



**HISTORIC ENVIRONMENT SCOTLAND
THE ENGINE SHED
CONSERVATION DIRECTORATE
CONSERVATION SCIENCE TEAM**

**STIRLING CASTLE
THE KINGS OLD BUILDINGS
VAULTS
METHOD STATEMENT FOR INTERNAL PLASTER AND MOISTURE ANALYSIS**

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METHOD STATEMENT FOR PLASTER INVESTIGATION AND MOISTURE ANALYSIS

INTRODUCTION:

The purpose of this document is to form an integrated part of the Scheduled Monument Consent (SMC) application for a wider programme of investigation works to the Kings Old Buildings.

This method statement details the proposed plaster and moisture analysis investigation of the interiors of the vaults in the Kings Old Buildings, Stirling Castle, for the identification of: (i) the binder employed in the manufacture of the internal plaster, and (ii) the relative near-surface moisture content within the walls, as per the request from the Architect Neil Greenshields, LDN Architects, and the District Architect Tom Gaze, Historic Environment Scotland.

Plaster investigation requires:

The investigation of the plaster includes:

- Take small samples of plaster that will be examined by binocular microscopy and X-Ray Diffraction (XRD).

To confirm the type of binder used within the different layers of plaster, small samples representative of the full thickness of the plaster material will be taken from the areas to be investigated for examination by XRD.

The samples, measuring a minimum of ~20mm x 20mm x thickness of the plaster, will be taken by means of a small chisel or fine dremel blade. The size will depend on the area that needs to be investigated and the thickness of the plaster. Although they have to be representative, the tendency is to take samples from non-conspicuous areas.

This technique allows the identification of the crystalline components of the plaster layers, and will determine whether the plaster is lime, gypsum or cement based.

On receipt in the laboratory, the sample will be dried to constant weight and the initial moisture content, degree of carbonation and colour of the sample determined. The plaster will then be examined under binocular microscope at ~5x magnification and prepared for XRD analysis by initially sub-sampling different layers of the plaster if present. Sub-samples are prepared for XRD analysis by grinding to a fine powder with a mortar and pestle.

Near surface moisture analysis requires:

The investigation of the relative near-surface moisture content of the plaster – stone substrate is carried out using an Rf technology MOIST 300 B microwave moisture analyser. This technique is

completely non-destructive and will not visually or physically impact on any part of the plaster material. Moisture analysis is undertaken by placing a sensor head in light contact against the wall, which then emits harmless microwaves into the material. Data is collected in a 30cm spaced grid across the surface of the material to be analysed.

Analysis can be carried out using the 3cm (for measuring moisture levels within the plaster) and 30cm sensor heads (for moisture levels within the plaster and near-surface of the underlying substrate).

Time required:

One day on site for collecting microwave moisture analysis data and extracting samples of plaster. XRD analysis of the collected samples and interpretation of all of the collected data will arrive in the weeks following the data collection/site visit.

Dr Callum Graham
Laboratory Scientist

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