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# CHARACTERISATION OF MORTAR DETERIORATION IN HISTORIC BUILDINGS IN BAGAMOYO, TANZANIA

**Charles Lucian**

Ardhi University (ARU), P.O. Box 35176l, Dar es Salaam, Tanzania

**ABSTRACT:** *Masonry components of Historic building in Bagamoyo, Tanzania have suffered considerable deterioration in a variety of forms, and close examination indicates that the root cause of the deterioration of the structure is mainly due to masonry mortar joint failure because of chemical and physical degradation of the material. This paper examines the colours, physical and mechanical properties as well as chemical composition of the mortar; thus its replacement carefully matches the historic in chemical composition, strength and texture as determined by a laboratory analysis. In terms of colour, the mortars were divided into three groups of colours namely light grey, light brown and light yellowish brown. Point counting by microscopical study indicated that the hard mortar has higher binder content and composed of a homogenous hydraulic matrix and a heterogeneous coarse fraction with moderate voids while the moderate hard mortar contained modest binder and soft and friable lime mortar contained little hydraulic binder. The results of chemical composition indicated that the stones composed of high amount of Calcium Oxide (CaO) while the mortar contained low percentage of CaO indicating that the mortar is not pure hydraulic lime but hydrated lime (air-hardening lime).*

**KEYWORDS**: Petrography Examination, X-Ray Diffraction (XRD), Absorption Capacity, Compressive Strength, Bulk Density and Repointing

## INTRODUCTION

Mortar plays an essential role in the function of historic buildings, thus it is important to understand the properties of mortar before undertaking any renovation work on an historic buildings (Ashurst & Nicola, 1988, Henry& Stewart, 2011 and Cullinane, 2013). Likewise, the conservation of historic building requires an understanding of physical properties (density, hardness), chemical composition (presence of acids, alkalines, salts, or metals) and mechanical properties (compressive strength, shear strength etc.) of building materials used in construction so that the replacement materials will be compatible with the historic resource(Robertson, 1982,Weeks and Grimmer, 1995, Charola, 1988, Feilden, 2003 and Van Hees et al., 2006).

Many historic building materials in Bagamoyo are subjected to damage caused by continued exposure to weathering agents, Biodeterioration and Biodegradation, vandalism, and pollution as well as deterioration of intrinsic properties of the materials (e.g. mineralogy, texture and structure). Masonry structures in particular have problems and damage associated with aging of mortar in masonry joints. Effort to renovate the historic buildings in Bagamoyo has always proved futile because of employing inappropriate conservation methods and materials. For example, it is a common practice in Bagamoyo to replace the old lime mortar with Portland cement. While lime mortar is flexible with an ability to breathe thereby allowing internal moisture to quickly evaporate from the surface of walls, the hard mortars made using Portland cement does not allow humidity to evaporate, thus causing the plaster coat to crack under the



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accumulated structural stresses due to trapped evaporation. Therefore, the knowledge of the chemical, physical and mechanical properties of the building structural material is very crucial for the selection of mortar compatible to the old masonry units.

The fact that the deterioration of masonry units is localized in the mortar, this article pays more attention on the physical properties, chemical composition and mechanical properties of the masonry mortars (mortars, plasters and renders) in order to characterize their technical requirements for suitable restoration. Because mortars do not occur in isolation but binds masonry units together, allusion has been paid to potential properties of stones found in historic buildings in Bagamoyo. The stones studied includecoral stones (fossil coral) and limestone used to erect the body of the walls of historic buildings in Bagamoyo.

## BACKGROUND TO BAGAMOYO

Bagamoyo is a small wonderful historic township in a quiet beautiful bay that strolls along the splendid clean sandy beach of unpolluted water of the Indian Ocean in Coast region, at a distance of approximately 75 km, north of Dar es Salaam (the capital city of Tanzania). Bagamoyo is one of the oldest towns in East and Central Africa, with a myriad of historical associations with the slave trade that drew African societies into the international trade transactions and promoted exports and infrastructure. When the German East Africa was established in 1888, Bagamoyo was chosen as their capital. Also, Bagamyois distinguished by its rich assembly of 18th century architectural heritage with a unique blend of African, European, Indian and Arabic cultures in the architecture of the buildings. Some of the outstanding testimonies of the built heritage are the Old Fort built in 1860, Customs House built in 1895 and the Old Boma Building built in 1897. These historic buildings are important for the future of the country to constantly remind the people the physical materials, ideas, skills, knowledge and the flow of the preceding culture.

## METHODOLOGY

To obtain the necessary information on historic buildings in Bagamoyo, the research approach involved physical site visit to document construction details of the buildings, identification of defects, sample collection for laboratory tests and laboratory tests to identify physical and chemical properties of building materials in historic buildings by means of surveys, literature identification and laboratory tests. The condition survey involved assessment of the structural condition of the buildings, disintegrating mortar, deterioration in windows, and roof deterioration. The survey entailed close examination on the tear and wear of roofing materials i.e. wood deterioration or water stains, sway, sagging, warping, swelling, pulling away from walls or physical damage.Mortar samples being the centre of this study were taken from different locations of several buildings. The selection of these mortar samples was based on construction period or age and overall quality. The samples were taken from internal and external sides of the rubble masonry walls at various heights and widths in order to be representative of the construction technologies and locations in the structure. All samples were taken with hammer and chisel and their location was recorded and photographed. The samples were tested in the laboratories at the University of Dar es Salaam and SEAMIC for physical properties and chemical properties respectively. These include petrography examinationof


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mortaraccording to ASTM C 1324, compressive strength test according to ASTM C170 1990, bulk density test and water absorption testaccording to ASTM C97 1990 and X-ray diffraction (XRD) test according to the method of Brown and Brindley (1984). The tests were conducted so that the obtained data would characterize valuable information for the application of studies materials in the restoration of historic buildings to their authentic state.

## RESULTS AND DISCUSSION

### Damages and Deterioration of Masonry Units in Historic Buildings in Bagamoyo

Due to years of deferred maintenancemost historicbuildings in Bagamoyo have suffered serious deterioration and lost their significant part of their heritage value**.**Some historic buildings have fallen completely into disrepair and eventually crumbled, collapsed or been abandoned(Figures 1 &2). Over a period of time the action of weathering and erosion has eaten deep into the lime plaster and mortar progressively reducing it to powder in places. In certain cases the friable mortar has completely disintegrated into micro-particles leaving the lime-stones and coral stones completely loose. Close examination revealed that the real root cause of the disintegration in the masonry elements is the deteriorated mortar leaving the lime stones and coral stone physically intact but loose bound. It is from this fact that most physical and chemical tests were mostly directed on the mortars and little allusion was paid to the walling materials.

Further inspections found out that rain water ingress through friable mortar and condensation have caused development of black mould, bands of discolouration and fungal growth on the walls and slabs.

| | |
|---|---|
|  |  |
| **Figure 1**: Total collapse of Building (Walls) | **Figure 2:** Deteriorated Windows |


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## Weaknesses in the different types of mortars

All mortar samples were examined with respect to classification of colours, contents and stability. Based on results from visual examination, the samples were divided into three main groups, namely hard mortars with contents of marine shells, lime inclusions and charcoal particles, moderate hard mortars with contents of marine shells, lime inclusions and charcoal particles and soft and friable Mortars with contents of soil lumps, lime inclusions and charcoal particles

The mortars of the first group are light grey, dense, with good adhesion to the building stones, and good moisture resistance. These mortars often display high contents of shell pieces with elongated morphology or spherical in outline. Lime inclusions and traces of small pieces of charcoal fragments also were observed. The matrix of the hard mortar is characterised by fine-grained, homogeneous, cohesive binder of carbonated lime with shrinkage cracks and fragments of original limestone features. A low abundance of charcoal particles are observed homogeneously and sparsely distributed throughout the matrix. These charcoal fragments are remnants from the wood used to incinerate the limestone. The intimate contact and bond between charcoal particles and mortar are strong. Furthermore, fine discontinuous polygonal micro-cracks were found throughout the matrix in moderate abundance (Figure 3).

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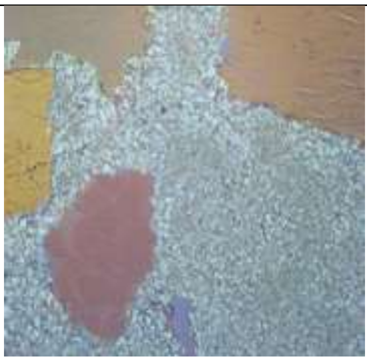
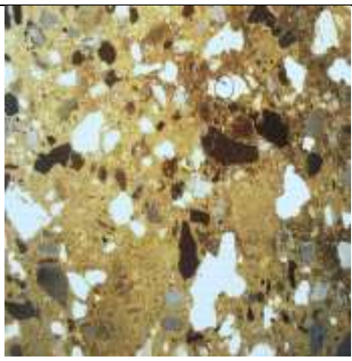
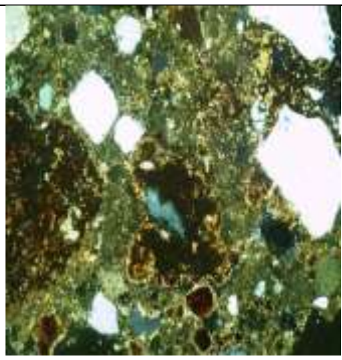
|  |  |  |
| **Figure 3:** Hard mortar - good adhesion | **Figure 4:**Moderate hard mortar- moderate adhesion | **Figure 5:** Soft and friable mortar – poor adhesion |

The mortars of the second group are light brown, characterised by porous lighter lime inclusions and charcoal particles. These mortars are dense but relatively soft with moderate adhesion and poor moisture resistance (Figure 4). The third group mortars are light yellowish brown, soft and friable, with very poor adhesion and moisture resistance. These mortars crumble easily, exhibit very low mechanical strengths and bonding characteristics and contain charcoal particles, soil lumps and inclusions of limestone fragments (Figure 5).

## Effect of different mortar type on building condition

Petrographic analysis evidenced that the hard mortar tested possessed homogeneous, carbonatednon-hydraulic lime matrix with moderate capillary porosity. The primary minerals in the mortar are quartz, feldspar and calcite; with the latter being more dominant. Further examinations of hard mortar showed the presence of aggregate whose shape varied from very round to very angular indicating that any locally available sands was used with no particular requirements for particle shape and size. Moreover, the examination indicated the hard mortar

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contained trace amounts of wood charcoal from calcination of the lime binder. Lastly, the microscopic analyses identified very fine-grained phases in the lime lumps.

These properties of hard mortar make building structures more compacts with limited defects. The soft and friable mortar on the other hand is characterised by more fine than coarse aggregates and little binding agent. Because of the lower content of aggregates in this mortar, a large amount of pores and shrinkage cracks prevails. Like in hard mortar, quartz, feldspar and calcite framework grains were the primary minerals; calcite being the dominant one. The matrix of the mortar consists of dense, fine-grained calcite crystals.Furthermore, the mortar contained small fragments of quartz grains, charcoal, undiagnostic fragments of bone and broken shells.

**Figure 6:**Peeling off plaster as a result of the use of soft and friable mortar

**Figure 7:** Deteriorated joint mortars resulting from soft and friable mortar

The condition of masonry structure to a certain extent varied depending on the type of mortar used. For example it was easy to conclude that the mortar used in Figure 6 is hard mortar as the peeling off of limestone material was not severe compared to that shown in figure 7. However the more severe damages were observed where a soft and friable mortar was noted. Generally different type of mortar used for the Bagamoyo Building heritage sites provide a key reason for the deterioration of masonry elements in some building and structures.

**Presence of expandable minerals in mortars**

Table 1 indicates the main crystalline compounds identified by XRD in the mortars estimated from the height of the corresponding peaks on the XRD diagrams. The relative height of the peaks is indicated by symbol "X" in the Table. In all mortars calcite appeared to be the most abundant compound followed by quartz and feldspar in small quantity. However, for soft and friable mortar, the XRD patterns show the additional presence of beidellite clay mineral. All these tests indicated lack of clay mineral which is the main source of expandable minerals with the exception of the soft and friable mortar. Further tests to examine the presence of expandable chemicals in the soft and friable mortar, showed no significant shifts in the peaks after glycolation were. Thus this study comes to a conclusion that the clay mineral present in the soft and friable mortar is a non-swelling.



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**Table 1: Main compounds in the historical mortars as detected by XRD**

| DESCRIPTION | | QUANTITY | | |
|---|---|---|---|---|
| **Compound** | **Formula** | **Hard Mortar** | **Moderate Hard Mortar** | **Soft and Friable Mortar** |
| Quartz | $SiO_2$ | **X XX** | **X XX** | **X XX** |
| Calcite | $CaCO_3$ | **X XXXX** | **X XXXX** | **X XXXX** |
| Feldspar | $(Na,K)(Si_3Al)O_8$ | **X** | **X** | |
| Clay mineral | $CaO.2Al_2Si_4O_{10}(OH)_2$ $.6H_2O$ -Beidellite | | | **X** |

**Effects of mortars with expandable minerals on building condition**

Given the observation made in previous studies that examined the structural composition of building materials at the site, all historic buildings were constructed of similar building materials. That is coral stone in lime mortars hence differences in damages or deterioration results from other factors such as maintenance rather than presence of expandable chemicals. Thus expandable chemicals were not considered as a reason for damages on construction elements of the Bagamoyo building heritage site.

**Differential composition of binder material in mortar**

Point counting by microscopical study on thin sections was conducted to establish the relative composition of binder material in the mortar samples. The results in Table 2 show that the hard mortar has higher binder content and composed of a homogenous hydraulic matrix and a heterogeneous coarse fraction with moderate voids.

**Table 2: Point counting for quantification of materials**

| Mortar Composition | Sample No.1 (Hard Mortar) | | Sample No. 2 (Moderate Hard Mortar) | | Sample No. 3 (Soft and Friable Mortar) | |
|---|---|---|---|---|---|---|
| | Point | Volume % | Point | Volume % | Point | Volume % |
| Binder | 97 | 48.5 | 80 | 40 | 64 | 32 |
| Quartz | 24 | 11.5 | 31 | 15.5 | 23 | 11.5 |
| Limestone | 48 | 24 | 39 | 19.5 | 54 | 27 |
| Lime lump | 6 | 3.5 | 11 | 5 | 16 | 7.5 |
| unknown lump | 0 | 0 | 3 | 1.5 | 24 | 12 |
| Void | 25 | 12.5 | 36 | 18 | 19 | 9.5 |
| Total | 200 | 100 | 200 | 100 | 200 | 100 |

The moderate hard mortar contained moderate binder and soft and friable lime mortar contained little hydraulic binder. Less binder in these mortars is due to the presence of impurities such as salts, charcoal, wood ash and un-burnt or partially burnt limestone.


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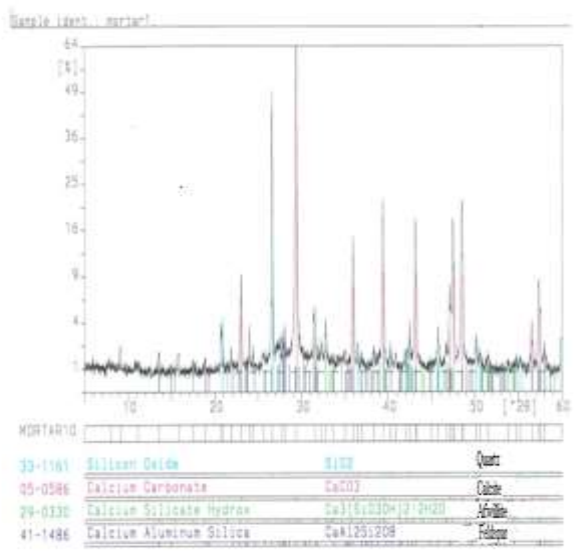


**Figure 8:** X-ray diffractogram showing the peaks attributed to the calcite, quartz and feldspar.

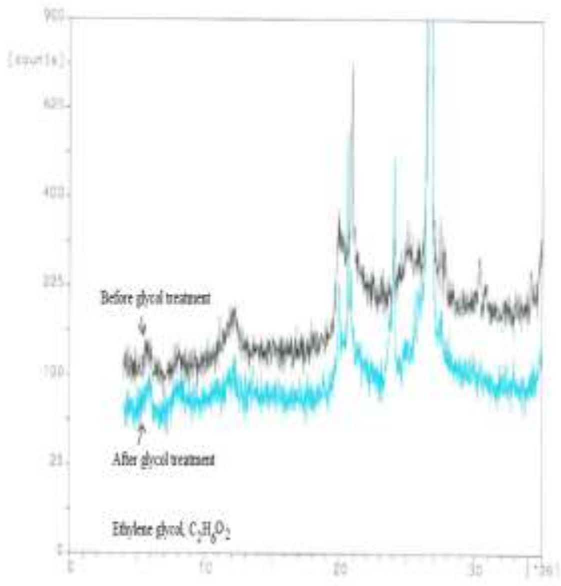


**Figure 9:**X-ray diffractogram showing peaks before and after treatment with ethylene glycol

**Effects of varying composition of binder material on building condition**

The strong mortar indicated good compatibility with the limestone and coral stones, thus the walls did not show any indication of either stress built up or settlements. Although the moderate hard mortar and friable mortar possessed different point counting attributes from those of hard mortar, they both accommodated the movements caused by expansions and contractions in the walls and didn't cause stress built up in the walls. However friable mortar indicated excessive porosity with the tendency for eventual breakdown of components resulting into low bond strength between the stones and the mortar phase.

**Relative absorption capacity of mortar**

When construction materials such as limestone and coral stones are exposed to degrading environmental condition they tend to react differently. With varying mortar type as well as chemical composition of coral stones the level of deterioration of buildings will differ based on absorption capacities, compressive strength and bulk densities of materials when exposed to water of other environmental agents. This study employed various methods to test water absorption capacity; density and compressive strength in order to verify the durability and resistance of masonry units and mortar when subjected to severe weather. The results are presented in Table 3.

For absorption test, the weights of the samples were measured and then, oven dried at 35$^{o}$C for twenty four hours. Then, the samples were weighted and subjected under water pressure for thirty minutes. After that, the weights of the samples were taken. The ratio of the increase in mass to the mass of the dry sample, expressed as a percentage, is termed absorption. The total absorption capacity of the limestone ranged from 5% to 8% while that of coral stones ranged from 28% to 34% (Table 4.7). Coral stones have higher rates of water absorption than lime


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stones indicating that coral stones are more porous and absorbent than lime stones. Unfortunately mortar samples could not be tested for absorption because they disintegrated when immersed in the water after oven drying at 35°C.

**Table 3: Compressive strength, bulk density and water absorption of Lime and Coral stones**

| Category | Compressive strength ($N/mm^2$ or Mpa) | Bulk density $kg/m^3$ | Total water absorption, % (weight percent) |
|---|---|---|---|
| Lime stone 1 | 17.1 | 2,481 | 5 |
| Lime stone 2 | 20.2 | 2,354 | 6 |
| Lime stone 3 | 25.1 | 2,100 | 8 |
| Coral stone 1 | 9.5 | 1,350 | 28 |
| Coral stone 2 | 9.2 | 1,015 | 32 |
| Coral stone 3 | 12.1 | 1,204 | 34 |

### Effects of relative absorption capacity on building condition

The water vapour permeability and absorbency depend on the porosity of the material. Porous Building materials have high absorption capacity that can absorb quite a large amount of waterfrom rain, groundwater leaks and floods, capillary action, air leakage or diffusion.Once enough water has been absorbed into the walling materials it becomes imperative to get it back out. It will usually saturate building assemblies and provide the potential for large amounts of moisture accumulation that can overwhelm their ability to dry out. As a results mortar may crumble, condensations and stains may appear on the walls and slabs (Figure 8). However most of the effects on building structures of environmental agents are linked to neglect and abandonment thus exposing masonry elements to the adverse impacts of environmental agents. For example Figure 9 the growth of fungi on the walls is a result of exposure rather than differences in mortar or construction material.


**Figure 8:** Condensation and black mould and stains growth on the walls

**Figure 9:** Fungi Attach on the Walls of Old Fort resulting from exposure to environmental agents


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**Relative compressive strength of mortar**

The average compressive strength of limestone was 20.8 N/mm$^2$ (found in the range of 17.1 to 25.1 N/mm$^2$) while that of coral stone was 10.3 N/mm$^2$ (found in the range of 9.2 to 12.1 N/mm$^2$) and that of mortar ranged from 0.61N/mm$^2$ to 0.82N/mm$^2$ with an average of 0.75N/mm$^2$. It is from these results that the compressive strength values of lime stone are greater than that of coral stone. Using Attewell & Farmer, (1976), the strength classification of coral stone is very weak while that of limestone is weak.

**Table 4: Strength for Mortar type ASTM C270**

| Mortar Type | Minimum average compressive strength, 28 days, psi (MPa)* |
|---|---|
| M | 2500 (17.2) |
| S | 1800 (12.4) |
| N | 750 (5.2) |

*Note that the strengths shown are for mortars made and tested in a laboratory. Field sampled mortars will likely exhibit different strengths due to differences in field water content, molding, and curing. This is normal and expected but does not generally indicate any problems with mortar.

**Effects of relative compressive strength of mortar on building condition**

Generally, the mortar strength does not have a major impact on the compressive strength of the wall. Usually Type N mortar is suggested in masonry construction because mortars having moderate or lower strength are preferred due to their ability to deform slightly under load thus handling small movements with minimal cracking. Mortar types are designated by ASTM C270, Specification for Mortar for Unit Masonry, as M, S, and N in order of decreasing strength (Table 4).

**Relative Bulkness of mortar**

The average bulk density of limestone was found to be 2,311 kg/m$^3$ while that of coral stone was found to be 1,189 kg/m$^3$. According to ASTM C568-03, limestone is Class II (Medium-density) while coral stone is Class I (Low-density).

**Effects of relative bulkiness of mortar on building condition**

Generally, the packing density of the mortar has no great impact on the compressive strength of the wall. However, better packing would reduce the permeability and porosity of the transition between the mortar and the walling materials. For better preservation of historic building, it is suggested that the density of the mortar be improved towards that of limestone.

**Chemical composition of mortar**

The results of chemical composition are presented in Table 5. Both stones composed of high amount of calcium oxide (CaO) with an approximate proportion of more than 50%. Thus, the stones used in this building are considered to be lime. The mortar on the other hand contains low percentage of Calcium Oxide **(**CaO**)** indicating that it is not pure hydraulic lime but hydrated lime (air-hardening lime), also known as quicklime. These mortars were probably made by mixing both hydraulic and non-hydraulic or feebly-hydraulic lime aggregates such as


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marine deposits, sand and crushed sedimentary rocks found in the neighborhood of the historic buildings. It is reported that the non-hydraulic conglomerate were burned using open heap kilns, with the alternating layers of limestone and woods laying on top of each other followed by a long-term storage of slaked lime (Ca(OH)2) under water.

**Effects of chemical composition of mortar on building condition**

Specification for Hydrated Lime for Masonry Purposes is clearly provided under ASTM C270 thatType N Hydrated Lime or lime putty (ASTM C5, C207, C1489) should be used (Table 6). The specification requires that the product contains no less than 95% combined values of calcium or magnesium and not more than 5% carbon dioxide. These dictate that the source rock must be pure and that the calcinations must be virtually complete. Unfortunately, the mortar used in the case sudy did not meet the above specification (Table 6), thus one possible cause of deterioration could be the inadequacy of prerequisite chemicals.

**Table 5: Chemical Composition of Coral and Lime Stones**

| Component | Content, % (weight in percent) | | | |
|---|---|---|---|---|
| | Mortar | Coral Stone-1 | Coral Stone-2 | Lime Stone |
| CaO | 27.52 | 50.81 | 46.71 | 42.98 |
| $SiO_2$ | 17.36 | 7.16 | 9.87 | 23.23 |
| $Al_2O_3$ | 3.77 | 0.61 | 2.26 | 3.10 |
| $Na_2O$ | 13.09 | 0.51 | 0.62 | 0.96 |
| $Fe_2O_3$ | 2.09 | 0.17 | 0.71 | 0.47 |
| MgO | 1.13 | 0.24 | 0.65 | 1.50 |
| $P_2O_5$ | 0.08 | <0.01 | 0.06 | 0.09 |
| $SO_3$ | 1.04 | 0.49 | 0.54 | 0.59 |
| $TiO_2$ | 0.62 | 0.09 | 0.35 | 0.21 |
| SrO | 0.29 | 0.79 | 0.72 | 0.55 |
| Cl | 9.61 | 0.14 | 0.04 | 0.02 |
| $K_2O$ | 1.06 | 0.16 | 0.38 | 0.75 |
| LOI | 22.10 | 38.80 | 37.00 | 25.50 |

The purpose of chemical composition test as presented in this study is to indicate the chemical properties of the materials used in Bagamoyo historic buildings. This comes handy during restoration that the same materials with the same chemical properties should be employed. The researchers are aware that chemical composition of masonry elements are linked to the condition of historic building but that is left out for further studies to be carried out in the future.

**Table 6: Specification Requirements for Types N and S Hydrated Lime, ASTM C270**

| Parameter | Type N | Type NA | Type S | Type SA |
|---|---|---|---|---|
| Calcium & Magnesium Oxides (nonvolatile basis), min. % | 95% | 95% | 95% | 95% |
| Carbon Dioxide (as-received basis), max. % | 5% | 5% | 5% | 5% |
| Unhydrated Oxides (as-received basis), max. % | | | 8% | 8% |
| Plus 30 Mesh Residue, max. % on, (or no pops or pits) | 0.5% | 0.5% | 0.5% | 0.5% |


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| | | | | |
|---|---|---|---|---|
| Plasticity (Emley Units), min. | | | 200 | 200 |
| Air Content - Minimum (%) | | 7% | | 7% |
| Air Content - Maximum (%) | 7% | 12-14% | 7% | 12-14% |
| Water Retention (%) min. | 75% | 75% | 85% | 85% |

The effects associated with both physical and chemical processes on masonry elements tend to be overt over the physical existence of buildings ad structures. Local communities within or in the vicinity of building heritage sites are in a good position to identify the immediate cause of damage or deterioration of historic buildings or structure. Although the actual process may not be obvious, the timing, magnitude and nature of deterioration can be usefully utilised in developing a conservation or preservation strategy.

## RECOMMENDATION

As it has been revealed by this study, the primary cause of the problem is neglected badly eroded mortar joints to external masonry that were allowing excessive water into the wall. The badly deteriorated mortar will need special repair known as pointing. Repointing refers to the process of removing deteriorating mortar from the joints of a masonry wall and replacing it with new mortar. Pointing involves both top-down process and bottom-up process. Joints should always be thoroughly cleaned of old mortar from top to bottom after wetting the wall, and pointing should be carried out from the bottom to up to take account of the effects of gravity. Old mortar should generally be raked out to a minimum depth of 2 to 2.5 times the joint width to prevent damage to the masonry units. Where the old mortar has been removed to a depth greater than 2 to 2.5 times the joint width, the deeper areas should be filled in layers and properly compacted and allowed to harden first. All of the old mortar should not be removed from a wall at once but working along the wall in small sections.

The new mortar for repointing should match the historic mortar in strength, physical and chemical composition (lime content, salt content, silica content etc.), colour, and texture (Schierhorn, 1996, Van Balen, et al., 2005, Cizer, et al., 2010 and Schueremans, et al., 2011). Preferably, the new mortar should be softer (measured in compressive strength) than both the historic mortar and the masonry units. It is necessary that mortar is softer and less rigid than masonry units in order to accommodate slight settlement and movement caused by expansion, contraction and moisture migration. In case lime is used, it should conform to the specification requirements for type S hydrated lime by ASTM C270

## CONCLUSIONS

The present study shows that most historic buildings in Bagamoyo exhibit deterioration mainly caused by the loss of the binder from the mortar. Efforts to renovate some buildings have proven to be inefficient and often resulted in improvised and unprofessional works which have actually saved to damage the historic character of Bagamoyo. Nevertheless, the unprofessional conservation using incompatible materials, mainly mortar, cannot save the life of the historic buildings and thus there is a need to establish materials suitable for the works. This report has tested physical and chemical properties of the mortar suitable for historic buildings in


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Bagamoyo. It is only through proper renovation that the valuable cultural-historical heritage of Bagamoyo can be preserved into a treasure of significant historical and socio-economic importance.

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