Understanding Building Conservation

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RICS Certified Historic Building Professional
Accredited by the Institute for Historic Building Conservation

Director: Edwards Hart Consultants
Making Decisions – Considering ‘Technical’ & ‘Significance’
1. Introduction
2. Significance and Philosophy
3. Technical Analysis
5. Interventions
6. Specifying, Managing and Implementing
Session Four

- Balancing technical and significance
- Using significance values
- Using data and information from building pathology
- Using ‘conservation policies’ from conservation management plans
TSI’s @ Cardiff Castle

- Environmental Monitoring
- Mortar & Masonry
- Architectural & Technical Paint Research with Chemical Analysis
- Building Services Engineering
Chemical present within substrate/decoration of each interior

<table>
<thead>
<tr>
<th>Room</th>
<th>Chemicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batchelor’s Bedroom</td>
<td>MgSO₄·7H₂O (Epsomite), MgCl₂·6H₂O, Mg(NO₃)₂·6H₂O, KMgSO₄Cl·3H₂O (Kainite), K₂SO₄, KCl, KNO₃</td>
</tr>
<tr>
<td>Lord Bute’s Bedroom</td>
<td>MgSO₄·7H₂O, MgCl₂·6H₂O,</td>
</tr>
<tr>
<td>Nursery</td>
<td>MgCl₂·6H₂O, MgSO₄·7H₂O</td>
</tr>
<tr>
<td>Banqueting Hall (south vestibule)</td>
<td>MgSO₄·7H₂O, MgCl₂·6H₂O, Mg(NO₃)₂·6H₂O, K₂SO₄, KCl, KNO₃, KMgSO₄Cl·3H₂O</td>
</tr>
<tr>
<td>Study, South Wall</td>
<td>MgSO₄·7H₂O, MgCl₂·6H₂O, K₂SO₄, KCl, KMgSO₄Cl·3H₂O</td>
</tr>
<tr>
<td>Chapel, Apse</td>
<td>MgSO₄·7H₂O, MgCl₂·6H₂O, Mg(NO₃)₂·6H₂O, K₂SO₄, KCl, KNO₃, KMgSO₄Cl·3H₂O</td>
</tr>
<tr>
<td>Chaucer Room</td>
<td>MgSO₄·7H₂O, MgCl₂·6H₂O, K₂SO₄, KCl, KMgSO₄Cl·3H₂O</td>
</tr>
<tr>
<td>Octagon Stairs</td>
<td>K₂SO₄, KCl</td>
</tr>
<tr>
<td>Library</td>
<td>MgSO₄·7H₂O, MgCl₂·6H₂O</td>
</tr>
</tbody>
</table>
ERH% of chemical mixture found in each interior

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>EQUILIBRIUM RH OF SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>Lord Bute’s small dining room surface</td>
</tr>
<tr>
<td>1(b)</td>
<td>Lord Bute’s small dining room – 29cm depth</td>
</tr>
<tr>
<td>2</td>
<td>Lord Bute’s bedroom</td>
</tr>
<tr>
<td>3</td>
<td>Nursery</td>
</tr>
<tr>
<td>4</td>
<td>Banqueting hall</td>
</tr>
<tr>
<td>5</td>
<td>Study</td>
</tr>
<tr>
<td>6</td>
<td>Chapel</td>
</tr>
<tr>
<td>7</td>
<td>Batchelor’s bedroom</td>
</tr>
<tr>
<td>8</td>
<td>Chaucer room</td>
</tr>
<tr>
<td>9</td>
<td>Octagon stairs</td>
</tr>
<tr>
<td>10</td>
<td>Library</td>
</tr>
</tbody>
</table>

This indicates the maximum RH% to be maintained within each interior regarding care of decoration only. This should ensure that the chemical is maintained in a solid state.
Relating all sources of data to each other

<table>
<thead>
<tr>
<th>Ref</th>
<th>Material/Element</th>
<th>Most Suitable RH</th>
<th>Most Suitable Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Books and documents</td>
<td>Between 55% and 65% fluctuations particularly damaging</td>
<td>Not higher than 15ºC</td>
</tr>
<tr>
<td>2</td>
<td>Furniture</td>
<td>Between 55% and 65% with daily fluctuations less than 10%</td>
<td>Not higher than 15ºC, avoid placing near heat sources</td>
</tr>
<tr>
<td>3</td>
<td>Mirrors</td>
<td>Between 55% and 65%</td>
<td>Not higher than 15ºC</td>
</tr>
<tr>
<td>4</td>
<td>Black and white photographs</td>
<td>Between 45% and 55%</td>
<td>Not higher than 15ºC</td>
</tr>
<tr>
<td>5</td>
<td>Stone (including marble and alabaster)</td>
<td>Between 50% and 60%</td>
<td>Between 5ºC and 15ºC</td>
</tr>
<tr>
<td>6</td>
<td>Timber panelling</td>
<td>Between 55% and 65% with daily fluctuations less than 10%</td>
<td>Not higher than 15ºC</td>
</tr>
</tbody>
</table>

Collections and contents of the building
## PROBLEMATIC EFFECTS OF RELATIVE HUMIDITY

<table>
<thead>
<tr>
<th>Ref</th>
<th>RH (%)</th>
<th>Typical Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>Saturation percentage</td>
</tr>
<tr>
<td>2</td>
<td>&gt;96</td>
<td>Mould can develop on glass wool</td>
</tr>
<tr>
<td>3</td>
<td>&gt;90</td>
<td>Bacteria can multiply: mould can appear on brick and painted surfaces</td>
</tr>
<tr>
<td>4</td>
<td>&gt;85</td>
<td>Dampness stage; materials may become visibly damp or damp to touch. Timber decay occurs</td>
</tr>
<tr>
<td>5</td>
<td>&gt;76</td>
<td>Mould can develop on leather. Multiplication of mites greatest above this level</td>
</tr>
<tr>
<td>6</td>
<td>&gt;70</td>
<td>Viability of mould increases markedly</td>
</tr>
<tr>
<td>7</td>
<td>65</td>
<td>Maximum optimal comfort level for humans</td>
</tr>
<tr>
<td>8</td>
<td>40-50</td>
<td>Minimum survival level for dust mites</td>
</tr>
<tr>
<td>9</td>
<td>45</td>
<td>Minimal optimal comfort level for humans. Electrostatic shocks more likely below this level</td>
</tr>
</tbody>
</table>

### Other effects ~ including people and health
1. The Health of the building and decoration
2. The Health of the Contents
3. The Health of the People

Building Pathology data - helping to make informed decisions
Remedy – environmental control and management in use

Sensor sends signal to Building Management System

Sensor Monitors Environment

HUMIDIFIER

HEATER

BMS
**MASONRY ~ testing moisture ingress rates for mortar mixes**

<table>
<thead>
<tr>
<th>No.</th>
<th>Capillary Rise Test</th>
<th>Moisture Ingress</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1 part Hydraulic Lime NHL 3.5, with 2 parts sand and limestone (blend)</td>
<td>40 - 45 mm</td>
</tr>
<tr>
<td>2.</td>
<td>1 part Hydraulic Lime NHL 3.5 (with magnesium stearate), with 2 parts sand and limestone blend (1:1)</td>
<td>38 mm</td>
</tr>
<tr>
<td>3.</td>
<td>1 part Hydraulic Lime NHL 3.5 with 2 parts sand</td>
<td>75 mm</td>
</tr>
</tbody>
</table>

Note: The magnesium stearate is 0.25% of binder by weight, which is the same proportion as St. Astier ‘Eco-Mortar. Test results represent moisture ingress via driving rain for 120 minutes.
## MASONRY ~ test on mortar mix conclusions

<table>
<thead>
<tr>
<th>No.</th>
<th>Capillary Rise Test</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1 part Hydraulic Lime NHL 3.5 with 2 parts sand and limestone (blend)</td>
<td>The second best</td>
</tr>
<tr>
<td>2.</td>
<td>1 part Hydraulic Lime NHL 3.5 (with magnesium stearate), with 2 parts sand and limestone blend (1:1)</td>
<td>The best</td>
</tr>
<tr>
<td>3.</td>
<td>1 part Hydraulic Lime NHL 3.5 with 2 parts sand</td>
<td>The worst</td>
</tr>
</tbody>
</table>

The magnesium stearate additive provides a reduction in penetrating dampness.
Remedy – exterior work

emphasis on protecting the interiors!

Based on TSI’s and Conservation Policies
Surveys and TSI’s with Pathology

- providing sustainable conservation

THE RISK OF FAILURE IS REAL!

An approach involving Building Pathology is essential!
Conservation Management Plans

Cardiff Castle

What are they?

• Comprehensive study - by a broad range of experts
• Considering all the issues.
• Produced in consultation.

Providing credibility!
• Faced up to issues
• Properly determined and graded significance
• Endorsed the analytical and self-critical approach.
Conservation Management Plans

Cardiff Castle

*International significance*
the present Burges scheme, which is an unsurpassed example of 19th century Gothic expression and medieval fantasy

*National significance within the United Kingdom*
unique resource reflecting 2000 years of history
an early attempt at interpreting and presenting archaeology

*Regional significance*
a focal point for civic pride and Welsh culture
a centre for spiritual and political expression
the reason for the siting of the present city of Cardiff, the capital city of Wales
What does have Significance?

Cardiff Castle

“The re-modelling of Cardiff Castle by William Burges for his client the 3rd Marquess of Bute has gained international significance because:

• Quintessential embodiment of the High Victorian Dream.

• Highly intellectual

• There is substantial documentary survival

• It is an early example of close co-operation between client, architect and antiquarian.

• Great Regional Significance and Local interdependence”.

ciobacademy.org
Conservation Work

POLICY 7.3A: SIGNIFICANCE STATUS  *(See issue 7)*

(i) All intervention, structural or otherwise which is proven to be necessary for the conservation of significant fabric should seek to understand, protect and enhance the significance during works and avoid the loss of other significant fabric.

(ii) Where intervention and loss of fabric is unavoidable it should be kept strictly to the minimum and fabric of lesser significance should be sacrificed in preference to fabric of considerable significance.

The significance of fabric elements are defined in greater detail with the Annex documents.
POLICY 7.4A: PRIMARY SIGNIFICANCE OF THE BURGES INTERIORS

The conservation of the Burges elements shall take precedence in the conservation strategy of the House at Cardiff Castle. A general policy of minimum intervention is endorsed but where careful research indicates that the survival of Burges interiors are dependent on intervention into other fabric of lesser significance this will be considered as an option.

POLICY 7.4B: RESTORATION

The significance of the Burges interiors largely relates to their completeness... Restoration may therefore be appropriate in order to conserve the significance of a particular room.
Combining Technical & Significance
Combining Technical & Significance

This is ‘Conservation’
Combining Technical & Significance

This is ‘Conservation’

Australian Burra Charter

“Conservation means all the processes of looking after a place so as to retain its cultural significance.....”

Significance means: “aesthetic, historic, scientific or spiritual value for the past, present and future generations.”

Australia ICOMOS Burra Charter 1999.
Noting the risks with ‘minimum intervention’
Combining Technical & Significance

BS 7913: 2013: Section 6.5 Minimum Work

“The level and nature of repair should be appropriate to the particular situation and historic building. For example, some elements of a structure require periodic replacement, such as roof coverings, which can be justified by the need to protect the structure below. The level of intervention can be higher if the costs and complexities of access merit this.”
Section 5.3.1: Sustainability: ‘When the use of a historic building is changed it can result in changes to internal environmental conditions that have an adverse effect. An analysis on this should be carried out. This could include comparing current environmental conditions with predicted environmental conditions’.
The change of use predicted at Cardiff Castle was increased visitor numbers and the effects on this had to be predicted and methods of mitigation developed. The method developed included timed tours only with a short tour and longer tour on offer which were to be priced at a rate whereby a tour of the house interiors would only be available at an additional cost thus helping to control the numbers of visitors entering the house. It also meant entering the Burges interiors via a new visitor centre and through this grit on shoes would be dispersed along the way as well as any wet clothing drying out as much as possible and the facility for leaving bags.
Exiting the building via more robust basement areas was also key as it would ensure that doors in the vicinity of the Burges interiors were kept closed thus helping to maintain reasonable environmental conditions.
Combining Technical & Significance

BS 7913: 2013: OTHER SECTIONS APPLY

5.1 Strategic and operational management and

5.7 The process of planning major change.
Combining Technical & Significance

Cardiff Castle EXISTING – Primary ‘attraction’
House interiors

NO Interpretation
NO Access
House Tours
Combining Technical & Significance
Combining Technical & Significance
Combining Technical & Significance

Cardiff Castle – much more than a house!

Strategic Planning ~ Balancing Conservation, Access and Economics!

Risk Management ~ How to deal with increased visitor numbers?
Combining Technical & Significance

VISITOR CENTRE – providing undercover access to the House (Burges interiors – no external exit)
Under cover access to House via visitor centre and timed tours only at an extra cost.
Combining Technical & Significance & Economics

Cardiff Castle – a strategic balanced plan

Front door not used

Entrance into the House under cover via visitor centre

Exit Burges interiors via ‘robust’ basement exit

2,000 years of historical development
Combining Technical & Significance & Economics

Cardiff Castle – a strategic balanced plan

- Increasing visitor numbers and income
- Increasing access – new access to more robust areas
- Managing risk – understanding the most sensitive areas i.e. the HOUSE
- Undercover access to the HOUSE and no direct exist from the Burges interiors to the outside
- Limiting access to the HOUSE with a short and long timed tours (limiting numbers) at an additional cost at an extra charge.

2,000 years of historical development
Combining Technical & Significance & Economics

Conversion of Warehouse into Apartments

• Improve information on construction
• Thermal imaging
• Bore holes
• Bore scopes
• Opening up
• Material testing & determine thermal conductivity
• More accurate information to calculate in specific locations - BS EN ISO 6946 ‘combined’
• Thermal simulation – WUFi
Combining Technical & Significance & Economics

Conversion of Warehouse into Apartments

1. Determine the present thermal performance.
2. Determine the improved thermal performance with a range of measures inc solid wall insulation.
3. DETERMINE OUTCOME
4. If proceeding consider all the risks and their mitigation – can they be dealt with?
5. DETERMINE OUTCOME
6. If proceeding consider SIGNIFICANCE – determine significance values (should be at the beginning of the process) & HIA’s
7. DETERMINE OUTCOME

NOTE that the HIA will consider impact on significance, but also take on board broader issues such as economics and use...