John J. Earley's Mosaic Concrete Art

Gods, saints, and battle maps

by Robert F. Armbruster

In his writings, John J. Earley asserted "there is no masonry material with which as much form and color can be expressed as with exposed aggregate concrete."[1] He demonstrated this with his polychrome mosaic concrete artworks of saints and battle maps. Earley unveiled concrete's potential as an artistic medium through his innovative techniques when he exposed hundreds of colors in the surfaces of intricate illustrations and created complex, three-dimensional (3-D) ornamentation.

Earley's Artistic Process

Trained as an architectural sculptor, and assuming charge of his father's studio at the age of 26,[2] John Earley was skilled in clay, gypsum plaster, carved stone, and lime-based stucco. He was attracted to portland cement as a binder because it offered easy workability in its plastic phase, rapid results, and a durable final product.[3] Earley began to use this binder in 1905 for stucco that he applied with traditional plastering methods.[2]

By 1920, Earley was creating beautiful architectural concrete with exposed aggregates. He had established procedures that allowed him to produce architectural concrete in the studio as cast stone or as thin, precast slabs. His craftsmen then installed the precast elements on-site along with architectural concrete that they cast and finished in place or applied as a cement mosaic stucco (Fig. 1 and 2).

A comprehensive color palette

Earley's colors came from the optical effect of the crushed pebbles and sands that he exposed in his concrete. Analyses of samples from his works, including the Bahá'í Temple in Wilmette, IL; the Parthenon replica in Nashville, TN; the Thomas Alva Edison Memorial Tower in Edison, NJ; and the Iwo Jima Memorial in Arlington, VA, show that most of Earley's polychrome mosaic concrete comprised pebbles that passed a 1/4 in. (6.3 mm) sieve and were retained on a No. 6 (3.35 mm) sieve. His materials were sourced from North America, France, Italy, and Africa, and they comprised ceramics, porcelains, opaque enamel glasses, marble plated with gold, and natural stones such as quartz, obsidian, and granite.[4] His palette of colors comprised 10 hues, five values from light to dark, and four chromas or intensities. The resulting 200 colors were more than enough for all his projects.[5]

Earley combined pebbles of different colors in a single concrete mixture to create the optical impression he desired. He explained, "A great wealth of color knowledge, all that of the impressionist or pointillist school can be immediately applied to concrete if we consider each grain of aggregate as a spot of color placed in [juxtaposition] to other spots, all of which will blend in the air to a hue of even value and chroma."[6] For example, he combined red and blue pebbles to create a shade of violet. He routinely combined three colors of pebbles with two colors of sand to create the visual results he wanted.

Earley developed the color palette for each project in a two-step process. First, he analyzed the design and planned the optical sensations and decorative effects required without considering what materials might be used. The results of the first phase became the reason for the selection and arrangement of materials during Earley's second phase, when he prepared formulations of pebbles and sand for the project's mosaic concrete colors.[4]

Producing vibrant color in mosaic concrete

For final color selections, Earley made multiple mosaic concrete samples for colors specified by the architect or artist. The samples were evaluated at the jobsite under the intended lighting conditions. After the final mosaic concrete colors were chosen, the required stones were procured, crushed, and sieved into pebbles and sand in quantities required for the many batches of concrete mixtures in the project.

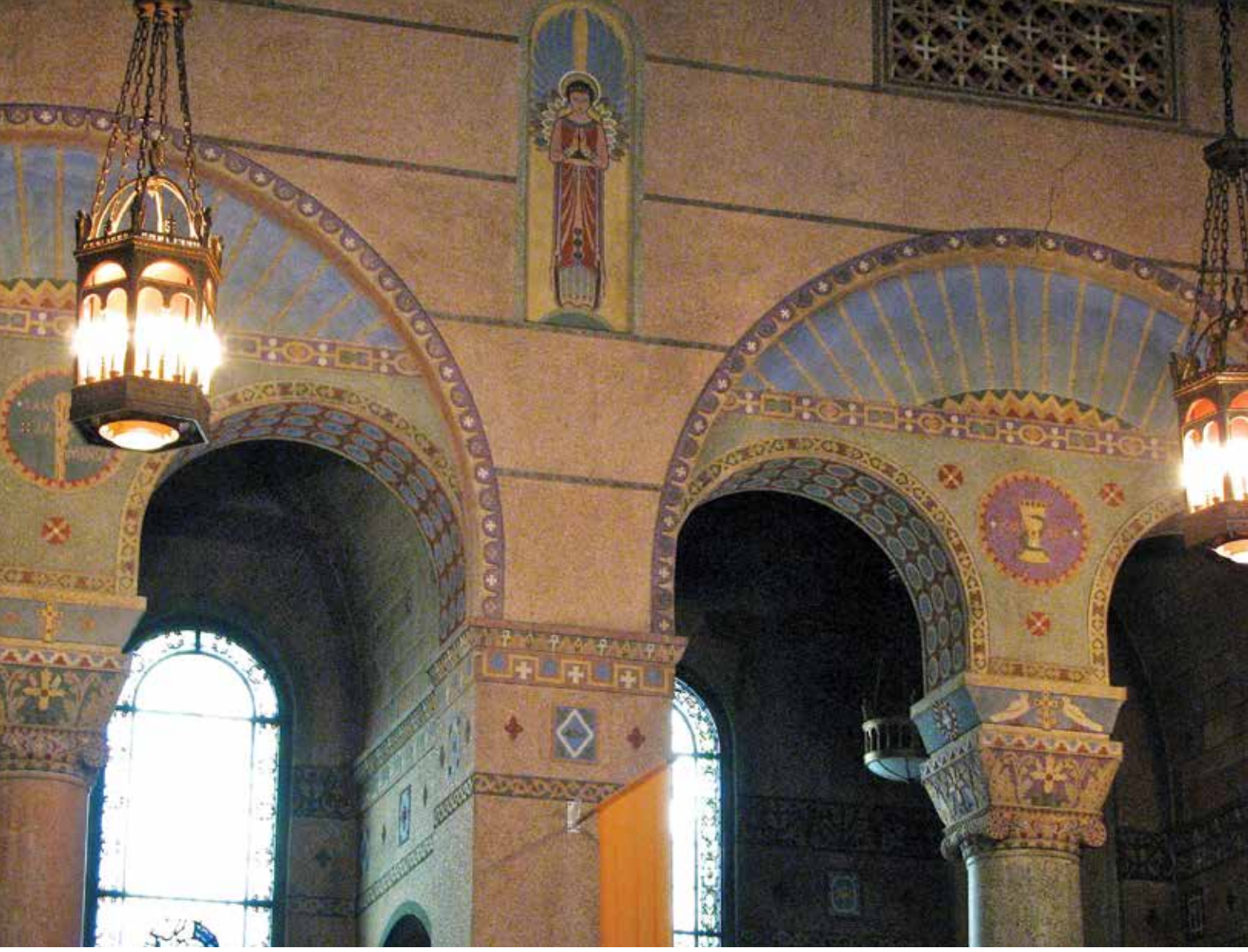

Fig. 1: John Earley stunned the industry in 1921 by creating breathtaking colors, forms, and textures with exposed aggregate polychrome mosaic concrete for the interior of the Shrine of the Sacred Heart, Washington, DC. For architectural decoration and moldings, Earley Studio installed polychrome mosaic concrete as thin, precast slabs and applied stucco with great precision. About 200 colors of aggregate were crushed and sieved into pebbles and sand before combining them in concrete mixtures

Earley Studio worked from detailed drawings prepared by the architect or artist. For polychrome mosaic murals or illustrative pieces, full-scale paintings were created by an artist. Earley Studio then prepared shop drawings for approval by the architect or artist. The shop drawings identified the precast pieces of mosaic concrete and applied mosaic concrete. They also showed the dimensions and colors of every area of the final composition. The approved shop drawings were mapped onto a full-scale mosaic drawing or "cartoon" with lines separating every area of color.[7]

In November 2011, I discussed this process with Mary Morse Jacobs, an artist who designed one of Earley Studio's projects. According to Jacobs, Earley's workers used traditional methods of paper tracing and pounce wheels to transfer the cartoon lines onto the surface of a plaster slab. The lines were then inscribed into the slab, creating V-shaped grooves 1/8 in. (3 mm) deep. The slab was shellacked, a release agent was applied, and a second plaster slab was cast from it. The second slab now had 1/8 in. high ridges outlining each area of color. This second slab became the mold for the mosaic concrete panel.[8] For polychrome mosaics applied to curved surfaces of domes, arches, and moldings (Fig. 2), Earley used the same techniques to create curved plaster molds.

The plaster molds were shellacked and coated with a release agent before each casting operation. To prepare for a day of casting, pebbles and sand of the different colors were measured in the correct quantities for every batch. At the time of casting, concrete was mixed for each color by combining the pebbles and sand with white portland cement and water. Craftsmen then used artists' palette knives to place and consolidate each mixture into its area on the mold.[8]

Based on studies of "Earley Studio Samples and Molds" at the Parthenon Museum, Nashville, TN, and at the National Bahá'í Archives, Wilmette, IL, the colored layer of concrete visible on the face of the mosaic concrete was just 1/4 in. thick. The first color was placed in the mold up to the top edge of the V-shaped ridge. The adjacent color was installed to cover the ridge and overlap the first color. After all the colored

Fig. 2: The dome of the open-air Chapel of the Ascension at the Franciscan Monastery, Washington, DC. Thin, precast slabs were prepared on curved molds in the studio for the figures, trees, and decoration. The thin, precast slabs were installed on the dome with a brown coat before mosaic stucco was applied by trowel onto the tan and blue background areas

concrete mixtures were placed, reinforcing steel was installed and covered by a backup mixture of concrete that filled the mold. Casting a panel with 15 ft^2 (1.4 m^2) of complex, polychrome mosaics could take 6 to 10 hours.[7]

When the mosaic concrete was removed from the mold on the following day, the surface was chalky and dull because particles of cement covered the pebbles. Based on examination of the Temple Photographs Collection from the National Bahá'í Archives, the sparkling mosaic effect came to life only after the pebbles were carefully exposed with 1 in. (25 mm) wide wire brushes. Concrete mixtures that had been placed late in the casting day were not yet as hard as those first put into the mold, so the exposing had to be carefully done for each color. Small picks, like dental tools, were used to clean the grooves in the mosaic concrete surface.

All ornamentation incidental to the general decoration was precast in the studio as thin slabs.[9] Earley Studio precast and finished small polychrome elements, 5/8 to 1 in. (16 to 25 mm) thick, that were later assembled into larger precast components or installed on-site into a brown coat of cement stucco. For larger assemblies at the construction site, the studio-fabricated precast components were locked into position with grout or combined with cast-in-place mosaic concrete.

Color for the Gods, Saints, and Mortals

The Parthenon replica in Nashville

Earley installed exposed aggregate architectural concrete finishes on the 1921 replica of the Parthenon. Color was required for features that had been painted on the ancient Parthenon. Instead of painting the replica, Earley produced architectural components with crushed pebbles and sand in buff, sky blue, or dark red colors.[10] The buff mixture was formulated to suggest the weathered appearance of the ancient marble. The red and blue areas were monochrome, made only with pebbles and sand of the desired color. The architectural features with red or blue colors were precast as smaller elements and then installed onto the building. In a few locations, such as the wall behind the pediment statues, the

colored aggregates were exposed after application in a cement stucco mixture.

On the exterior of the replica, Earley separated the colors by placing the concrete mixtures within different depths of relief in the molds. By 1928, when the interior polychrome mosaic concrete was installed, the studio had achieved more precise control over the crushing and screening of their aggregates, tighter packing of the pebbles, and finer definition of colors and patterns by using molds with ridges to separate the colors.

Polychrome emerges in the Shrine of the Sacred Heart

When architects Murphy and Olmstead designed the Shrine of the Sacred Heart in Washington, DC, in 1921, they wanted to finish the interior with colorful north Italian Romanesque decoration.[11] The budget would not provide for traditional frescoes, mosaics, or painted finishes, so the architects explored alternatives.[4] They asked Earley if he could create the effects using his mosaic concrete material. Earley was excited by the unprecedented opportunity that the project presented.[3]

The architects prepared detailed interior elevations and renderings showing the symbols, saints, geometric patterns, moldings, and colors required throughout the church. Earley met their specifications by providing every form, texture, and color in polychrome mosaic concrete.[12] Earley covered the walls of the church with a generous palette, including rich reds, soft pinks, warm oranges, muted browns, brilliant blue, pale green, navy blue, sky blue, emerald green, brilliant white, sparkling gold, and lemon yellow (Fig. 1).

Following the geometric tiling of the architects' design for the ornamental patterns and moldings, Earley divided the interior finishes into small, repetitive elements. This let him use the same mold multiple times and provided easily handled, precast mosaic concrete components for installation at the church. For example, in the domes over the altars, Earley laid out tiles on a hemispherical model. The figures of the saints filled several tiles within the overall pattern. The same mold was used to cast the angels Gabriel, Raphael, and Uriel, with different colors of aggregate used to vary the appearance from angel to angel. A section of the mold that spelled out the angel's name was replaced for each angel.

Earley Studio's sculptors and model makers employed traditional techniques of low-relief modeling to create shadows and apparent overlap in leaves and wings of birds. Shallow relief was also used to great effect for the geometric patterns and iconic symbols. Although the relief was often less than the thickness of one pebble, the relief added highlights and shadows that visually reinforced the images. The texture of the exposed aggregate surface created another effect to enrich the viewer's experience.[4]

Within a single area, Earley could vary the color from one shade to another by blending different colors of aggregate as the mosaic concrete was installed into the mold. After visiting Earley in Washington, DC, Laredo Taft, the sculptor of the *Fountain of Time* statue in Chicago, suggested that Earley placed his colors of aggregate with a "pepper box."[13]

Where precast mosaic concrete moldings wrapped around 90-degree corners of columns, pilasters, or openings, Earley made the thin slabs of precast moldings with 45-degree reverse bevels for an installation with a tight, mitered joint. For short returns, the moldings were precast with the polychrome aggregates on the return. The studio's model makers laid out the designs so that geometric patterns turned corners without interruption.

Every column capital in the shrine is uniquely decorated and appears to be seamless, but the capitals were assembled from small, thin slabs of precast ornamentation. To create complex 3-D components in the studio, Earley first made thin precast slabs and then inserted them within larger molds before placing additional mosaic concrete to complete the larger precast component. Earley also used thin precast slabs to build up larger architectural components during final installation. By combining precast elements displaying different symbols and colors, the desired variety was obtained.

Earley enjoyed great freedom in sequencing the installation for efficient production. Studio artisans could place thin, precast pieces of polychrome mosaic concrete into a brown coat of stucco on walls, ceilings, arches, or domes.[14] The precast units could be set before or after a single color of mosaic concrete was applied to adjacent areas. Studio artisans temporarily installed thin strips of wood onto the surface to screed the applied mosaic concrete surfaces. After removing the wooden strips, the craftsman either installed precast, patterned moldings of mosaic concrete or placed mosaic concrete of an alternate color to fill the strip area. As precast moldings were installed against finished areas of applied mosaic concrete, any gaps could be closed in a seamless manner using mortar with the same color of sand as the adjacent field of mosaic concrete.

As artisans applied mosaic concrete colors in polychrome designs upon the church walls, it was difficult to place different colors of the wet concrete mixture accurately. Earley's craftsmen solved the problem by creating grooved plaster slabs as templates that were pressed into the wet brown coat to create raised ridges outlining each area of color. On the following day, the craftsmen applied the mosaic concrete mixtures within the ridges.[2]

Earley adapted the ridge technique to precast molds. The ridges in the mold produced grooves in the finished mosaic concrete surface that provided crisp delineation, highlights, and shadows. The molds were easier to produce than a low-relief mold. Earley used this technique extensively on later projects.

The architects for the Shrine of the Sacred Heart combined traditional tesserae mosaics and painted illustrations with Earley Studio's mosaic concrete. For example, Earley produced precast mosaic concrete for 3-D frames around features such as the stations of the cross. In some later church

projects, polished marble or ceramic tile was used to surround and highlight Earley's polychrome mosaic concrete panels.

The Franciscan Monastery projects

Earley created multiple projects at the Franciscan Monastery in Washington, DC. Finished in mosaic concrete, the Rosary Portico is articulated with spiral columns of multiple designs and colors between 15 chapels. Each chapel features an illustration of a mystery of the rosary (a meditation on an episode in the life and death of Jesus) in a traditional tesserae mosaic. The tesserae mosaics are framed by polychrome mosaic concrete. Earley produced a vibrant visual effect by combining multiple colors of aggregate in each mosaic concrete mixture. The geometric patterns and letters in this mosaic concrete are not as well delineated as Earley Studio's later work and do not have the V-grooves in the surface.

Within the gardens on the grounds of the monastery, Earley constructed a domed, open-air Chapel of the Ascension (Fig. 2). The architectural features of the chapel are finished with one mosaic concrete color. However, the interior of the dome is covered with polychrome mosaic concrete illustrating the Ascension of Christ with figures of Christ, Mary, and 11 apostles. Earley precast thin, curved, polychrome mosaic concrete slabs for the figures and decoration. The craftsmen installed the thin precast slabs onto the dome's surface. Next, in the areas between the figures and decoration, a uniform mosaic color was applied as cement stucco, troweled smooth, and the aggregate exposed. The colors in the ascension figures demonstrate Earley's ability to generate colors in pure, primary hues, as well as subtle variations of tone.

The visitors' entrance to the monastery is surrounded by precast, polychrome mosaic concrete in shades of soft rose, olive, and golden tan. Earley created the patterns with his V-groove technique. Gold leaf was applied on the surface of the mosaic concrete lettering above the door. Comparison of photos taken in 1993 and 2013 show that although the gold leafing has worn away and needs to be replaced, Earley's polychrome materials remain in excellent condition.

Near the entrance to the monastery, Earley sculpted a statue of St. Christopher with the Christ child and cast it in place with mosaic concrete. Earley was also the artist for two smaller statues set in wall niches flanking the entrance.[2]

Glorious church interiors

Earley sought religious projects by preference. Earley Studio created polychrome mosaic concrete interiors for several churches in the 1920s.[2] Holy Family Church in Dayton, OH, features shades of green and blue on walls and columns in the nave. Column capitals, arches, and moldings were precast in polychrome mosaic concrete at the studio and shipped to the site. The walls of the narthex welcome churchgoers with warm, red tones of applied mosaic concrete walls and precast mosaic concrete moldings.

The architects of the Chapel at the Villa de Matel in Houston, TX, chose Earley in 1927 to create soft, pastel tones of pinks, yellows, greens, and blues for the chapel interior. During the same year, for the St. Francis de Sales Church in Buffalo, NY, Earley used deep shades of mauve and blue, light pinks, green-grays, parchment yellows, and bright turquoise for a very different effect. The following year, Earley covered the interior of the Church of the Sacred Heart in Newark, NJ, in warm shades of tan and brown.

In 1927, Earley was commissioned for the interior of the Church of St. Philip and James in Baltimore, MD. Earley created mosaic concrete for muted green columns with Corinthian capitals supporting arches and a hemispherical dome over the altar. The dome features figures of Christ, angels, and saints; a star-studded blue sky with religious symbols surrounding a central sun; and a dove of peace above Christ's head. Words of scripture set in polychrome mosaic concrete wrap around the spring line of the dome. Within the nave, the architect had Earley produce figurative polychrome mosaic panels that were installed within a field of tiles on the pendentives of the central dome and in arches above rose windows.

The studio also created an entrance façade for St. Charles Borromeo Church in Newark, NJ, in 1936. Here, the polychrome aggregates produce a wonderful impact in a simple, modern design. In the same year, Earley Studio completed the interior of St. Anne's Church in Houston, TX, where the architect chose a combination of rose, tan, and muted green mosaic concrete.

Campus decorations and a reptile house at the zoo

For the Louisiana State University campus in Baton Rouge, LA, the studio provided precast ornamentation such as polychrome mosaic concrete medallions that were installed on the walls of the campus buildings.

In 1925, Earley fabricated an entrance to the Reptile House at the National Zoo in Washington, DC. The architect's fanciful design featured reptiles carved in stone and set off by polychrome precast mosaic concrete moldings. Above the doorway is a brightly colored scene with a dinosaur, palm trees, and clouds rendered in polychrome mosaic concrete. Earley translated the artist's painting into polychrome mosaic concrete displaying brilliant mixtures of pebbles and sand.

Modern polychrome projects

With the onset of the Great Depression, Earley's polychrome projects came to a halt.[15] Earley's market for decorative church interiors never recovered. In 1932, the studio started three decades of work on the Bahá'í Temple (Fig. 3 and 4).[16] Two years later, offering his contribution to the construction of small houses, Earley produced a series of polychrome houses with precast mosaic concrete panels.[17]

In 1936, Earley produced six murals illustrating the progress of shipbuilding for the U.S. Navy's Model Basin in Carderock, MD.[18] Even the rigging of the sailing ships is rendered in delicate lines of mosaic concrete. In Washington, DC, Earley created a polychrome entrance façade for the Scottish Rite Center. The central panel was the largest

polychrome work that the studio cast in one continuous operation. Earley also created 11 ft (3.3 m) tall polychrome mosaic concrete urns for each side of the entrance. The studio fabricated the urns in segments, incorporating curved, thin precast slabs into larger molds. Completed precast sections of the urns were assembled on-site and the joints pointed with a mortar of crushed quartz sand. The studio also began work on the Thomas Alva Edison Memorial Tower in Edison, NJ. The tower was constructed using architectural precast panels of mosaic concrete in 12 different hues.[19]

John Earley's Successors

John Earley passed away in 1945, a few weeks after he sold Earley Studio to his associate Basil Taylor.[2] Taylor continued the work of the studio until retiring in 1955. His son, Vernon G. Taylor, then took over the direction of the studio.[7] Both of the Taylors were skilled in the art of polychrome mosaic concrete and enjoyed creating it whenever the opportunity presented itself. Earley Studio made dozens of Great Seals of the United States in polychrome mosaic concrete. The Great Seals were created in three sizes and installed in U.S. embassies throughout the world. The studio also fabricated a 6 ft (1.8 m) diameter polychrome mosaic concrete emblem for the Naval Research Laboratory in Washington, DC.[7]

Fig. 3: The Bahá'í Temple interior displays 2457 panels of polychrome precast mosaic concrete with ornamentation sculpted in 2 in. (50 mm) deep relief

Places of worship

Basil Taylor directed work as the studio finished the interior of the Bahá'í Temple in 1948. Earley Studio's bid to fabricate and install 2457 precast panels of polychrome mosaic concrete was $12,000 less than bids for plain white ornamental plaster.[20] The architects selected an off-white mixture of white, clear, and amber quartz for the ornamentation and a mauve combination of pink, amber, and gray pebbles for the background. On the side portions of the sculpted ornamentation, which projected as far as 2 in. (50 mm) from the background, the studio did not expose the aggregates. This technique provided an additional chroma of white without requiring another concrete mixture.

The Islamic Center in Washington, DC, was finished in 1953 with Earley Studio's precast polychrome mosaic concrete panels.[2] The architect chose an elegant combination of off-white quartz with a light blue mosaic concrete mixture to highlight the geometric and calligraphic ornamentation. The studio fabricated thin, perforated screens to cover window openings. At entrances and along colonnades, the

Fig. 4: Closeup of concrete panels for the Bahá'í Temple. Panels display remarkable precision in delineation of the color, sharp arrises, uniform exposure of the aggregate, and a third chroma effect by not exposing the sides

Fig. 5: The most intricate artwork that Earley Studio created in polychrome mosaic concrete can be found in 20 battle maps extending along galleries in the National Memorial Cemetery of the Pacific, Honolulu, HI

architect combined polished granite columns with precast mosaic concrete capitals to support pointed arches of precast panels in polychrome mosaic concrete.

Historic battle maps

The American Battle Monuments Commission asked Earley Studio to create battle maps for two memorials. The first project was two battle maps for a World War II Memorial Chapel at the American Cemetery in Brittany, France, in 1956.[21] The battle maps illustrate the advancement of Allied troops after the invasion of Normandy and the progress of the war throughout Europe.

The second memorial project displays the most elaborate artworks that Earley Studio ever created—20 battle maps for World War II and the Korean War located at the National Memorial Cemetery of the Pacific in Honolulu, HI (Fig. 5). The maps are four times as intricate as Earley's other polychrome mosaic concrete because the studio used 1/8 in. diameter pebbles instead of their normal 1/4 in. size (Fig. 6). The smaller pebbles were needed to render the extensive amount of detail required in the battle maps.

The artist, Mary Morse Jacobs, painted full-scale drawings with text, symbols, and geographic features in addition to wonderful scenes of soldiers, marines, military equipment, and local animals and plants. She designed 1450 ft^2 (133 m^2) of maps[8] with a dynamic range of colors requiring hundreds of color blocks within each 2 in. thick precast panel measuring approximately 3 by 5 ft (0.9 by 1.5 m) in size. The studio chose crushed glass for the pebbles and sand, and it added pigments in the miniature concrete mixtures. For panels full of text, the studio selected quartz aggregate for a parchment-colored background. Forty-eight thousand plastic

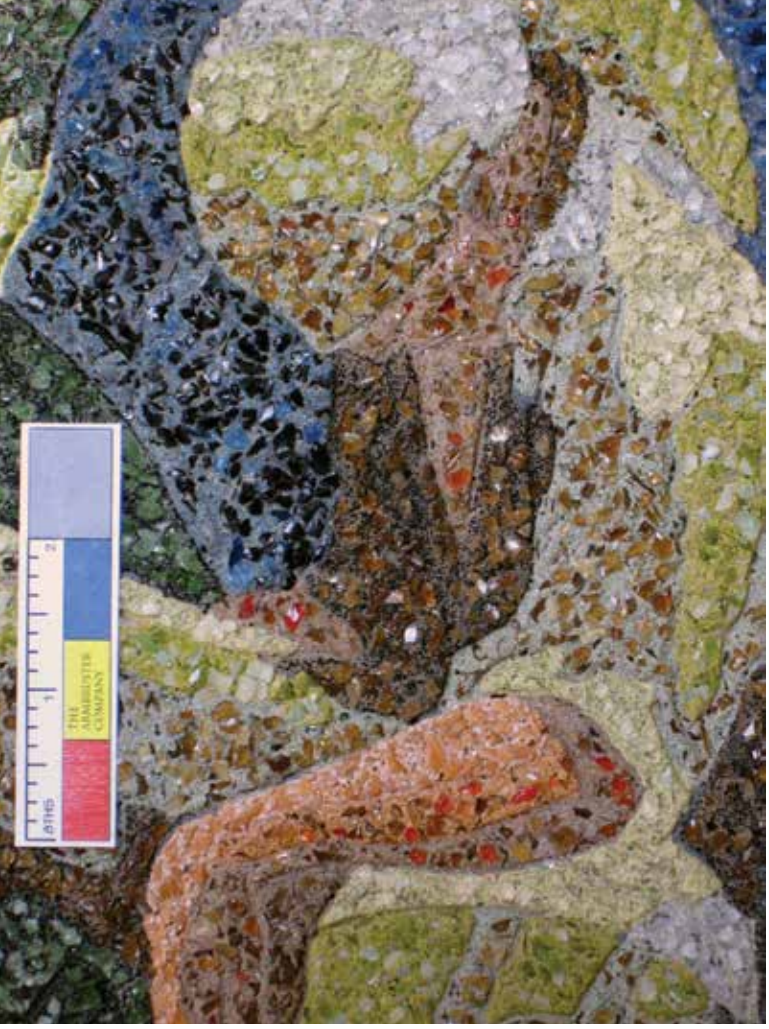

Fig. 6: Earley Studio's craftsmen rendered the battle map artwork using polychrome mosaic concrete mixtures with 1/8 in. (3 mm) pebbles and fine sand produced using crushed glass

Fig. 7: This 18 by 24 in. (450 by 600 mm) legend on the battle map includes plastic letters and glazed ceramic symbols among flags, soldiers, plants, an airplane, and clouds created with polychrome mosaic concrete

letters were embedded within the mosaic concrete panels to identify geographic features and military units and provide descriptive narration (Fig. 7).[22] A total of 887 tiny, glazed ceramic shapes were cast into the maps for symbols of ships, planes, and military units.[8]

Earley Studio worked for 3 years to design and fabricate the project's 88 panels. The 10 ft (3 m) high maps extend along open-air galleries clad in travertine marble. In the warm, reflected light of the Hawaiian sun, the crushed-glass mosaic produces a vibrant optical effect that touches the hearts of the visitors and would have delighted Earley.

Earley Studio was commissioned to create the battle maps in polychrome mosaic concrete after the memorial's original battle maps, which had been fabricated in Italy using scagliola, deteriorated after just a few years of humid Hawaiian weather.[8] Nearly 50 years after their completion, Earley Studio's map panels remain in superb, like-new condition.

The Future of Polychrome Mosaic Concrete

Few artists, craftsmen, or architects have continued to use the artistic medium of polychrome mosaic concrete. When Earley Studio closed its doors in 1973, several of the studio's craftsmen collected the remaining sacks of aggregates, with dozens of colors of crushed pebbles and sand. They also formed an association and continued to practice their art. However, according to John Richardson, a staff member at Bahá'í Temple who in 1999 interviewed Jim Linville, the leader of the group, they ceased working on projects in 1989. Demand had declined due to shifting economic costs of labor and materials, a reduced number of readily trained craftsmen, decreased use of the decorative arts in architecture, and shifting tastes in style.

However, this need not be the end. Earley shared the artistic principles he employed and the technical aspects of his craft in eloquent articles that describe his polychrome mosaic concrete. Careful study of Earley's writings and projects, together with a solid training in the art and craft of the architectural sculptor, will provide a sound basis for the creation of polychrome mosaic concrete artwork in the future.

Thanks to that wealth of knowledge, my company designed and produced mosaic battle maps for the new Vietnam War Pavilions at the Honolulu Memorial located within the National Memorial Cemetery of the Pacific, using a style, materials, colors, and techniques like those used in Earley Studio's historical battle maps.[23] Even though we manually created some plaster models and molds, we augmented Earley's methods with modern materials, software for illustration, and CAD and CAM, with CNC machining of molds (Fig. 8).

Fig. 8: Craftsmen working on a battle map for the Vietnam War Pavilion at the Honolulu Memorial use artists' palette knives to place and consolidate polychrome mosaic concrete mixtures into molds. Ridges in the mold outline every small area of color in the artwork

Let us hope that the artistic potential of polychrome mosaic concrete will once again capture the interest of artists and architects. As Earley said, "Such a multiplicity of hues is a property of architectural concrete, unequalled by any other masonry material, in fact it is rivaled only by the great medium of the mosaicist, which however is not adaptable to form in three dimensions."[4] "In the hands of a skilled craftsman, concrete is an exquisitely decorative material affording with extraordinary facility the expression of predetermined form, color, and texture."[5]

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Selected for reader interest by the editors.

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