Decision Support Tool

Annexes and background information to be used with the tool

EMERISDA

Types of damage

The tool asks which types of damage are visible that are expected to have a relation with rising damp. In this chapter, the mentioned damage types are briefly explained. Also, reference pictures are included that can help with the visual inspection of the site.

- ### Moist spots

Areas of the masonry or plaster that look and/or feel wet

- ### Detachment or disintegration of plaster

The plaster is no longer attached to the substrate or loses cohesion itself

- ### Peeling of paint

The paint is no longer attached to the substrate or loses cohesion itself

- ### Loss of cohesion of brick, stone and/or mortar

The brick or stone is powdering, sanding or crumbling, or the top layer of the material is being pushed off

- ### Efflorescence

Deposit of salts on the surface of the wall

- ### Cryptoflorescence

Deposit of salts underneath the surface of the wall, often seen in combination with other types of damage

- ### Biological growth and/or mould

Fungus or mould stains on the surface

A selection of reference images of damage types often related to rising damp:

Figure 1 - algae on brick masonry (left) and on a plastered facade (right)

Figure 2 - peeling of tar/paint on masonry (left) and crypto-florescence and damage to plaster and paint (right)

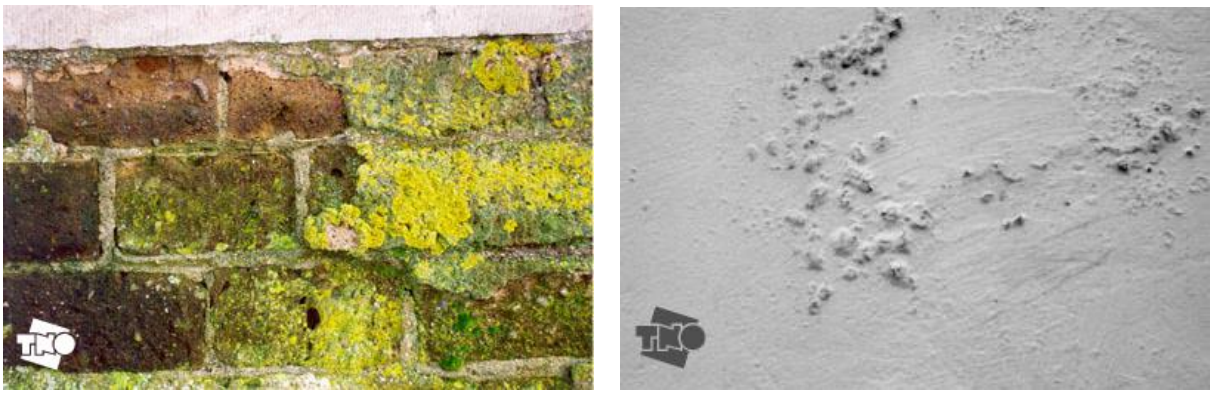


Figure 3 - moss/lichen on masonry (left) and blistering of paint (right)

Figure 4 - powdering of paint/plaster (left) and mould on plaster (right)

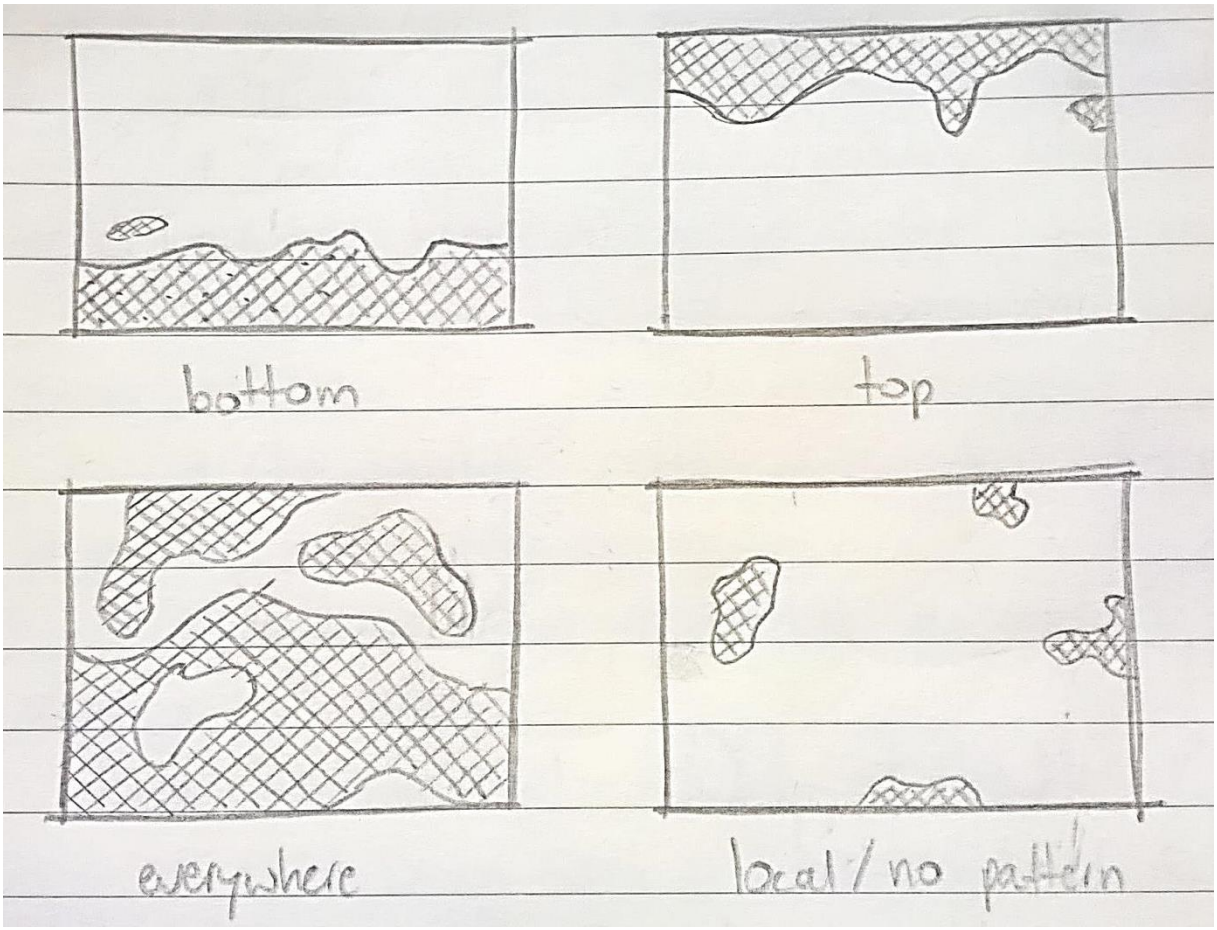
Figure 5 - efflorescence on brick masonry (left) and on plaster (right)

Figure 6 - moist spots, efflorescence and detached plaster (left) and powdering of brick and mortar (right)

All images: mdcs.monumentenkennis.nl

Locations of damage

The tool asks on which part of the wall damage is located. It offers four possible answers:



Bottom: damage is visible mainly on the lower part of the wall.

Top: damage is visible mainly on the higher part of the wall

Everywhere: damage is visible over a large part of the wall surface, without a clear concentration of damage at a specific point or side

Local: damage is visible only locally on one or more smaller spots on the wall surface, without a clear pattern

I did not include an option for 'only near the windows' or 'only near the sink' because I assume that people using the tool will understand that that is not related to rising damp.

Manual: obtaining reliable measurements

The moisture content is to be determined gravimetically on samples collected from the walls. Other methods, for example with two pins measuring the wall conductivity, are not as reliable and are not recommended.

Sampling

Powder samples can be collected by drilling. The drilling needs to be carried out at different heights and depths, along a vertical profile up to the undamaged area. For example, holes can be drilled at a height (measured from the floor level) of 0.2, 0.5, 1, 1.5 and 2 meters. For each hole, the powder for different depths needs to be collected separately, for example 0-20 mm, 20-50 mm, 50-150 mm and 150-300 mm, up to the middle of the wall.

As the moisture content depends also on the type of material, it is recommended that all samples are collected in the same material. Information on the type of material and on the presence of damage should be recorded.

The powder samples are collected in bottles or plastic bags, which are then hermetically closed and transported to the laboratory for measurements of the MC and HMC.

Determining the actual (MC) and hygroscopic moisture content (HMC)

The actual moisture content (MC) is determined gravimetrically. This method consists in weighing the sample before and after drying the samples in the oven until constant weight is reached.

The actual moisture content is derived from the difference between the weight of the sample before and after drying, and it is expressed in w%.

$$MC = 100 * \frac{(\text{weight sample} - \text{dry weight})}{\text{dry weight}}$$

If hygroscopic salts are present in the wall, these can adsorb moisture from the air, when the RH of the air is higher than the RH of equilibrium of the salt. When this condition is verified, the wall will have a moisture content (MC) which is partially determined by the amount and type of hygroscopic salt and the RH of the air. Therefore, for a complete and sound assessment of the moisture content, and thus effectiveness of an intervention, both the actual moisture content and the hygroscopic moisture content (HMC) should be measured.

The HMC is measured by storing the dry samples (the same samples as used for the MC measurements) in a climatic box for 4 weeks at 96% RH and 20C.

$$HMC = 100 * \frac{(\text{weight 96\%RH} - \text{dry weight})}{\text{dry weight}}$$

Overview of available techniques

In this chapter, the interventions mentioned in the Decision Support Tool are explained briefly. For each intervention, the working principle and the process of execution are mentioned. Also, a schematic diagram is included.

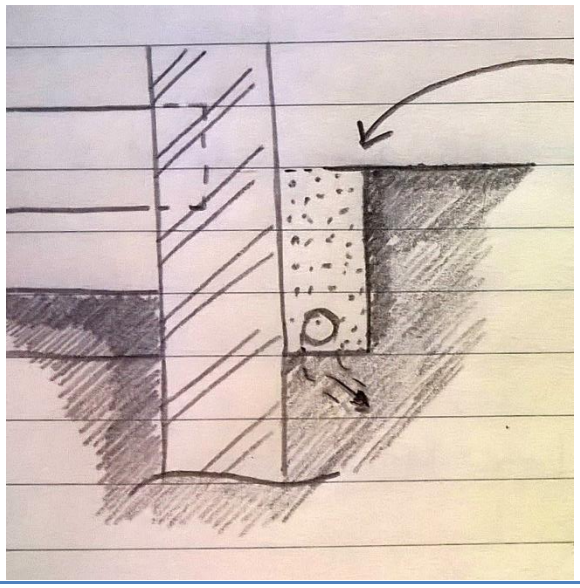
I have deliberately not mentioned the pros and cons of each method, because this will become clear from the tool itself. This document is only intended to avoid confusion about what the intervention is about.

Category 1: Methods based on reducing the amount of water entering the wall

These methods only involve changes outside of the wall itself. No changes are made to the wall or foundations. The methods are meant to drain moisture away from the wall before it actually enters the wall.

Sub-soil drains

- Some soil is removed on the outside of the wall
- Drain is placed at the bottom, leading water away from the wall
- Usually left empty (with a metal grid over it) or filled with a coarse material (e.g. gravel)

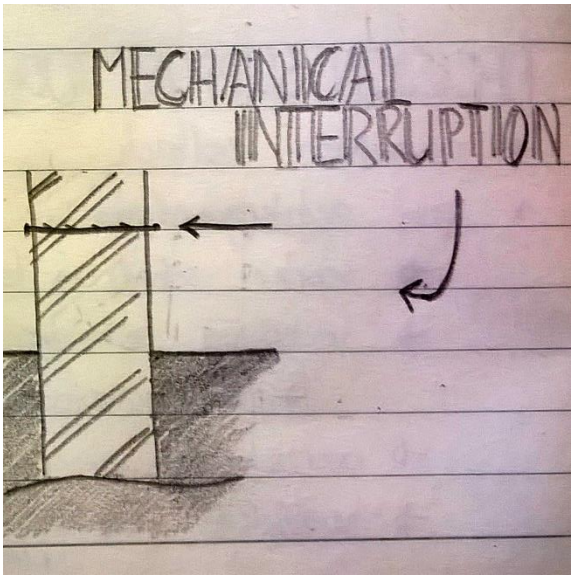


Category 2: Methods that block capillary transport through the masonry

These methods effectively form a barrier inside the masonry, where moisture can not be transported upward through the wall.

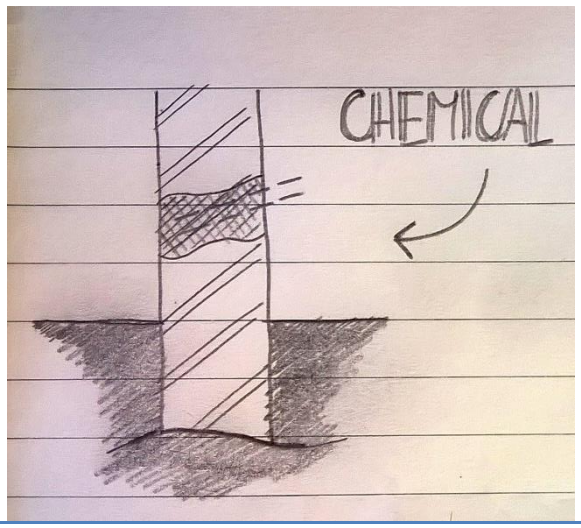
Mechanical Interruption

- An impermeable layer (usually a metal or plastic sheet) is inserted into the masonry, preferably in a horizontal joint



Chemical Interruption

- Holes are drilled in the wall at a regular distance (e.g. 15 cm) from each other
- A chemical product is inserted into the holes and spreads through the masonry, stopping capillary transport of moisture
- The holes are filled with a mortar
- In thick walls, the treatment can be executed from both sides

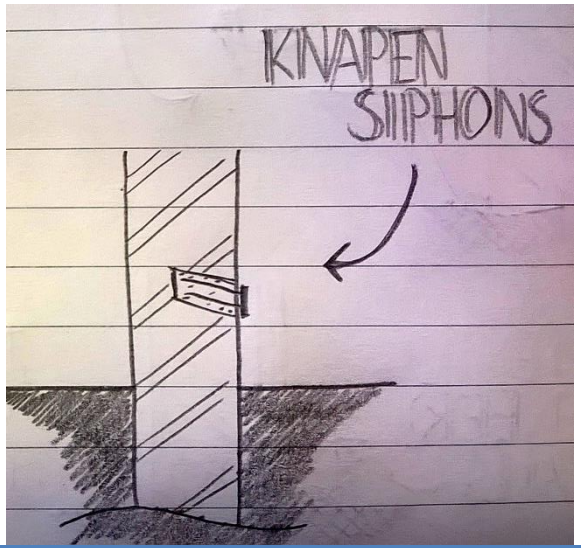


Category 3: Methods based on evaporation increase

These methods do not prevent water from entering the wall, nor do they reduce the capillary transport inside the wall. The methods are intended to enhance evaporation of moisture from the masonry, thereby decreasing the maximum rise level of the rising damp.

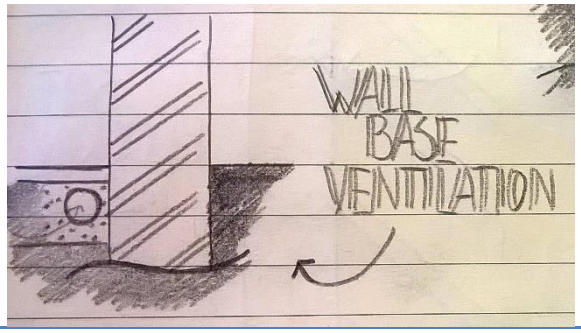
Knapen Siphons (and similar systems)

- Holes are drilled in the wall on the outside
- The siphons are inserted into the holes together with a moisture transporting mortar
- The method should enhance ventilation and therefore evaporation of moisture



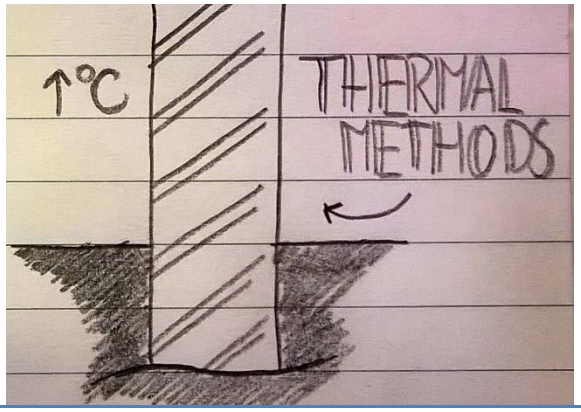
Wall Base Ventilation

- Different systems exist, execution depends on the chosen method
- A ventilation system (active or passive) is applied to the base of the wall, enhancing evaporation of moisture



Thermal Methods

- Different systems exist, execution depends on the chosen method
- The wall is heated in order to enhance evaporation of moisture

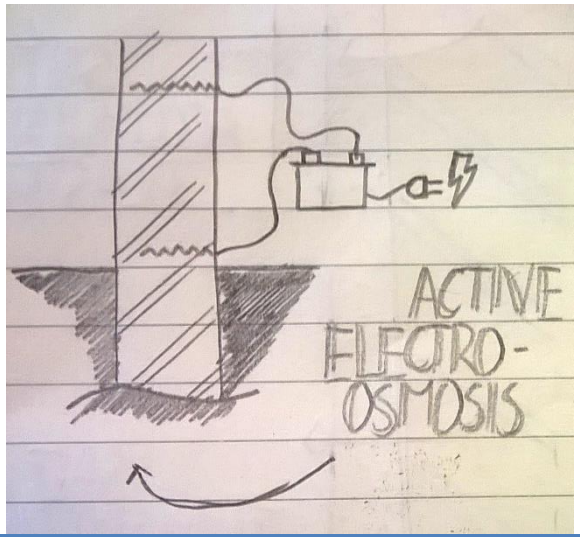


Category 4: Methods based on electrokinetic phenomena

These methods are supposed to alter the behaviour of moisture in the wall by means of electrokinetic phenomena.

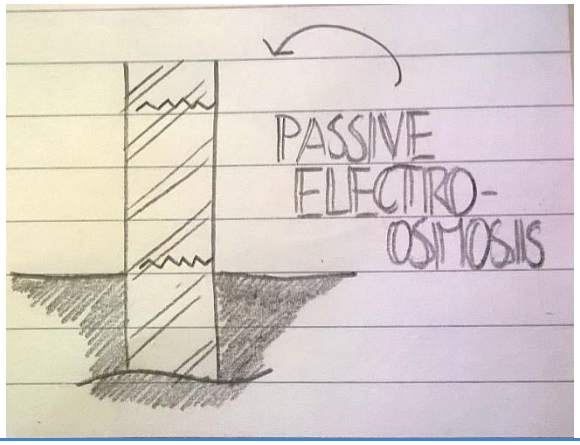
Active Electro-Osmosis

- Electrodes are inserted into or applied onto the masonry and are connected to a power source
- The behaviour of moisture in the wall is affected by the electric current



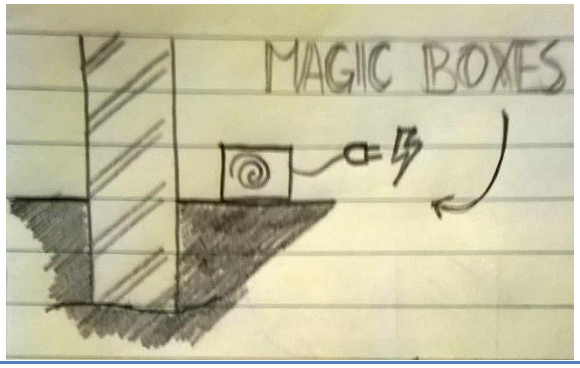
Passive Electro-osmosis

- Electrodes are inserted into or applied onto the masonry but are not connected to a power source
- The difference in potential between the anode and the cathode should influence the behaviour of moisture in the wall



Wireless Methods

- Several methods exist, with different working principles
- A device is placed in the vicinity of the wall and is connected to the electric power.

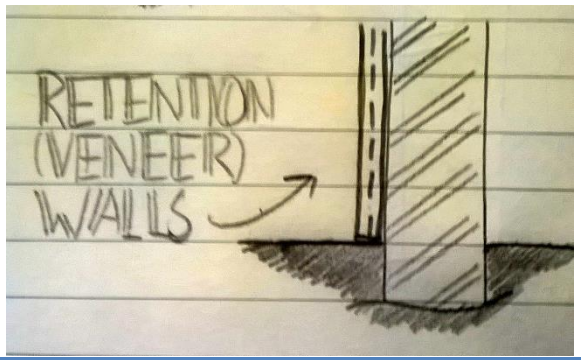


Category 5: Accept rising damp, treat only the symptoms

Sometimes it is not possible to stop rising damp, but the negative symptoms, such as aesthetic damage, can be treated nonetheless. These methods can also be applied together with one or more of the methods treating rising damp (e.g. a sub-soil drain combined with a plaster layer).

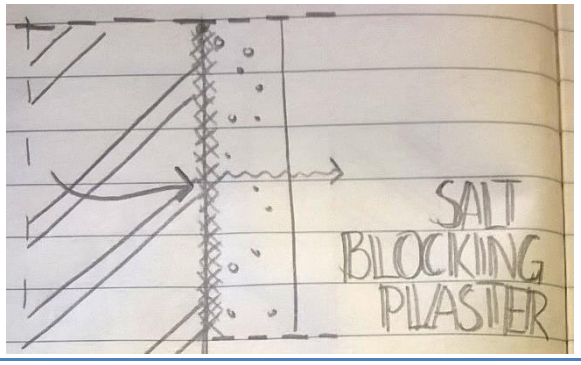
Retention Walls/Veneer Walls

- The wall is covered with a veneer wall or is tiled, effectively hiding the moist wall and the symptoms of rising damp



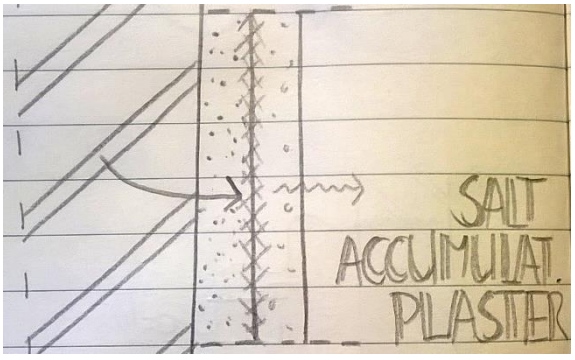
Salt Blocking Plaster

- A layer of plaster is applied onto the wall, that does not allow moisture transport. Damp can go through the plaster (at a slow rate).
- Moisture evaporates at the interface between the substrate and the plaster. This is also where salts crystallise, if present



Salt Accumulating Plaster

- A first layer of plaster is applied, that allows moisture transport.
- A second layer is applied that does not allow moisture transport. Damp can go through the plaster (at a slow rate).
- Moisture evaporates at the interface between the two plaster layers. This is also where salts crystallise, if present.



Salt Transporting Plaster

- A layer of plaster is applied, that allows moisture transport.
- Moisture evaporates at the surface of the plaster. This is also where salts crystallise, if present.