The sustainable restoration of historic masonry: Robben Island

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Abstract

This poster presents the results of an experimental investigation into the physical properties of the cementing materials from the 1700s and 1800s. The samples were collected from the South African political heritage building, Robben Island and analysed.

The original plaster, render, bedding mortar and floor material from the island's oldest buildings were composed of seashell aggregates and lime as a binder.

Some sections of the render, plaster and raised pointing were cement based. These take up a minority area of the buildings and were referred to as recently repaired areas. In most areas where such cement-based materials were used, the materials show signs of detaching from the original surfaces.

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Introduction

The historic buildings construction, before the introduction of Portland cement, were made of lime-based mortars (Arandigoyen & Alvarez, 2007). However, the majority of the heritage restorers in present years misunderstood the compatibility repair approach. As per Gulbe et al. (2017), and Marini et al. (2018), the common practice is the use of the Portland cement on lime-based materials which harms the original fabric. This is the case on the south African Robben Island. As a result, there is a need for repeated repairs due to incompatibility. The Typical failures on repair material is shown in Figure 1. where cement-based material is detaching from the original surfaces.

Figure 1. Recent repairs (Robben Island, 2019)

This calls for a compatible and sustainable approach that could only be achieved through original material characterization prior to restoration (Schueremans et al., 2011).

Significance

The heritage authorities in South Africa and the world as a whole could benefit economically if they practice the compatible restoration of historic buildings. It can be achieved through the original historic material analysis. As a result, historic buildings could live to see many more years for future generations and will enhanced the tourism of the country.

Material analysis will help in the production of a replica mortar, hence, compatible restoration.

Methodology

The historic mortars were collected from the 1700s (Pre-primary school building) and 1800s (Maximum security prison) building precincts at Robben Island following the procedure illustrated in Figure 2. below.

Figure 2. Sample collection: Robben Island

A total of 15 representative samples from the floor, internal plastering, rendering and bedding material were investigated for their physical properties at the CPUT laboratory. The samples were tested for the parameters depicted in Figure 3.

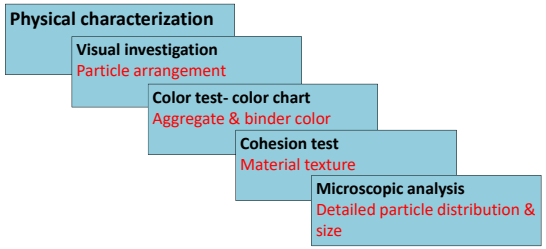

Figure 3. Physical characterization

The above procedure provides information on the mortar components such as the aggregate and binder type which could be verified using detailed chemical analysis. According to Palomo et al. (2014), the analysis as depicted in Figure 4. is a leading tool for search of repair mortars on historic masonries.

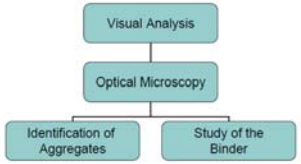

Figure 4. Mortar composition analysis (Palomo et al., 2014)

Results

The physical properties of the 1700 and 1800 building precincts at Robben Island are shown in Table 1.

Table 1. Physical properties

Sample ID	Sample type	Color	Cohesion	Binder	Aggregate
MSP1	Raised pointing	Light grey	Tough	Cement	Sand
MSP2	Raised pointing	Grey	Tough	Cement	Sand
MSP3	Bedding	Dark grey	Tough	Cement	Sand
PS1	Render	Dark grey	Tough	Cement	Sand
PS4	Plaster	Whitish grey	Very tough	Lime	Shells
PS12	Floor	Grey	Very tough	Lime	Shells

The microscopic images for some of the mortars from the pr-primary school building (1800s) are shown in Figure 5.

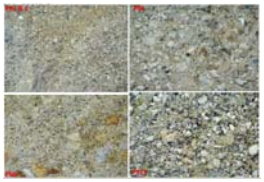

Figure 5. Microscopic mortar images

Conclusions

The concept of characterizing original historic materials needs to be given attention not only in Africa but across the world. It is proven to yield repairs which would last for decades as application of suitable materials would be ensured.

Acknowledgements

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