THE CONSERVATION AND RELOCATION OF A MONUMENTAL PETRACHROME MURAL: HELEN LUNDEBERG'S *THE HISTORY OF TRANSPORTATION*

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ABSTRACT
The History of Transportation is a 240 foot long (73 metre) cement-and-aggregate pictorial mural located in Inglewood, California. Created in 1940 by Pasadena painter and muralist Helen Lundeberg, the mural was once situated along one of southern California's most traveled commuter arteries. Changes in traffic patterns and demographics left the mural in a state of neglect over the years, subjecting it to structural and surface decay, including copious acts of vandalism that left it all but unreadable as an artwork. The mural's multi-faceted conservation program, carried out 2003–2007, was predicated on its relocation. Indeed, had it not been possible to remove and relocate this large-scale architectural artwork, the extensive repairs, graffiti removal, structural reinforcement, and mitigation of erosion that were carried out during treatment would have been nullified almost immediately after re-installation. Therefore, the plan for relocation to a site extensively used by the public was the essential component in this project.

INTRODUCTION

In May 1935, USA President Franklin Delano Roosevelt created the Works Progress Administration (WPA) to provide economic relief to Americans left unemployed by the great depression. Under the Federal Art Project (FAP), a division of the WPA, 225000 works of public art were created during the years 1935 to 1939. Because the idea of the WPA was to put people back to work, large-scale projects like murals were frequently produced during the period in question. *The History of Transportation*, a 60 panel, 240 foot (73 metre) long curved mural designed and executed by Pasadena artist Helen Lundeberg, was the largest WPA mural in America at the time of its 1940 dedication (Fig. 1). A freestanding artwork made of a cement-and-aggregate based material known as petrachrome, the mural is listed on the California Register of Historic Places, and remains one of the largest WPA artworks in the USA.

Designed by the then 31-year old Lundeberg to hang on a poured-in-place concrete wall that curved along the boundary of Vincent Edward Jnr Park in Inglewood, the mural was intended to be seen by commuters as they drove along Florence Avenue, at the time one of southern California's most traveled thoroughfares. The narrative reads from right to left to facilitate viewing from an automobile or trolley car. The subject matter is the history of man and transportation in the Centinela Valley, which encompasses Inglewood. The first panel begins with images of the region's native Gabriellino Indians, the middle section depicts Spanish *hacienda* owners, and the final portions show smartly dressed twentieth-century travelers waving to a DC-3 airplane. The mural makes a point of demonstrating humanity's technological progress from nomadic wanderers to farmers who used horses and carts, to residents of industrial societies where railroads, ships, automobiles, and early airplanes are all part of daily life.

Fig. 1 Helen Lundeberg at the dedication of *The History of Transportation*, 1940.

FABRICATION AND MATERIALS

Though the mural is a two-dimensional image, it was conceived as a freestanding piece — a sculpture of sorts. The wall on which it hangs formed part of the original commission awarded to Lundeberg. A 240 foot (73 m) long, 14 inch (36 cm) thick convex-curved concrete structure shaped like a bull-nose at both ends, the support wall was poured in place into wooden moulds and finished at the top with a 1 inch (2.5 cm) wide concrete cap. The image portion consisted of sixty 4 foot (1.2 m) wide × 7.5 foot (2.3 m) high panels made of a terrazzo-like blend of pigmented white Portland cement and crushed rock aggregate called petrachrome. Measuring approximately 1 inch (2.5 cm) in thickness, the petrachrome was backed by a 1 inch (2.5 cm) bed of reinforced concrete.

Championed for local use by Stanton MacDonald-Wright, technical advisor to the southern California FAP, petrachrome is one of a number of aggregate and cement mixtures developed during ancient and Renaissance times that, like terrazzo, underwent a resurgence during the 1920s when electrical polishing machines became available for efficient finishing. Petrachrome is thought to be adapted from *opus sectile*, a fourth-century Roman marquetry technique that employed large sections of stone inlay to create pictures. MacDonald-Wright encouraged the use of petrachrome because its purported durability would render it stable even in the strong sunlight of southern California. In this regard, MacDonald-Wright was prescient: though the mural suffered considerable damage in the ensuing 65 years, most was a product of vandalism and poor restoration; degradation and erosion were insignificant compared with other types of damage.

Lundeberg began the work by creating a 5-foot (1.5 m) long watercolor drawing of the image. The image was rendered in the flat poster style of 1930s American Regionalists, a school of art noted for representing ordinary people in ordinary settings, and whose flat planar style was easily adaptable to petrachrome. A scale drawing was created from this initial drawing. This was transferred in graphite pencil onto a wooden pad. Lundeberg's team next delineated the borders of each area of color on the wooden pad using thin flexible metal shims that curved easily. Crushed stone aggregates in different colors and sizes were laid into the individual sections according to the layout of the design. A cement-based mortar in corresponding colors was poured over the stones, and after the mortar was dry, the shims were removed and the panel was machine polished.

Once the petrachrome cured, 2 inch (5 cm) gauge steel chicken wire was laid across the back of the mural and a 1 inch (2.5 cm) bed of concrete poured onto the back. The concrete bed was reinforced with three 6-foot long (1.8 m) pieces of ¼ inch (6 mm) structural steel rebar. A final pour of concrete embedded 10 wire

ties, affixed with mortar into keyhole shaped holes in the support wall for hanging. The last step in the fabrication was the casting of the concrete curb and cap that served to seal the piece from the elements at the top, sides and bottom.

DETERIORATION AND THE DECISION TO RELOCATE

Fifteen years after the mural's installation, streetcar lines disappeared in favor of automobile travel, and the freeway system drew travelers away from previously established street routes. Florence Avenue, once the bustling major artery that connected the downtown area to the port of Los Angeles, soon became a little-used, semi-abandoned thoroughfare. Trees grew up and around the mural, obscuring its appearance and cracking its foundation wall. Fewer and fewer people noticed the piece from the street. Minor cracking, which could have been easily mitigated, was allowed to expand, and large and small fragments began to fall from numerous panels. The mural also sustained damage, getting hit by forklifts moving caskets at a vault company that abutted the support wall on the back, and on two occasions, by automobiles that jumped the curb, destroying two panels and severely damaging several others. Worst of all, Vincent Edward Park became a hotly-contested street gang territory, turning the mural into a platform for regularly-applied graffiti (Fig. 2).

In 1988, a committee of Inglewood citizens convened to decide what to do about this community treasure which was nonetheless an eyesore. By this time, the mural was so marred by graffiti that 30% of the design was completely obscured by spray paint and magic marker (Fig. 3). These initial efforts to save the mural failed due to a lack of funding. The matter was not taken up again until in 1999, when funds to evaluate the future of the mural were obtained from the J. Paul Getty Trust's *Preserve LA* grant. A blue ribbon team was convened[1] to evaluate the feasibility of deinstalling the mural and conserving it. At issue were two key factors:

- Could the mural be safely removed for conservation?
- Could a new safe location be found for the mural that had historical significance, while improving public access to the mural?

Because no documentation existed that described how the mural was hung, the only way to determine whether the panels could be safely removed was by attempting to remove one panel. The conservators worked with local stone contractors Carnevale and Lohr (C&L) to determine this. The team easily cut away and removed a section of the top cap and de-installed the 21st panel in the sequence (Fig. 3). The panel was attached to the wall using the 10 wire ties and a 'dollop' of wall plaster. A material as water-soluble as calcium sulfate-based wall plaster — referred to as 'slop' in the construction trade — is today an unusual choice for outdoor use, but at the time of the mural's installation it was not uncommon.[2]

After removal, the panels were brought back to the Sculpture Conservation Studio (SCS) in Los Angeles for cleaning and graffiti removal tests. Samples of the petrachrome and concrete backing were taken and sent to a mortar analysis laboratory.[3] Graffiti removal tests and minor repairs were carried out. The results of these tests will be described below, in the conservation section. It was determined that the mural could be safely removed from its wall, and that conservation would be successful.

The second question — the appropriateness of relocation — was more complex. Because the mural was a site-specific artwork whose subject matter reflected the character of its original site, historical accuracy dictated replacing the mural after conservation. Nonetheless, the representatives from the City of Inglewood who had spearheaded the conservation efforts were eager to move the piece to a site with greater public access and visibility. The blue ribbon committee considered several suggestions from the city for the new site, and finally settled upon Grevillea Park, a green space along busy Manchester Boulevard that is opposite Inglewood City Hall and High School. In addition to being highly visible, this site was originally a switching station for railroad cars bringing oranges from the agricultural areas of California to the port, providing an apt thematic link.

Once a site was chosen to accommodate the mural, the blue ribbon team deliberated the suitability of relocation. Relocation had to meet rigorous art historical and conservation standards; it also had to make sense to funding agencies that would require justification for such an undertaking. The most important factor influencing the decision to relocate was the obsolescence of the original site. Lundeberg had chosen the site because of its visibility, yet with no pedestrian traffic, and little commuter traffic, no one — apart from graffiti artists — ever passed by the mural in its Florence Avenue location. The new location was a major artery with significant pedestrian traffic due to the proximity of the high school, city hall, and public library. The new location would be a well-lit open park, which would significantly reduce the chances of the artwork being vandalized. After

Fig. 2 The middle section of the mural before treatment, covered in graffiti at Vincent Edward Jnr Park.

Fig. 3 De-installation of the mural, showing texture from wooden moulds on the concrete wall and plaster 'slop' on the wall.

[1] Headed by the authors, and composed of art historian Portia Lee; architectural historian Carson Anderson; environmental analyst Terry Hayes; structural engineer Mel Green; Tobey Moss, the artist's dealer at the time of the mural's installation; and Ed Lohr, Carnevale and Lohr, a stone-and-concrete panel installation firm.

[2] Ed Lohr, pers. comm.

[3] Technology of Materials, Santa Barbara, California (hereafter TM).

Fig. 4 Power washing to remove graffiti.

Fig. 5 Panel #25, showing insoluble graffiti ghosting that required removal by powder blasting, and texture of petrachrome.

deliberation, the blue ribbon committee concluded that Lundeberg was unlikely to have chosen the Florence Avenue site in its present state. Coupled with the fact that there was a very high probability that the mural would attract graffiti almost immediately after re-installation, the decision to relocate was unanimous.

CONSERVATION TREATMENT

In 2001, the city amassed sufficient funds to begin conservation. Because of the size and weight — approximately 500 pounds or 227 kg apiece — the panels could only be safely maneuvered in groups of four. The plan, therefore, was to deinstall the entire set of panels and store them in specially fabricated crates that would also serve to protect them once they were treated, and while they awaited installation. The panels were faced on the wall with Japanese paper to keep fragments from falling off during deinstallation. The facing was applied using a 20% solution of Acryloid B-72 in acetone. A number from 1 through 60 was assigned to each panel, and written both on top of the facing and on the back. The panels were removed and packed in crates to await conservation.

In-studio conservation began with removal of the facing and the graffiti (Fig. 4). The panels were brushed with a commercial paint stripper and cleaned with hot pressurized water at 2–4 times atmospheric pressure. Careful monitoring was undertaken to insure that the water pressure and distance were kept at even levels so the petrachrome would not be marred. This process, repeated several times, successfully removed the facing and 80–90% of the graffiti. However, because it had been applied over so many years, multiple layers of paint had seeped into the porous structure of the petrachrome. Microscopical examination[4] revealed that there was no longer any resinous paint binder, but that the pigments from the graffiti were lodged in the pore structure, and were insoluble in both organic solvents and alkaline cleaning agents (Fig. 5).

The conservators concurred with representatives from the city and the California Office of Historic Preservation (OHP), and it was unanimously agreed that leaving traces of graffiti would invite additional damage. The question then became how to remove this insoluble pigment without damaging the surface. For advice, the conservators turned to numerous colleagues in the field.[5] The recommendation was that solvent cleaning would not help, and testing of mild abrasive cleaning methods, such as calcium carbonate and aluminum oxide was suggested. The examination had indicated that the pigment was close to the surface, i.e. it was not deeply bound into the pore structure. Because most, if not all of the pigment particles were softer than the surrounding silica from which the petrachrome substrate was composed, abrasive blasting of this nature could be carried out successfully. Tests indicated that aluminum oxide was the most effective and least abrasive method for removal of the graffiti 'ghosting'. The treatment was carried out on all the affected panels, and followed by a final cleaning with acetone and hot pressurized water.

A key aspect of this project involved compliance with OHP guidelines. As one of the chief funders of the project, OHP required SCS to submit protocols for all steps in the conservation treatment for their prior approval. Because the reviewers were not conservators or trained in conservation, this process often led to lively discussions about processes and intended outcome. One of the initial areas of concern on the part of OHP was in the repairs to the concrete backing. The concrete was riddled with cracks caused by corroding steel rebars (Fig. 6). In many cases, this steel was sufficiently intact to be cleaned and coated with Sikadur 23, a commercial epoxy-based structural adhesive that has been successfully used in a similar capacity on the conservation of the Simon Rodia Towers in Watts, California. The rebar was then covered with a mortar mix that did not exceed the strength of the original. Any rebar that had lost more than 50% of its diameter was replaced. Because the concrete that topped the steel was less than 1 inch (2.5 cm) thick, OHP recommended the use of stainless steel for the replacement rebar. However, it

Fig. 6 Panel #59, showing exposed rebar supports before treatment.

[4] By Sam Iyengar, TM.

[5] Including Dr George Wheeler, Director, Center for Preservation Research, Columbia University.

Fig. 7 Fabrication of new replacement panel using colored Jahn M-90 mortar.

was evident to the conservators that this could pose problems of galvanic corrosion if the stainless steel made contact with the mild steel chicken wire that was used as reinforcement in the concrete. Support from colleagues made it possible to convince OHP that though mild steel was inherently less stable than stainless, it was the best material for this process.

Another area of debate was the choice of fill material for missing areas of petrachrome. Funding for the project did not allow for significant analysis to determine the composition of all the aggregate used in each section. Lundeberg's process was idiosyncratic and therefore not easily reproducible without such analysis. This meant that the match would have been done by guesswork and more than likely would have looked like a poor imitation of the original. Because the conservators were also attentive to the ethics of trying to recreate the petrachrome, especially where large sections of loss were concerned, the treatment proposal was to recreate losses using pigmented cement mortar that matched the surrounding petrachrome. The result would provide readability without compromising ethics. Test areas were created using custom-colored Jahn M-90 Mortar, a textured pigmented restoration mortar that resembled the base color of the original panels (Fig. 7). From a distance of 5 feet (1.5 m), roughly half the intended viewing distance, the mural would read as a continuous narrative. From close up, textural differences would be easily distinguishable from the original. Samples of this were approved by a committee from the City of Inglewood and, ultimately, after much discussion, by OHP. Once these repairs and fills were completed, the overall image regained its narrative unity, allowing it to be clearly read by the viewing public.

Additional steps in the treatment involved repair to major and minor cracks in the petrachrome, as well as the application of coatings to protect the surfaces from moisture intrusion as well as possible graffiti writing. The methods and materials of these steps were relatively straightforward — as much as anything can be straightforward when working with an artwork of such scale and idiosyncratic manufacture. Cracks in the petrachrome surface were repaired with Jahn M-30 injection mortar. Repair to fragments that had come deteched from the original were executed using Sikadur 23. After repairs were completed, the back of the concrete bed was coated with Prosoco Conservare H100, an alkoxysilane consolidant/water repellant intended to keep moisture from penetrating the concrete and rusting the interior rebar. Once the mural was installed, the petrachrome was coated with Prosoco SC-1, a reversible sacrificial coating intended to provide protection from graffiti. This step was carried out once the mural was fully installed on its new wall.

PREPARATION OF THE NEW SITE AND INSTALLATION

The final area of concern in this treatment was the preparation of the new support wall at the Grevillea Park site. As mentioned above, the original support wall was a convex-curved structure designed for the original site and fabricated by pouring in place into wooden moulds. The new site was situated next to an assisted living complex for senior citizens and there was concern that the mural would obscure the entryway in a manner that was not in keeping with city codes. The city proposed to mitigate this by changing the shape of the retaining wall from a convex curve to an undulating curve that would be shorter in overall length, and not obscure the entryway. OHP did not accept this solution. Because the original wall was part of Lundeberg's commission, and because it was deliberately finished with bull nose ends and a 1 inch (2.5 cm) cap on top, it was considered an unalterable component of the design. A rubble-filled concrete block wall had been proposed for the replacement, but OHP also insisted on the wall's fabrication by the original poured-in-place method, using moulds that would provide the original wood texture to the reverse side. Though such a wall was far more complex and expensive to fabricate, in the end this is what was done. The city accommodated the shape issues by shifting the position of the wall and mural to avoid blocking the entry to the senior center. The wall was poured in place by contractors hired by the city to construct the hardscaping at the newly named Grevillea Art Park. The mural was hung by C&L under the supervision of SCS, using a variation on the original method employed, but substituting exterior-grade mortar for the original 'slop'. The last stages in treatment were the application of the anti-graffiti coating and the grouting of the joins between panels.

CONCLUSION

The conservation of *The History of Transportation* was a five-year effort, involving numerous participants, which required continual evaluation of processes, ethics, and methodology. At the center of the discussion was the safety of the mural, of course. But in this case that safety hinged on restoring its visibility and public accessibility. The mural is now the centerpiece of a new park in the City of Inglewood (Fig. 8). Renamed Grevillea Art Park, the site, which is well lit at night and labeled to allow the public to understand the history of the artwork, is expected to become not only a cornerstone for art awareness in the City of Inglewood, but a major component in the city's urban renewal and pedestrian access. Hence, relocation and renewed public access can be seen to be the key to the preservation of this historic artwork.

Fig. 8 The mural after conservation, installed on new wall at Grevillea Art Park.

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MATERIALS AND SUPPLIERS
Jahn Mortar M-90, M-30: Cathedral Stone Company, 7266 Park Circle Drive, Hanover, MD 21076, USA, www.cathedralstone.com

Jasco Paint Stripper: Homax Products, P.O. Box 5643, Bellingham, WA 98227, USA, www.homaxproducts.com

Conservare SC-1 sacrificial coating and H100 consolidant: PROSOCO, 3741 Greenway Circle, Lawrence, KS 66046, USA, www.prosoco.com

Sikadur 23 Lo-Mod gel epoxy: Sika Construction Co., 201 Polito Ave, Lyndhurst, NJ 07071, USA, www.sikaconstruction.com

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