Rising damp, a reoccurring problem in basements – a case study with different attempts to stop the moisture

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Object

School from 1965:

- 2.900 m² basement
- 700 m concrete outer walls
- 700 m internal brick walls

From Google maps
Original problems and 1\textsuperscript{st} renovation

1998 Mould problems due to:

- Defect drainage
- Leaky sewage system under basement floor
- Capillary suction in concrete floors
- Rising damp in internal walls

100 mm new concrete floor
300-500 mm expanded clay
0-200 mm screed with drain
Membrane
Existing concrete floor

New outlet from storeys above the basement
150 mm insulation
Perimeter drain
Drain
2002 Rising damp in internal walls

- Higher groundwater level (above new floor)
- Steel plates do not stop water under pressure
- No anti-flood valve between the drains
- Drainage under new floor was blocked by ochre
New solutions

Two test methods:

May 2003: **Method 1**

- Damp-proof membrane
- Floor repairs
- New concrete
- Additional membrane
- Steel plates
- Existing bricks
- Mortar
- Hard burnt bricks

July 2004: **Method 2**

- Damp-proof membrane
- Membrane and plastic foil
- New concrete
- Hard burnt bricks
- Steel plates
Time frame of tests

Method 1
Feb. 03
Aug. 03
Feb. 04
Aug. 04
Feb. 05
Aug. 05
Feb. 06
Aug. 06
Feb. 07
Aug. 07
Feb. 08
Aug. 08
Feb. 09
Aug. 09
Feb. 10

Method 2

Feb. 03
Aug. 03
Feb. 04
Aug. 04
Feb. 05
Aug. 05
Feb. 06
Aug. 06
Feb. 07
Aug. 07
Feb. 08
Aug. 08
Feb. 09
Aug. 09
Feb. 10

Microwave moisture measurements
Feb. 08

Nuclear moisture density measurements
Aug. 08

Vertical separation from untreated wall
Aug. 09

Forced drying stopped
Feb. 09

Forced drying
Feb. 10
Moisture measurements

Nuclear moisture density gauge
Neutron radiation reflected by hydrogen atoms

(Troxler)

Microwave moisture measurements
Reflected microwaves depend on dielectric properties of materials (high in water)

(hf-sensor)
Measurements

Nuclear moisture density gauge

- Low moisture: 0-10
- Low to medium moisture: 10-20
- Medium to low moisture: 20-30
- High moisture: 30-50

December 2007

Microwave moisture measurements

- April 2008
- November 2008
- February 2009

Test area 1 Test area 2
Measurements

- Nuclear moisture density gauge:
  High moisture: 21 weigh-% in brick and 6 weigh-% in mortar

- Microwave moisture measurements

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<tr>
<th>Specimen</th>
<th>Location</th>
<th>Date</th>
<th>Weighing Mortar [Weigh-%]</th>
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<th>Microwave moisture measurement [Brick weight-%]</th>
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Conclusions

• Rising damp:
  • Steel plates do not stop water under pressure
  • Drainage is important

• Test methods
  • Capillary suction can be horizontal
  • Non-destructive methods show relative results, not actual moisture content
  • Non-destructive methods can be useful for visual understanding