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Reinforcing relief sculpture work: A key to proper adhesion

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Abstract: The recent relief sculpture works showed lack of bonding properties for the work to last long. Therefore, this study sought to reinforce relief sculpture letters for better adhesion. A practice-based method was used, consisting of the following steps. The wall nailling, binding, and cement grouting were used in constructing relief sculpture letters. This was done to reinforce the work. First, the template (mould) was made from plywood, traced onto the cement rendering, and hacked the layout of the letters to give the key. In the second step, the mould was mounted or fixed onto the cement rendering for hacked areas to show through the template. This was followed by fixing the wall nails and binding wire in the mould and applying the cement grout onto them. Finally, cement mortar was filled into the mould. It was found that the wall nails and the binding wire had reinforced the relief sculpture letters, while the cement grout also exhibited a good bonding. As a result of this, the relief sculpture lettering did not crack or peel-off from the cement surface. By using wall nails, binding wire, and cement grout as reinforcing agents, it can be concluded that relief sculpture works can withstand tensile or shear stresses caused by forces.

Keywords: Key, Letters, Reinforce, Relief sculpture, Template (mould)

1. Introduction

Sculpture has been one of the artworks many people get interested in. Unlike painting, sculpture can last for many years especially when exposed to weather conditions. When visiting some homes or hotels in Cape Coast and other towns in Ghana, many of these works are displayed on the walls. They are either in-the-round or relief (in the form of a mural). It is interesting to note that they carry the rich cultures and identities of the indigenes. Though sculpture works are used, not all are in pictorial form as murals. Others are presented in words in relief letters (sculpture lettering) that carry information such as proverbs, names of people or organisations. However, such beautiful artworks, especially the relief types, are deteriorating. In other words, they are cracking and peeling-off from their backgrounds.

To highlight the deteriorating states of the works, Figure 1 shows a relief work done on a cement rendering in the form of plaque. The surface was hacked to receive the weight of the letters. Unfortunately, the hacked (key) has extended to other areas which the letterform doesn't reach, thereby making the negative area unpleasant to the beauty of the letters. Again, the hacked area is presumed to serve as the key to holding the letters in position. However, the unhacked areas act as repellents, causing the letters not to adhere to the surface, hence cracking and peeling-off.

Not only does Figure 1 has a cracking and peeling-off defect, but Figures 2 and 3 also had a similar problem. To make the situation worse, the surface that holds both words and impressions was not hacked, making the images peel-off. These approaches, however, do not contribute to the value for which the work was made (e.g., the cost of the work, aesthetic appeal, and sustainability of rich cultures and identities of the indigenes). In this

paper, the researcher introduces how such works can be given proper key and reinforcement to achieve proper adhesion devoid of cracks and peeling-offs.

Figure 1:. Cracking and peeling-off relief sculpture lettering, Prospect lodge, Cape Coast. Anonymous, n.d.. copyright 2015 by James Ekow Appiah. Photograph with permission.

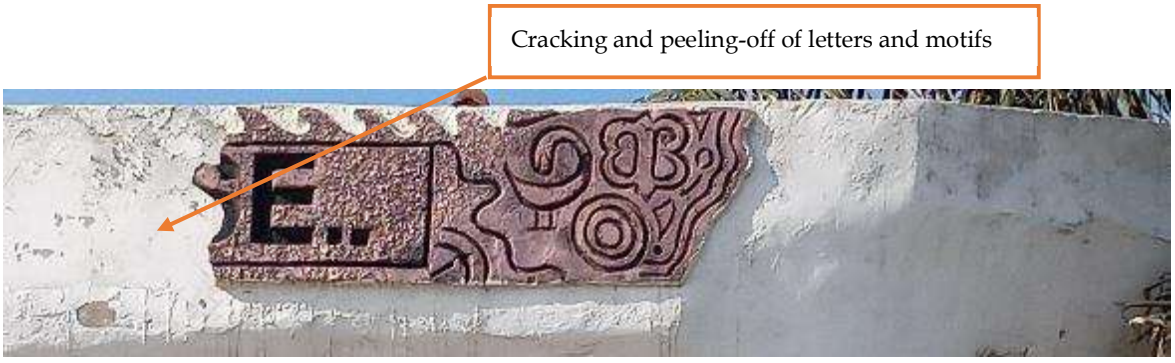

Figure 2: cracking and peeling-off relief sculpture lettering and motifs, Komanste, Mfatsiman District. Anonymous, n.d.. copyright 2019 by James Ekow Appiah. Photograph with permission.

Figure 3: Peeling-off of relief sculpture lettering, Bricksfileds, Cape Coast. Anonymous, n.d.. copyright 2015 by James Ekow Appiah. Photograph with permission.

2. Literature review

2.1. Sculpture

At this moment, understanding of the concept of sculpture will be appropriate for this study. Sculpture is the formation of distinctive materials such as stone, metal, wood, and clay in three-dimensional shapes (Hopkins, 2003; Rogers, 2018). This implies that apart from clay which, by its nature, is very soft, the other materials mentioned are very strong to be useful in making sculpture works. This is not to say the clay cannot be strong. When it is subjected to heat (fire), it becomes hard and, therefore, able to withstand weather conditions such as rain, wind, and others., especially when used for outdoor works.

It will be interesting to note that Hopkins (2003) left out another distinctive material like cement which is durable and mostly used in the building industry. Due to the durability and distinctiveness of this material, it will be suitable for achieving the purpose of this study. Hopkins (2003) also indicates that sculpture being a three-dimensional art has the capacity to be touched as well as looked at. For this study, relief work, it is not out of place in that it has the ability to be held, touched, and looked at.

2.1.1 Relief sculpture

Relief sculpture has been the focus as far as this study is concerned. To Sanchez (2013), relief or relive rilievo is a type of sculpture work that is raised above the background plane. It can be Bas-relief or Low relief (has a very low degree of relief from the base), High relief (this has more than half the mass or height of the surface), Sunk relief (this is made in such way that the image which is relief never rises beyond the original flat surface), and Counter-relief (the image is fully modeled in 'negative' manner). The image goes into the surface so that when impressed on wax, it gives a normal relief. An example is the inside mould of a relief work. This brings to light the various dimensions these sculpture work can attain. For these types specified, each can be more permanent on cement wall when being reinforced. This is what this study aims to achieve.

2.2 Reinforcement in concrete

Reinforcement includes deformed bars, plain bars, wire, fabric and steel products, all of which increase the tensile and compressive stress carrying properties of concrete. Steel reinforcement is also the essential contributor towards crack control of concrete structures (The Australian Steel Company, 2008). This is understood as metals able to strengthen the concrete structure of the physical and naturally built environment, including public works such as roads, bridges, canals, dams, airports, sewage systems, pipelines, structural components of buildings, and railways. It is very important to understand the significance of using the same materials to reinforcing relief sculpture works. Though the reinforce materials are used in cement mortar, it will give the same strength properties.

3. Research methodology

The study was practice-based research. This involves the exploration of materials, techniques, and procedures to arrive at intended results in or outside studio spaces. Materials used for the project are as follows: cement, tap water, sea-sand, binding wire, wall nails, and cement grout. The study used the ordinary Portland cement (OPC) used in the building industry. Tap water was used for the mixing mortar and grout, sea-sand was used in preparing the mortar. The study used the ordinary binding wire used in binding iron rod in the building industry, as well as nails used in fixing objects such as wood, metal etc. onto concrete or block walls. The cement grout is a bonding agent made from ordinary Portland cement.

Among the materials used, binding wire, wall nails, and cement grout were used as reinforcement. These were local materials that can be obtained at the Cape Coast market and other hardware stores across Ghana. The materials labelled as reinforcement are very important due to their reliability and suitability in the construction industry. To Britannica (2020), when a metal is embedded in concrete, it acts to resist forces. To them, the reinforcing steel rods, bars, or mesh absorbs the tensile or shear stresses caused by wind, earthquakes, vibrations, and other forces. This, therefore, means that when a binding wire and nails are used in relief sculptures made of cement composite products such as mortal or concrete, they can withstand the aforementioned forces.

Not only are binding wire and wall nails suitable for the project, but also cement-based grout plays a significant role as far as the bonding of cement mortar is concerned. This is a mix of cement and water in a given ratio. This ratio is defined as the water to cement ratio by weight and is signed by w/c (Draganović, 2009). Grout

has characteristics such as plastic and fluid. This makes the material flows through the spaces in which it is applied (Vanza, Modi & Chaudhari, 2013). To Vanza et al. (2013), there are different types of grouts. These include cement, cement and sand, cement clay, slag-cement, fly ash-cement and epoxy resin grout. To them, each type can give a good bond to the reinforced bar when applied to them. This implies that when cement grout is used to coat wall nails, binding wire or iron bar, and cement substrate, it would help in bonding, thereby helping in the reinforcement of the relief sculpture works.

Knowing the materials and suitability for the study, the following was how the result was achieved:

1. The outline of the letters was generated by using Coral Draw software. However, Photoshop software could also be used since it has the same operating tools as the former. This allowed enlarging the image to any size preferred. The next step was carried out by printing the image on printing paper with A4 size. However, A3 paper size could have also served the same purpose depending on the size of the printing machine (see Figure 4).

Figure 4: Outline of letters on drawing paper, Studio, Cape Coast.
by James Ekow Appiah, 2016.

2. The image was transferred onto the plywood of one (1) inch thickness. This dimension varies depending on the depth (thickness) of the relief required. The transfer of the image can be done in any of the transferring techniques: chalking or using carbon paper. For chalking, chalk or charcoal is coated at the back of the paper that contains the image (see Figure 5). In this project, the carbon technique was used (see Figure 6).

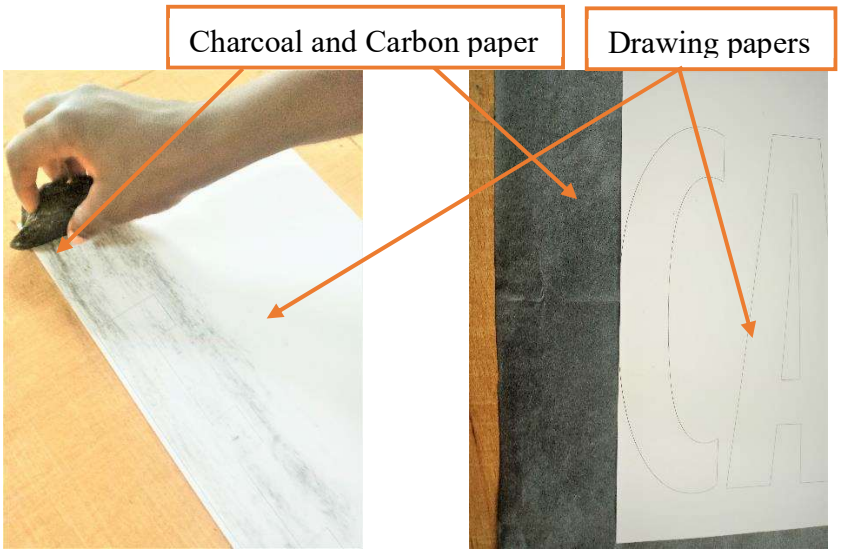

Figure 5: Transfering techniques (coating with charcoal or use of carbon paper),
Studio, Cape Coast. By James Ekow Appiah, 2016.

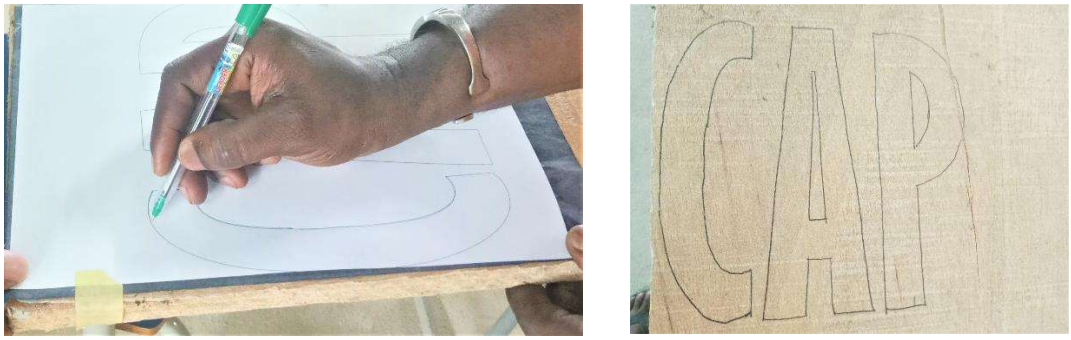

Figure 6: Transfering the image onto the plywood, Studio, Cape Coast. by James Ekow Appiah, 2016.

3. The image (letter) on the plywood was cut out with a jigsaw machine to get the template (mould). Before cutting, the positive areas of the letters were perforated with a drilling machine for easy penetration of the jigsaw blade (see Figure 7). The letters with counters should be handled with care since they can damage. Hence, it was cut first. However, the drilling was done a little far, say one (1) inch away from the counter in a manner that would not affect it. The template was traced onto the cement wall or surfaces on which the sculpture letters (work) would be accommodated (see Figure 8). One should be mindful of some letters having counter(s) (an enclosed area of a letter) such as A, B, D, O, P, Q, R, a, b, d, e, g, o, p, and q. These counters were traced as well to make the letters complete.

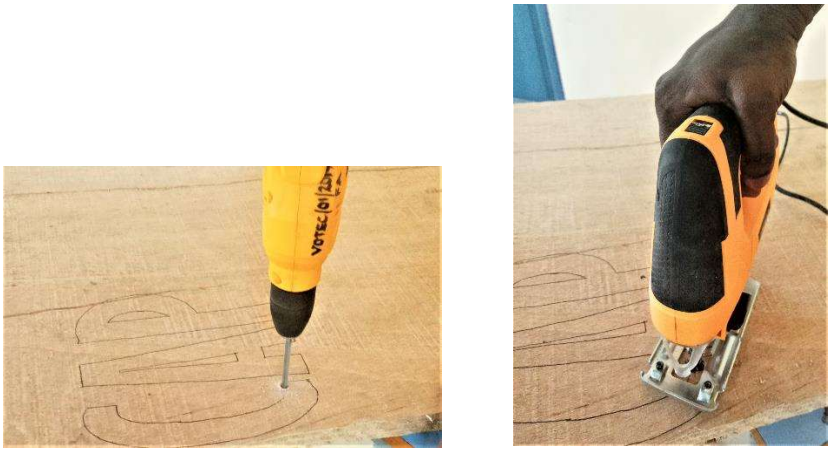

Figure 7: Drilling and cutting of plywood, Studio, Cape Coast. by James Ekow Appiah, 2016.

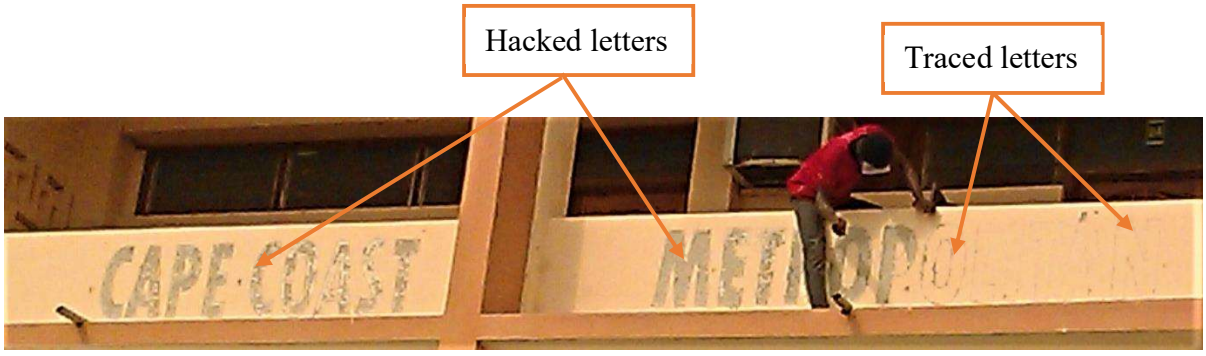

Figure 8: Tracing and hacking of letters on wall, Cape Coast Metropolitan Assembly, Cape Coast. by James Ekow Appiah, 2016.

4. The next step after tracing was hacking the traced letters on the cement surface to give the key to the letters. This was done by using a hacking hammer and cold chisel and hammer for areas that were very hard (see Figure 8).

The template's walls or edges were filed to remove unwanted parts and to make the inner section smooth. This is followed by a coating of release agents (mixture of oil and soap) to make the removal of the template (mould) from the dry cast easy (see Figure 9).

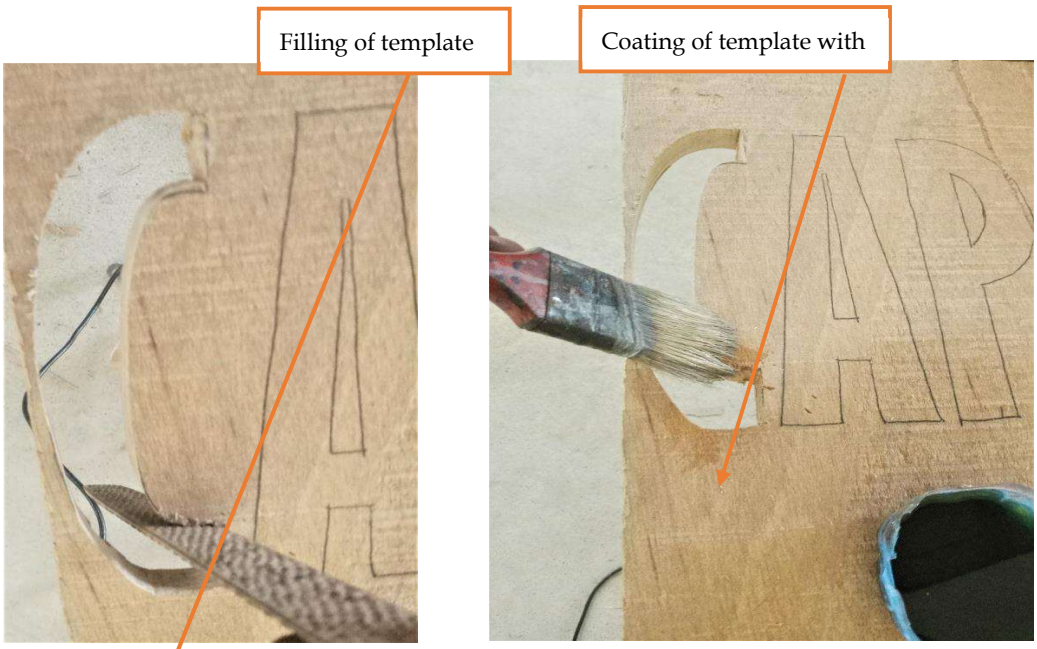

Figure 9: Filling and coating the template with a release agent, Studio, Cape Coast. by James Ekow Appiah, 2016.

5. The hacked areas were used as a guide to set the template in position. This was then secured onto the surface with wall nails (see Figure 10).

Wall nails of one and a half (1 ½) height were nailed into the hacked letters, especially the borders, corners, and body of the letters. Nails were given an allowance of half an inch (1/2) away from the walls of the template so that they do not show in the finished cast. This was followed by inter-weaving of a binding wire to connect every wall nail serving as reinforcement. The grout is then applied onto both the hacked area and reinforced metals (wall nails and binding wire) to serve as a bonding agent to cement mortar (see Figure 10).

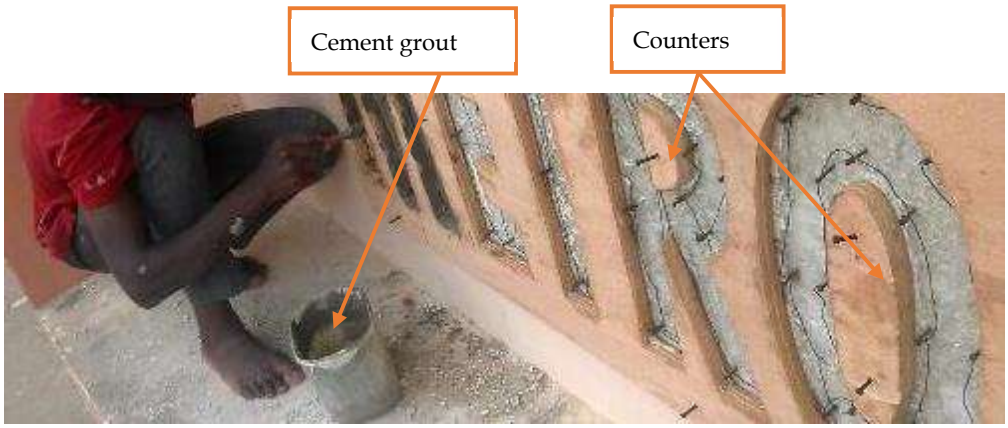

Figure 10: Application of cement grout, Cape Coast Metropolitan Assembly, Cape Coast. James Ekow Appiah, 2016.

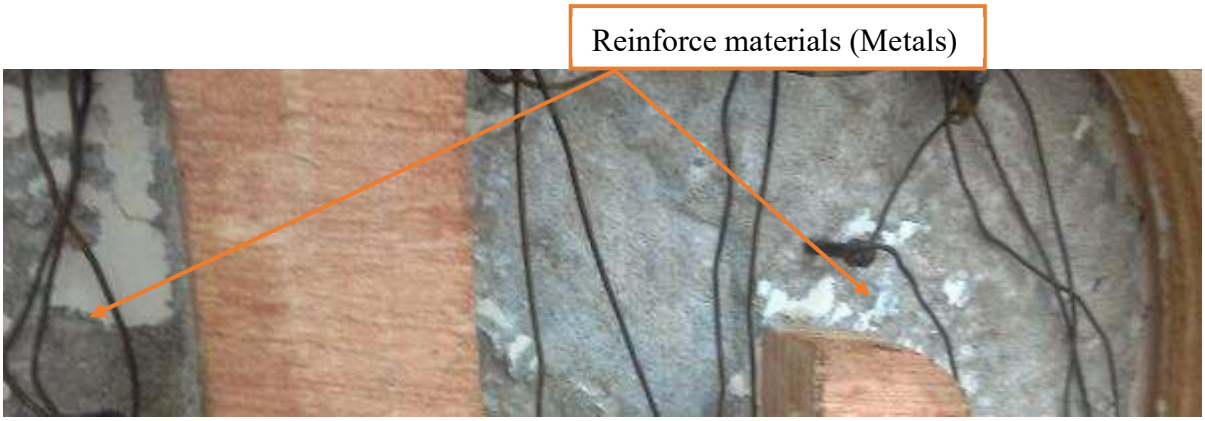

Figure 11: Closed details of reinforced materials, Cape Coast Metropolitan Assembly, Cape Coast. by James Ekow Appiah, 2016.

Immediately after the grout was applied, cement mortar with the ratio of 1:3 (one part of cement and three parts of fine sand) was used to fill the letter space created in the template (mould). This was allowed to cure for two weeks before the template is removed (see Figure 12).

Figure 12: Filling the template (Mould) with mortar, Cape Coast Metropolitan Assembly, Cape Coast. by James Ekow Appiah, 2016.

Figure 13: Final painted work, Cape Coast Metropolitan Assembly, Cape Coast. by James Ekow Appiah, 2016

4. Results and discussion

The study involved a studio practice that sought to improve the existing procedure of making relief sculpture works. The techniques and procedures adopted prove that the relief sculpture lettering can adhere to the cement surface for many years without cracking or peeling-off. The work was done in 2016. At the time of writing this paper, it was still in a good condition. This was manually tested by using flat tools to force the base to come out, but still it was in a strong bond without peeling or cracking effects. This confirms what Britannica (2020) said about the resistance of forces such as wind, earthquakes, and vibrations by using rods, bars, or mesh in the concrete composite. It also authenticates what Vanza et al. (2013) said about the functions of grout: grout has a good bond to the reinforced bar.

5. Conclusion

The recent relief sculpture works showed lack of bonding properties for the work to last long. This current study, therefore, filled this gap in knowledge through the use reinforcement agents (materials) to make the sculpture work free from peeling-off and cracking. This study has shown that metal bars, wall nails, binding wire, and cement grout can be used to reinforce relief sculpture works. It is, therefore, recommended that sculptors working on relief sculpture works should apply these new procedures in this study to reinforce their relief works to prevent cracking and peeling-off defects. It is also recommended that scholars should explore more contemporary methods and available materials in preventing the aforementioned defects that may occur in other forms of cement sculpture works.

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