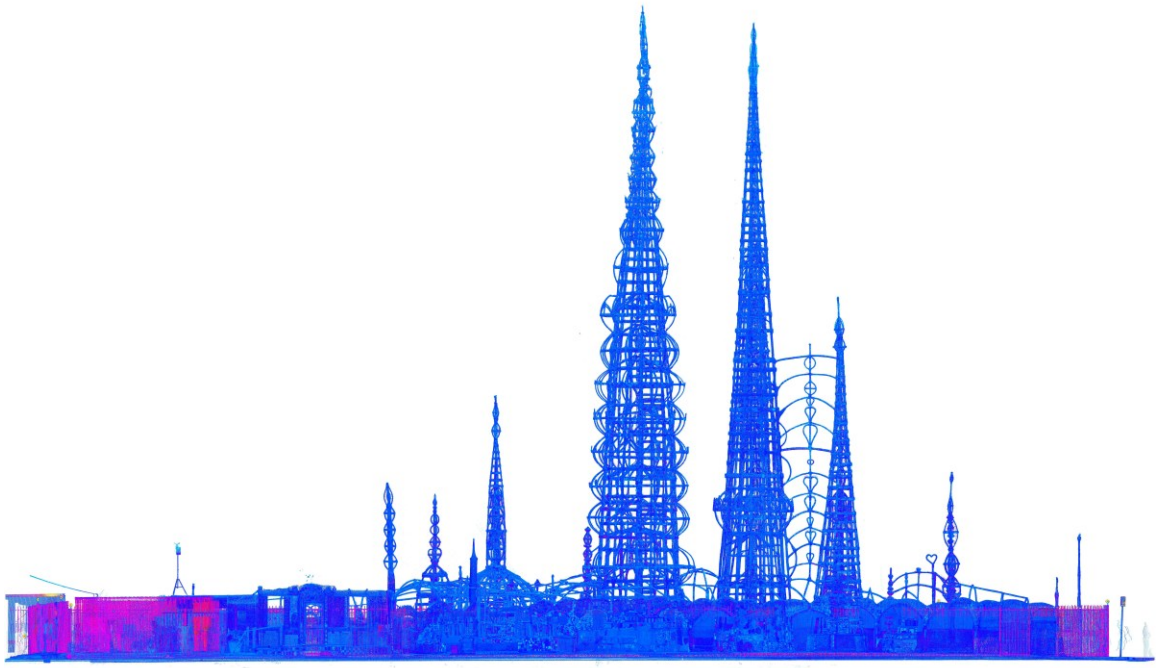
LACMA

LACMA, DCA, and Watts Towers

Progress Report January 2013 through March 2013 (Eighth Progress Report)

Prepared for the DCA, City of Los Angeles, by Frank Preusser and Mark Gilberg



The unacceptably high failure rate for concrete repairs is a major problem in the repair industry. To achieve durable repairs, it is necessary to consider the factors affecting the design and selection of repair systems as part of a composite system.[1]

Summary

Work on the fragments in the office trailer storage room has continued.

Inspection and photo-documentation of the three tall towers with a spotting scope and photography with a telephoto lens continued. Comparison of the current condition of the monuments with the Rand photographs was continued.

[1] J. E. McDonald et. al., Development of Performance Criteria for Dimensionally Compatible Cement-Based Repair Materials, ACI SP 193 (August 1, 2000) p.441

Research in potential crack fillers, repair mortars, and adhesives continued and a variety of materials was purchased for testing and evaluation. Testing protocols have been developed for repair mortars and adhesives and testing has begun. A testing protocol for elastomeric crack fillers was developed.

Additional data-logging crack monitoring equipment (displacement transducers and thermocouples) was installed in February and operates satisfactory.

UCLA's Department of Civil and Environmental Engineering has installed on the Center Tower a tilt meter, accelerometer, wind monitor, two displacement transducers (crack monitors), and the associated computer equipment.

In-situ test repairs have been started on the garage, house posts, and the West Tower

Accomplishments

Staffing

No changes.

Consultants

- Mr. **Mel Green** (Melvyn Green & Associates, Inc.) continues working on a review of the Ehrenkrantz calculations of the structural stability of the Towers.

- Prof. **Bruno Pernet** from the California State University Long Beach continued his study of the seashells on the Towers.[2]

- On January 23 Profs. **Ertugrul Taciroglu** and **Robert L. Nigbor** (UCLA Department of Civil & Environmental Engineering) installed a tilt meter, one accelerometer, and the associated computer system at the Center Tower. On March 12 they added The Wind Observer II. The latter is a more sophisticated instrument for measuring wind speed and direction and turbulences than our existing weather station. They also added two displacement transducers (crack monitors).

- On March 8 Mr. **Peter Howell** from KEIM Mineral Coatings of America, Inc. visited to discuss with us the most suitable paint system for color matching and aesthetic integration of repairs at the Towers.

[2] LACMA is only providing access to the site and to the existing photographic records.

Office

Nothing to report.

Chemical Safety

Three staff members were respirator fit tested.

General Safety

During this reporting period we had one minor injury involving one of the heavy fragments in the Office Trailer storage room. During removal of another fragment it slipped off the shelf and fell on the foot of the staff member. Subsequently handling procedures for heavy objects were reviewed by Frank Preusser.

On February 27 we conducted the mandatory quarterly safety inspection.

Site Maintenance and Improvements

The site is surveyed daily for any fallen ornaments and other problems. The daily survey also includes visual examination for new cracks or significant changes in existing cracks.

Archival Research

One more file box with photographs and negatives was discovered and its content is currently being re-housed and inventoried.

Treatment Database

The current version of the new database was evaluated and a list of pending issues was submitted to Colleen Boye. In a meeting between Frank Preusser and Colleen it was agreed to upgrade the router, to allow access to the database from remote locations. In the coming months Colleen will also work on the remaining bugs, data entry issues, and the transfer of the data from the Access database to the new database.

Re-Photography of the Artwork

The re-photography of the higher elevations of the tall towers with a telephoto lens continues.

X-Radiographs

Another ~30 X-radiographs have been scanned by Yosi Pozeilov and are currently being processed by Mariana Ruiz..

Inventory of Detached Ornaments

Ms. Kimberly Blanks has completed the inventory of the fragments with the exception of the very heavy pieces that have been removed during previous restoration campaigns[3]. This leaves only the fallen fragments that have been collected and are currently held by the Watts Towers Art Center. These will be documented and entered in the database as soon as the WTAC hands them over.

Evaluation of Changes since Rand Photo Campaign

Mariana continued the comparison of the Rand photographs with the current state of preservation of the monument.

Evaluation of Cracks

Monitoring of selected cracks with plaster bridges continued. We also continued monitoring cracks to determine if they are propagating lengthwise.

The strain gauges and displacement transducers continue to provide useful data. The data are downloaded on a monthly schedule and data reduction is carried out by Dr. Charlotte Eng[4] and Ms. Mariana Ruiz.

On February 14 we installed an additional five displacement transducers and more thermocouples.

Figure 1:

Figure 2:

On January 23 Profs. Ertugrul Taciroglu and Robert L. Nigbor (UCLA Department of Civil & Environmental Engineering) installed a tilt meter, one accelerometer, and the associated computer system at the Center Tower (figure 1). On March 12 they added the Wind Observer II (figure 2). The latter is a more sophisticated instrument for measuring wind speed and direction and turbulences than our existing weather station. They also

[3]This will be completed once we have secured help in moving the big pieces for photography.

[4] LACMA Conservation Center, Research Laboratory

added two displacement transducers which are time synchronized with their other sensors. Initial results from the tilt meter indicate that due to one-sided heating the towers bend slightly in the northern direction when the sun comes up, and return to their original position as the sun sets.

Weather Station

The Weather Station continues to reliably record the environmental conditions. The data are downloaded and processed at regular intervals by Ms. Kimberly Blanks.

Thermal Imaging and Monitoring

Currently the thermal imaging program is on hold due to other, more pressing issues. To further evaluate the effect of the ornaments on the temperature profile at the Towers we created a test plate (figure 3) in which we embedded thermocouples under a tile and in undecorated concrete and on the surfaces of the tile and the concrete. The test plate was the placed on our exposure rack. The results (figure 4) confirm previous findings that generally the undecorated concrete heats up significantly more than the concrete under tile decorations.

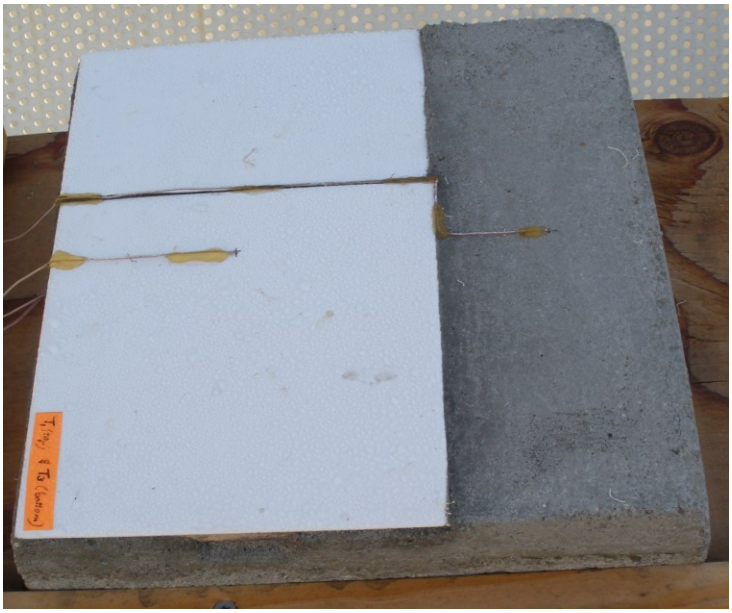


Figure 3: test plate for thermal test

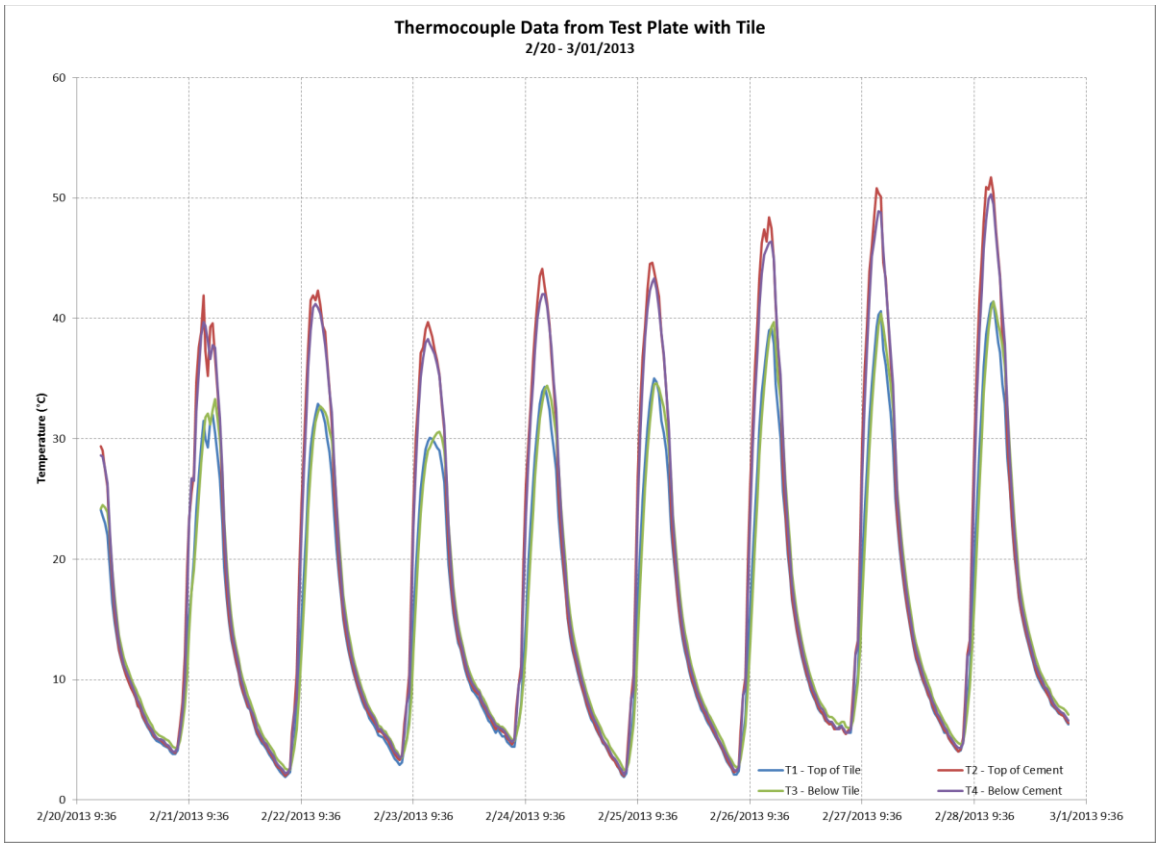


Figure 4: results of thermal test

Weather Events

No special events.

Identification and Evaluation of Conservation Materials

Almost all of the repair mortars, elastomeric crack fillers, and adhesives we identified as promising have been obtained. Testing procedures have been designed. The Getty Conservation Institute agreed to let us use some of their aging facilities and discussions are underway with the UCLA Department of Civil & Environmental Engineering about some physical testing of mortar and adhesive samples.

Repair Mortars

Additional experiments were carried out to develop procedures to simulate the weathered appearance of Rodia's plaster and older repairs[5]. Figures 5 and 6 show the successful modification of the surface of amended mortar test samples.

[5] In the weathered cement plaster the aggregate is protruding, creating a rough surface.

Figure 5:

Figure 6:

Since no laboratory test can fully simulate the real conditions on the monument we started an *in-situ* testing program, removing failed previous repairs and re-restoring these areas. This allows us to further improve our repair methodology and to observe the repairs for an extended period under natural conditions[6].

a) Garage

The previous repair was cracking and appeared to be detached (figure 7). The failure of this repair appears to be mostly corrosion related (figure 8). After removal of the old repair and treatment of the metal with a primer (figure 9) the loss was filled with an amended mortar (figure 10).

[6] Previous *in-situ* repair tests carried out by ARG failed in less than 18 months.

Figure 7: Cracked and detached repair at garage

Figure 8: During removal of old repair

Figure 9:repair removed, metal treated

Figure 10: Completed repair

b) West Tower Base

An area was selected that was last repaired in 2001 and then again in November 2004, using Jahn Mortar M90 (figure 11). The old repair was removed and the surface prepared for restoration (figure 12). This will be restored with a pigmented polymer amended cement mortar and serve as another site for the monitoring of the performance of these mortars.

Figure 11: WTO base, 2001 & 2005 repairs

Figure 12: WTO base after removal of repair

c) House Posts

The demolition of the deteriorated house platform provided an opportunity to access the house foundation, previously inaccessible areas of the South wall of the house and the fireplace. It also made the posts on the East side of the house more accessible. It was therefore decided to carry out some repairs on the posts and, where needed, the foundation.

The back door of the house is far too complex to be addressed in a short term project and it was decided to postpone its treatment to some future date.

Post 5 however required immediate attention due to losses in cement covering, corrosion of the steel armature, severe cracking, and a general instability (figures 13 and 14). To structurally stabilize the post it was decided to connect it to the house foundation by pinning it with a threaded stainless steel (figures 15 and 16).

Figure 13: Post 5, pre-treatment condition

Figure 14: Detail of figure

Figure 15: Before pinning

Figure 16: After pinning

The space between the post and the foundation will then be filled with amended cement mortar to provide additional stability and protect the steel rod. In the next steps the voids behind the steel armature will be filled by injection grouting and the cracks will be filled with an amended mortar. The work will be completed by stabilizing the decorations.

Adhesives for Decorative Ornaments

The outdoor exposure of the adhesives continues and the samples are inspected at regular intervals and changes are documented...

Elastomeric Crack Fillers

Seven elastomeric crack fillers have been identified and purchased. A preliminary testing protocol has been developed and the first test plates have been made.

Water Repellents

Since it is anticipated that the application of a water repellent will be the final step in any future treatment we identified and obtained four high end products. At this point we will test their compatibility with the repair mortars, adhesives, and crack fillers. Limited *in-situ* tests may also be carried out. We also obtained some Karsten Tubes to be able to measure their effectiveness[7].

Four sets of three cement test plates have been impregnated with the selected water repellents and have been placed on the outdoor exposure rack Initial qualitative tests indicate significant differences in the effectiveness of the various products.

Next Steps

- Continuation of the repair mortar testing program in the laboratory and *in-situ*.
- Completion of the repair work at the house posts and foundation.
- Implementation of a detailed testing program for elastomeric crack fillers.
- Continue testing of water repellents.
- Identify equipment and potential consultants for corrosion monitoring.
- Begin evaluating migrating corrosion inhibitors.

[7] We are grateful to Dr. Beril Bicer-Simsir (Getty Conservation Institute) for donating the tubes for our first round of testing.

Fundraising

No updates this quarter.

Other

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Respectfully submitted by Frank Preusser, Senior Conservation Scientist, Conservation, with support from Mark Gilberg, Suzanne D. Booth and David G. Booth Conservation Center Director

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