



Methods for investigation and conservation planning at historic stone buildings

This document elucidates my way of working on weathering, risk analysis and conservation planning at historic stone buildings. Further description can be found in my doctoral thesis ([PDF, 19.1 MB](#)). This was published in 1997, but is (hopefully!) not yet completely outdated. It has guided me in most investigations I have done and [reported](#) since then. Most links will lead you to documents on my website - www.per-storemyr.net

Thematic mapping and condition analysis



Figure 1. Simple map of damages at Utstein monastery, Norway.

I usually start a condition analysis with [mapping](#) the object. This may be the whole or part of a monument. Mapping may include themes such as:

- Materials and structures
- Previous restorations
- Damages
- Exposure conditions

In order to understand causes of damage, I rely on experience and targeted studies of material properties and decay products, as well as environmental (climatic) impact and other relevant features.

Risk assessment and monitoring

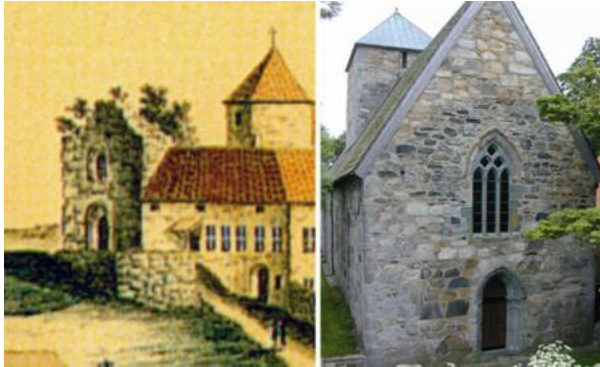


Figure 2. The west wall and portal at Utsein monastery in 1822 (painting by Dreier) and in 2002. Current (salt)-weathering is mainly caused by the former lack of roofing.

In assessing risks of future damage, I take advantage of knowledge of damage (or weathering) processes. Moreover, I make prognoses according to possible changes in environmental impact and proposals for conservation and restoration. In doing so, I also rely on historical records (old photos, drawings, plans, descriptions etc.). What happened in the past may happen again! A “damage record” will also aid in assessing future damage rate. And if it can be shown that minimal change took place in the past, there is usually no need for drastic conservation measures.



Figure 3. Condensation event at 15th century fresco, Romitorio San Michele, Nemi, Italy

When it is hard to understand damage processes and assess risks, I undertake targeted monitoring over shorter or longer time spans.

This may include repeated visits at the object in all kinds of weather, as well as sampling/analyses of decay products and detailed photography.

Monitoring may typically also include (indoor) climate measurements (especially in the case of mural paintings).

Conservation concepts



Figure 4. Gargoyles getting rid of water during a heavy downpour at Notre Dame in Paris

I favour regular maintenance and minimal intervention and generally propose conservation concepts according to these principles. Otherwise I aid in the following:

- Issues related to water discharge and exposure to weather
- Adaptation of indoor climate
- Selection of conservation materials (especially stone, mortar and plaster)

I also make plans for (periodic) inspection and maintenance and can aid in monitoring after conservation/restoration work has been finalised.

Tools and techniques

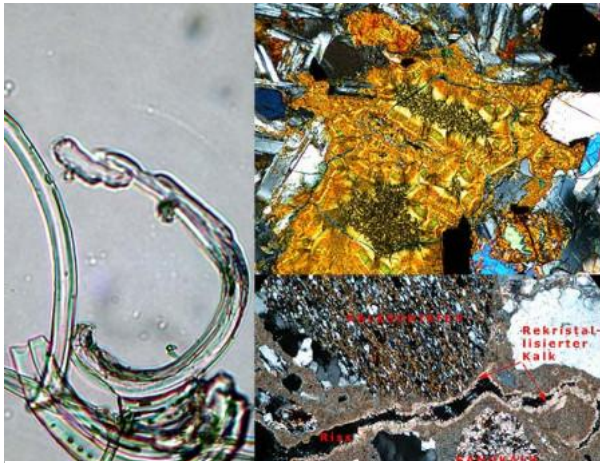


Figure 5. Materials through the microscope: Sodium nitrate salt (left); altered volcanic glass in basalt (top); lime cement mortar with recrystallised calcite

Mapping

I usually rely on available base maps made by photogrammetry, but can also survey using photos and manual drawings. I use software such as Quantum GIS ([QGIS](#), open-source geographical information system), which can easily be made compatible with CAD-software. In simple cases I may draw using Adobe Photoshop. Thematic maps come as PDFs.

Indoor climate

Monitoring of temperature and relative humidity can be undertaken with any logger, from which data can be exported. For interpretation I make diagrams and compare measurements with available outdoor climate data (using Microsoft Excel).

Material analyses

I analyse the properties of materials such as stone, mortar, paint and decay products (soluble salts) myself or in cooperation with other experts. I don't run my own laboratory, but have a partnership with [CSC Conservation Science Consulting](#) in Fribourg (CH). I have also used laboratory services available at the [Geological Survey of Norway](#) in Trondheim.

Reporting

Depending on the project, I favour giving progress and final reports orally at the building site, so that a discussion with responsible persons can take place. But investigations, results and recommendations are, of course, documented in written reports, which come as PDFs.

A note on limitations: I work as a "generalist" at historic building sites, but I don't carry out static stability analyses. Other limitations may be defined in discussions with potential clients.

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