conserved and appropriately maintained consistent with its heritage significance.

i) Building including alterations and additions

a) Minor external alterations and changes may be made to the buildings, including the window weather mouldings, and the conservation of the stonework, and other external finishes where they will not adversely affect the heritage significance of the place and where they are undertaken in accordance with the current Conservation and Management Plans for the place endorsed by the Heritage Council.

b) Any work to conserve the place shall be in keeping with the requirements of the current Conservation and Management Plans endorsed by the Heritage Council.

ii) Landscape

a) The area around the existing buildings shall be retained as open space and additional buildings or structures shall only be permitted where they do not adversely affect the heritage significance of the Place.

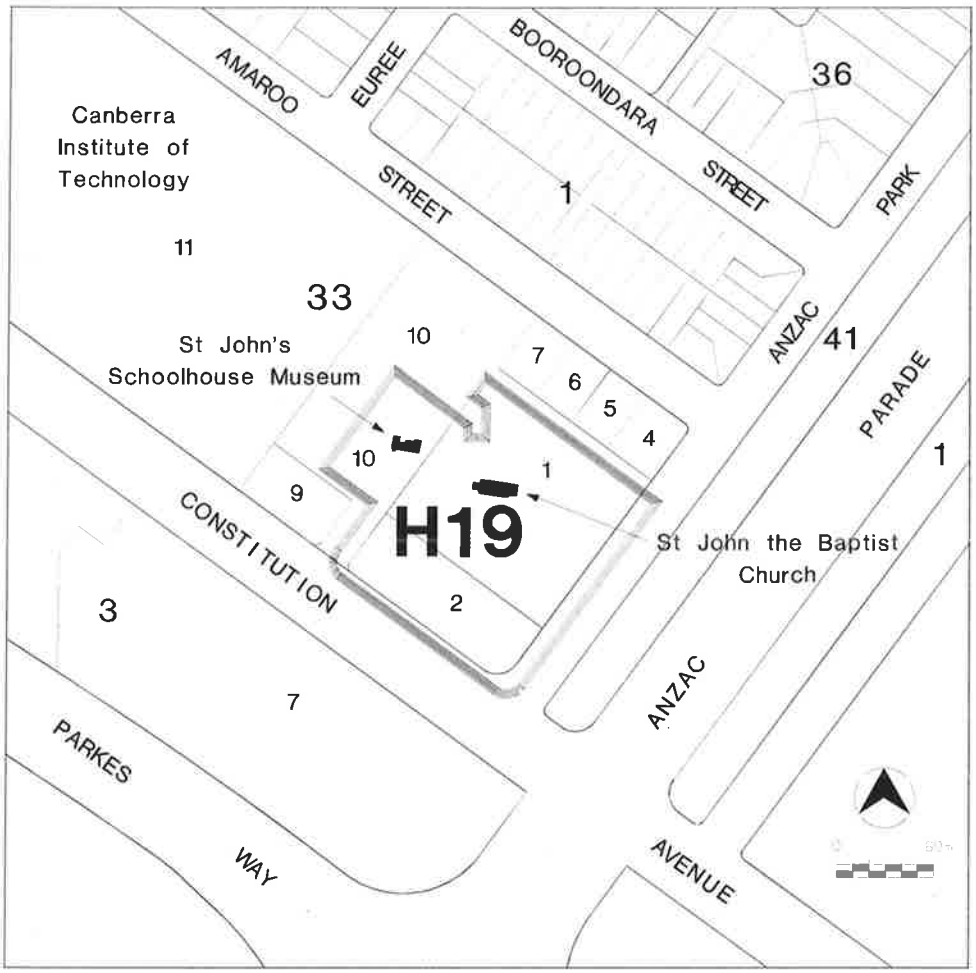
b) The lychgates and perimeter hedges shall be conserved to provide a visual screen.

iii) Demolition

a) Subject to (iii)(b) demolition of the original built fabric shall not be permitted, other than in exceptional circumstances, including circumstances in which the building or structure is structurally unsound and beyond economic repair or where there are significant public health and safety reasons to warrant demolition. Demolition shall not be permitted unless there is no prudent and feasible alternative.

b) The demolition of original built fabric shall only be permitted in the context of sympathetic alteration and additions.

Figure 19: St John the Baptist Precinct, Reid



11.3 2007 HMP Assessment for National Heritage Listing

Criterion A: the place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history.

The original nineteenth century Canberra Church group in the hamlet settlement of 'Canberry' was, with the Molonglo River, crossing and the Duntroon estate one of the key elements of the early settlement, which later grew to be the birthplace of the national capital. The evolution and development of the Anglican Church of St john the Baptist precinct was mirrored by, and evolved with the development of the national capital itself. The intimate connections of the Church precinct with the Duntroon estate and the Duntroon RMC has nationally significant values in terms of land settlement, land tenure, establishment of churches and education and the intimate links between private wealth and benefaction and community good.

Criterion B: the place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.

The precinct as a whole is notable as a 'palimpsest' of the nineteenth and twentieth century geometries of Molonglo Valley settlement, and of the core elements that characterized the hamlet and later city of Canberra. The precinct as a whole (buildings, landscape, archaeology, cemetery and moveable heritage) remains a notable 'thing of beauty' near to the heart of the national capital, which is notable for its intactness, longevity and integrity and which is an uncommon and rare value in a national sense.

Criterion C: the place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history.

The cultural archaeology of the precinct, both above and below ground is probably of national significance, given the relative lack of disturbance over the period of European settlement. The undisturbed nature of the precinct's archaeology must be seen in the context of the radical disturbances occasioned as part of the works associated with the National Capital.

Criterion D: the place has outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of:
a class of Australia's natural or cultural places

The Church and School functions of the original St John's Church group, and although the School was closed early in the twentieth century the function of Church and School remain clearly evident within the precinct as does the clear distinction made evident in the early settlement and establishment of the distinction of consecrated and 'public' ground, i.e. church and state values made real within this precinct.

Criterion E: the place has outstanding heritage value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group

The St John's Heritage Precinct evidences the work of architects, artists and crafts persons (regarded to be)? of national eminence and skill. Nationally regarded architects with involvement in the precinct include Edmund Thomas Blacket, Alberto Dias Soares, Morton Herman, Louis Williams and John Goldsmith. Nationally regarded planners who helped shape the precinct include the Griffins, William Holford, Richard Clough, Grenfell Ruddock and Denis Winston.

Criterion F: the place has outstanding heritage value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group

The St John's Heritage Precinct evidences the work of architects, artists and crafts persons regarded to be of national eminence and skill. Nationally regarded architects with involvement in the precinct include Edmund Thomas Blacket, Alberto Dias Soares, Morton Herman, Louis Williams and John Goldsmith. Nationally regarded planners who helped shape the precinct include the Griffins, William Holford, Richard Clough, Grenfell Ruddock and Denis Winston.

Criterion G: the place has outstanding heritage value to the nation because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons

The history of the precinct clearly evidences the strong and special associations the precinct has had, and continues to have with ecclesiastical, educational, community, military and government entities.

Criterion H: the place has outstanding heritage value to the nation because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history

The associations of the precinct with the life or works of persons and institution of importance in Australia's natural or cultural history is clearly of national status. The precinct has historical and ongoing associations with nationally significant historians community leaders, military personnel politicians and Governors General.

The evolution and development of the Anglican Church of St John the Baptist precinct was mirrored by and evolved with the development of the national Capital itself. The intimate connections of the Church precinct with the Duntroon estate and the Duntroon RMC has nationally significant values in terms of land settlement, land tenure, establishment of churches and education, and the intimate links between private wealth and benefaction, and community good.

The precinct as a whole is notable as a 'palimpsest' of the nineteenth and twentieth century geometries of Molonglo Valley settlement, and of the core elements that characterized the hamlet and later city of Canberra. The precinct as a whole (buildings, landscape, archaeology, cemetery and moveable heritage) remains a notable 'thing of beauty' near to the heart of the national capital, which is notable for its intactness, longevity and integrity and which is an uncommon and rare value in a national sense.

The cultural archaeology of the precinct, both above and below ground is probably of national significance, given the relative lack of disturbance over the period of European settlement. The undisturbed nature of the precinct's archaeology must be seen in the context of the radical disturbances occasioned as part of the works associated with the National Capital.

The Church and School functions of the original St John's Church group, and although the School was closed early in the twentieth century the function of Church and School remain clearly evident within the precinct as does the clear distinction made evident in the early settlement and establishment of the distinction of consecrated and 'public' ground, i.e. church and state values made real within this precinct.

The St John's Heritage Precinct evidences the work of architects, artists and crafts persons regarded to be of national eminence and skill. Nationally regarded architects with involvement in the precinct include Edmund Thomas Blacket, Alberto Dias Soares, Morton Herman, Louis Williams and John Goldsmith. Nationally regarded planners who helped shape the precinct include the Griffins, William Holford, Richard Clough, Grenfell Ruddock and Denis Winston.

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