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January 19, 2023

TREATMENT REPORT

NORMAN COURT AND NORMAN ARCH
Limestone, Sandstone, Cementitious mortar

LOCATION: Bishop's Garden

PROJECT NO. 19192

ADDRESS: Bishop's Garden
Pilgrim Road
Washington, DC 20016

The work was completed on November 23, 2022 by Marcin Pikus, Conservator of Stone and Architectural Features, of McKay Lodge Conservation Laboratory.

DOCUMENTATION

The report is accompanied by 24 "key" digital images printed and as files on a disc. The images are referenced in the text below by image numbers. The images are printed on Epson® archival paper with Epson® Ultrachrome K3 lightfast inks. In addition, on an enclosed Verbatim® Ultralife™ Gold Preservation disc (DVD), there are 197 digital images.

DESCRIPTION

The stone structure known as Norman Court is located on the grounds of the Bishop's Garden, situated on the south side of the National Cathedral in Washington, D.C. It is a stone structure designed by All Hallows Guild member - Florence Brown Bratenahl and built-in 1928. The Court incorporates several architectural and sculptural features such as Norman Arch, Thistle Fountain, and two other historic reliefs: a limestone plaque with a pelican and the fish and a granite basrelief depicting the scene of the Crucifixion. The Norman Arch is a historic, 12th-century Romanesque portal arch imported from a ruined monastery in Normandy in France to the United States. The Norman Arch is incorporated into a semicircular arch of the Norman Court. Carved in Caen limestone, it was acquired from the collection of the George Grey Barnard (Fig. 1).

Fig. 1. Norman Arch before the treatment.

Fig. 2. Norman Court before the conservation treatment.

CONDITION

NORMAN COURT

The walls of the Norman Court are built of sandstone blocks and pointed with cementitious mortar. The condition of the Court is good; however, several harmful factors were contributing to its gradual deterioration. Most of the stone surface was covered with algae, lichen, and moss. The surface of the sandstone blocks appeared severely weathered, particularly in the area above the Thistle Fountain.

NORMAN ARCH

The condition of the limestone arch was poor, and the extent of its deterioration was alarming. The decay, caused by the improper pointing mortar and the inherent fragility of the limestone, was widespread and reached deep into the structure of each element. Many elements were showing an irreparable level of deterioration. The stone was powdery and crumbly. The weathering, which included spalling the external layer of the stone, was several inches deep. As a result, most elements have lost their original surface (Fig. 3 and 4). Only a few elements retained their original shape.

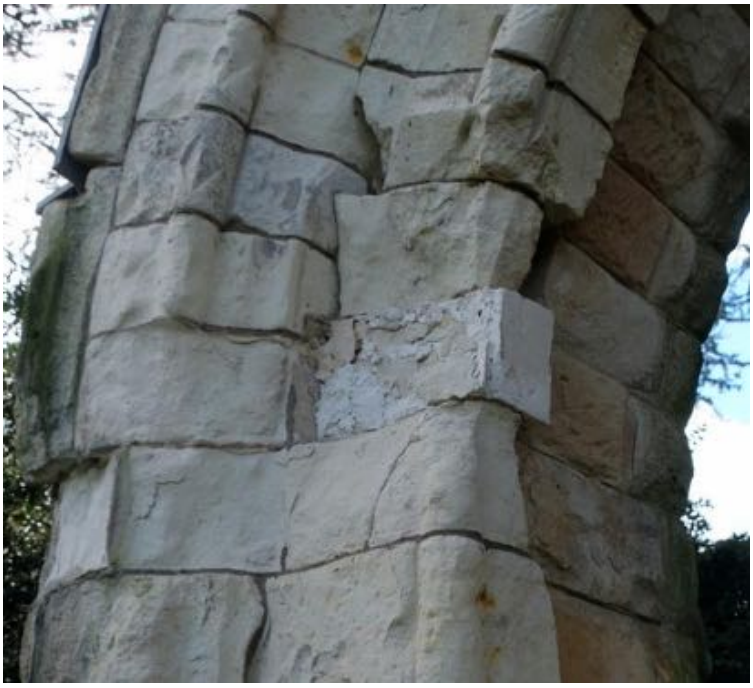

Fig. 3 and 4. Deteriorated blocks of the Norman Arch.

The Norman Arch consists of 110 limestone blocks. Before the treatment, only 20-25 blocks exhibited the original ornaments. Approximately 45 blocks maintained their original shape, yet their surface was heavily weathered. The remaining 65 blocks (representing approximately 60% of the entire Arch) seriously deteriorated and exhibited extensive losses. As many as 38 blocks have lost the entire original surface and a significant part of their original form. Almost all the blocks appeared crumbly and chalky. Many of them exhibited structural cracks and delamination of the external layer.

POINTING MORTAR

The pointing mortar was a very hard cementitious concrete mix with an extremely high content of cement (Fig. 5). The pattern of the deterioration observed of the limestone elements (recessed surface of the stone blocks and proud, well-preserved joints) is an example of the destructive impact of a wrong choice of pointing mortar. The mortar with these properties does not allow the water to evaporate from the porous structure of the stone and contributes to its accelerated deterioration caused by freeze-thaw cycles.

Fig. 5. The fragment of the Norman Arch. Old and extremely hard cementitious pointing mortar before it was removed from the joints of the Arch.

TREATMENT

The conservation treatment of the Norman Court and the Norman Arch included the following steps:

1. Cleaning the sandstone structures of the Norman Court, the Thistle Fountain, and the medieval limestone Norman Arch (Images 001-007).

   The cleaning was carried out using a hot water pressure washer and a cleaning agent. The successful removal of the biofilm composed of algae, lichen and moss was made possible by applying D/2 (D/2 Biological Solutions) – a masonry detergent and a biocide. The D/2 was applied to the pre-wetted stone and remained on the surface for 10-15 minutes before thorough pressure washing.

2. Diamond cutting and removal of the old, faulty pointing mortar from the limestone portion of the Arch.

   The old cementitious mortar was cut with diamond discs mounted on angle grinders. The mortar was extremely hard and very well adhered to the limestone. The joints were cut and carefully chiseled out using tungsten chisels. The debris was removed from the joints by blowing it out with compressed air and flushing it out with water.

3. Chiseling and grinding loose and crumbly fragments of the limestone elements.

   The crumbly and loose portions of the limestone elements of the Arch were removed by chiseling. All the areas showing an irreparable level of decay were prepared in this manner. The removal of the deteriorated stone allowed the consolidation of the stone below.

4. Preparatory chiseling and cutting the edges of the losses to be properly filled with patching mortar.

   A necessary step before filling the losses in stone was shaping the edges of the damaged areas into a clean straight line. Another requirement is to make the losses at least 0.5 inch deep. All the losses were prepared in such a manner. The edges were cut at a straight angle, and their depth was increased to 0.5 inch (or more) wherever necessary.

5. Two-step consolidation of the limestone elements.

   The first step of the consolidation was saturating the limestone elements with PROSOCO Conservare Hydroxylating Conversion Treatment followed by rinsing the stone surface with Conservare HCT Finishing Rinse. Both the HCT and the HCT Finishing Rinse were applied to the stone surface with pump sprayers (Image 012). This

procedure was followed by consolidating the stone with PROSOCO Conservare OH100, a siloxane-based stone strengthener. The stone was saturated with the OH100 using long-haired synthetic brushes. The treated areas were covered with plastic sheeting to keep them protected from rain and allow proper curing (Image 013). The consolidation treatment was successful, as the limestone appeared less chalky and crumbly.

6. Installing the stainless-steel reinforcements and anchors.

   A system of stainless-steel anchors and brackets was installed to provide additional reinforcement and increase the longevity of the mortar fills. U-shaped and L-shaped anchors were installed in the stone using an epoxy adhesive (Sikadur 32 Hi-Mod LPL/SIKA). Image 014 shows an example of the reinforcements.

7. Filling the losses in the limestone elements.

   The losses and the missing elements were recreated using a high-quality restoration mortar JAHN M70 (Cathedral Stone Products). The mortar used for fills was custom color matched by Cathedral Stone Products color lab. These two base shades and their combinations were used to match the color of the original stone (Images 015 and 016). Several elements of the Arch were a total loss and were recreated entirely (Images 017 and 018).

Fig. 5. A badly damaged section of the Arch before and after the treatment.

8. Re-pointing

The joints in the limestone portion of the Arch were re-pointed with the restoration grade mortar CONPROCO RePoint O-type (Images 019-024).

Fig. 6. The Norman Arch after the treatment.

RECOMMENDATIONS

An additional consolidative treatment is recommended to protect the delicate historic limestone arch after its conservation-restoration. The limestone elements and the newly installed fills should be protected against the adverse effects of water by treating these areas with PROSOCO Conservare H100, a product that (apart from its strengthening properties) is used as a water repellent. A treatment (similar to the recent consolidation with PROSOCO Conservare OH100) should be carried out in the nearest future to minimize the water infiltration. A proposal for such treatment can be provided.

The stone structures in the Bishop's Garden are a part of the garden's natural ecosystem. The environment is moist and humid for most of the year. Also, the Norman Court is nested in a shaded area among tall trees. These conditions are ideal for plants and microorganisms to thrive and flourish. The recolonization of the newly cleaned stone surfaces by algae, fungi, lichen, and moss is expected to begin quickly (within next 12 months).

A periodic maintenance cleaning and disinfection of the entire structure of the Noman Court is recommended. The surface should be cleaned with D/2 (D/2 Biological Solutions, Inc.) and hot water. A professional conservator should carry out the cleaning. The limestone, despite being consolidated, is still very delicate and can be easily damaged by improper cleaning techniques. The Norman Court and the Norman arch should be cleaned approximately every 3-4 years. A brief condition survey determining the condition of the Norman Court structure should be carried out each time when the structure is being cleaned.

A stone conservation professional should be notified and consulted if more significant damages and other alterations occur.