

**REVIEW OF WATTS TOWERS  
NOVEMBER 12, 1996  
1765 E. 107TH STREET**

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**REVIEW OF WATTS TOWERS**  
**NOVEMBER 12, 1996**  
**1765 E. 107TH STREET**  
**9 a.m. to 1 p.m**

The Watts Towers earthquake repair and conservation program is managed by Cultural Affairs Department - Jay Oren, A.I.A. Staff Architect and Virginia Kazor, Historic Site Curator.

**Summary:**

In late December, the six uppermost scaffold platforms will be disassembled and removed from the 14-levels of scaffold around the three tallest towers. Invited attendees shall have access to the scaffold to inspect Northridge Earthquake damage and conservation work and repairs accomplished to date. The invitees will be accompanied by Cultural Affairs consultants who will answer questions about the repair and conservation work.

**AGENDA**

INSPECT THE SCULPTURES

DISCUSSION

**Invited Attendees:**

Los Angeles County Museum of Art : Pieter Meyers  
Steve Colton  
John Twilley

The Getty Conservation Institute : Neville Agnew  
Alberto Tagle  
William Ginell

The J.Paul Getty Museum : Jerry Podany

State of California:

Department of Parks & Recreation-

Dan Preece

Neil Braunstein

Historic Preservation Office-

Steadie Craigo

Governor's Office of Emergency Services-

James Lyons

**Los Angeles Cultural Affairs Department :**

Consultants: Zuleyma Aguirre, William 'Dewey' Ambrosino, Rosa Lowinger,  
N.J. Bud Goldstone

## **REVIEW INFORMATION NORTHRIDGE EARTHQUAKE DAMAGE TO WATTS TOWERS**

### **BACKGROUND & SUMMARY**

Before the earthquake in the early morning of January 17, 1994, Cultural Affairs had completed conservation efforts on the Ship of Marco Polo, the Garden Spire, the "A" Tower, the "B" Tower, the Chimney and most of the Gazebo, House Facade and Canopy. No damage was found after the earthquake in work done on those eight sculptures. Damage occurred in eight other of sculptures: the three tall towers, North and South Walls, Canopy, House Stairs, Patio Floor.

At the present time Cultural Affairs has completed all of the Northridge earthquake repairs to the canopy and house facade stairs, approximately 70% to the North Wall, 50% to the East Tower, 70 % to the Center Tower, 50 % to the West Tower and 10% to the South Wall. With the scaffold resting on it, no repairs were made to date on the patio floor.

### **TALL TOWER SCULPTURES**

#### **BACKGROUND**

In March 1994, an initial Northridge Earthquake Architecture & Engineering (A&E) Report was prepared for Cultural Affairs by N.J. Bud Goldstone and Zuleyma Aguirre and submitted by the City of Los Angeles to FEMA/OES. The three-year schedule of repair was from July 1, 1994 through June 30, 1997. Costs for repairs were based on estimates of damage made from the ground by visual inspections. Eight of the seventeen sculptures on the site were found to have suffered damage. Inspections of the inaccessible upper portions of the three tall tower sculptures (55 feet, 97 feet 10 inches and 99 feet 6 inches tall) were only possible by sightings of the portions of the intricate sculptural members that were visible to observers using binoculars. Between October and December 1994 scaffolding was erected to provide access to the three tallest towers.

Later findings showed that the March 1994 A&E report cost estimate was underestimated. A June 1995 inspection from the scaffolding and 1994 and 1995 repairs of the damaged sculptures disclosed additional damaged areas and more extensive damage to areas previously identified.

The major underestimation occurred in assessing damage to joints on the three tallest towers. These towers contain almost 5,000 joints between multiple segments in more than 150 horizontal bands, dozens of vertical columns, radial members, external loops and the center columns of each tower. For example, there are 16 external columns on the West Tower and up to 22 such columns on each the Center and East Tower. During the initial inspection, only a limited number of earthquake-damaged joints could be seen from the ground. Months later when the scaffolding was up, damaged joints were opened and repairs were made. It was then found that joints at each intersection of vertical columns with the damaged band had also separated from other vertical columns. Analyses now show an increase in damaged joints of 90 percent in the 99-foot, 6-inch tall West Tower, 137 percent in the 97-foot, 10-inch tall Center Tower and

283 percent in the 55-foot tall East Tower. Furthermore, failures also occurred in the repairs made from 1979 to 1985 by the Office of the State Architect crew. The failures uncovered to date have been repaired using improved methods developed by Cultural Affairs.

Since 1994, Cultural Affairs developed plans and techniques to remedy earthquake damages. They prepared a detailed plan for conservation; performed X-rays in areas of uncertainty; performed a survey of the towers to determine any movements of the sculptures by measuring changes to prior verticality measurements first taken in 1989; performed foundation investigations; developed specific designs for repairs of foundations, joints, splices and individual bands, columns, radials and other members. Inspection of the shorter sculptures and of the East Tower, Center Tower and West Tower Sculpture were made from the scaffold and executed repairs described below.

#### NORTH WALL SCULPTURE

Repairs were made to the North Wall and some 'Overheads', sculptures which join the walls to other sculptures. The wall has ornaments on one side, the inside. Repairs consisted of opening cracked areas. Failed reinforcements were replaced with new steel channels in posts. Steel channels were placed within the panels to brace the posts and repair many of the twelve damaged wall panels. Failures occurred in the wall from high horizontal earthquake forces. These forces were 40% higher than those from the Whittier quake of October 1987, based on the official earthquake data from CSMIP report No. 5.

#### SOUTH WALL SCULPTURE

Only a few posts have been repaired under the Canopy at the entrance through the wall.

#### CANOPY SCULPTURE

Repairs were made to the sculpture and to the support columns from scaffolding. The sculpture suffered horizontal separations in four places and failures in the support columns from the forces of the Northridge quake. Repairs consisted of removing major portions of the sculpture, performing re-consolidations in failed areas, cleaning ornamentation and re-bonding the portions in place. New steel reinforcements or repairs were required to several vertical supports and the four main horizontal beams of the sculpture.

#### HOUSE STAIRS

The sculpture suffered through-cracks from forces transmitted by the adjacent house facade and canopy supports. Repairs consisted of opening the cracks, removing major portions of the stairs and inspecting the foundation and reinforcements to the house facade. Conservation efforts included re-consolidating the failed areas, cleaning ornamentation and re-bonding the portions in place.

#### PATIO FLOOR

The large floor - a triangular shape, 140' by 100' by 50' - failed in several places near the tall towers from Northridge quake forces transmitted from the towers. The sculpture suffered

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through-cracks from forces transmitted from the adjacent towers. Repairs will consist of opening the cracks, replacing failed foundation pads with new steel plates and reinstalling the decorated patio flooring mortar. Conservation efforts will include re-attaching the original mortar to the new, repair mortar. Specific designs will be developed for repairs of flooring, steel plates and joints and splices.

#### DOCUMENTS CONTROLLING REPAIRS

Repair work is governed by the Watts Towers Conservation Handbook document which is available at the site. The Conservation Handbook includes tested and acceptable conservation materials and techniques to repair and treat damage. Modifications to the document may be required in repairing previously un-repaired sculptures, including portions of the 3 tallest towers. Other documents which control repair work include the Secretary of the Interior's Conservation Guidelines.

#### ENCLOSURES

The following pages contain photographs and descriptions of damage and repairs to the sculptures.

The following photographs are typical of repairs required on members and joints in the tallest three towers because of failures from the Northridge Earthquake.

Most repairs required removals of the outside mortar in the area of failures. The removal was necessary to gain access and inspect for the cause of failure. A limited number of x-rays were taken in areas where opening the members involved a great deal of effort. All areas subjected to x-rays proved to require opening to effect the proper repairs. The simplest repairs were filling shallow cracks with cement mortar or Jahn restoration mortar or Sika Dur 23. The most complex repairs required removing the covering from a complete band. These repairs usually required replacing the band's steel reinforcement, welding or bolting the band to most intersecting vertical columns and radials or spokes and then re-covering the band and other members with their original coverings.

Repairs were either made directly to members from the scaffold, or made in fixtures placed on the scaffold or on the ground for members which were first removed from the sculpture.



This damaged mortar wheel was removed from the sculpture and repaired on the ground. The upper photograph (Nov. 1995) shows the inside of the wheel under repair. The side of the wheel has fewer damage sea shells than the other side which faces 107th street and suffered vandalism.



January 1996, the wheel after repair and ready for reinstallation.





This mortar separation was found at the 74 foot level of the Center Tower. A previous repair c1981 had separated from the original mortar due to inadequate bonding. Top photo, August 1995.



This vertical crack was the result of a major failure of a main support of the Center Tower. Bottom photo, December 1995.





Severely damaged horizontal band and covering was removed completely around the Center Tower. The steel channel reinforcement replacement is shown in place before reattaching the original mortar on the band and intersecting vertical columns. Photo above. October 1995

Entire steel reinforcement in a damaged 20 foot section of a column is shown after replacement and wrapping with steel mesh. Left photo. October 1995.





Upper photo shows exposed columns where damaged band #19 has been removed prior to installation of new steel channel. Wood beams support the upper ring to compensate for reduced strength in columns. February 1996.

Darkened area shows water intrusion into Center Tower column about 75 feet elevation. Left photo. February 1996.







Three photos show new steel channel reinforcement installed to replace failed reinforcement in original band. Segments of the band are welded to each other and to each vertical column. Steel mesh has been wrapped around the channel in the top photo as Rodia did initially. March 1996.





Band repair in progress. Rodia's coverings over each of the band segments are being reinstalled. New mortar was applied over the new reinforcement. Segments had been removed to install the new channel reinforcement. The segments were cut with a diamond cutter. Next they were thinned from the inside to maintain the original overall dimensions and now they are shown reinstalled over new cement mortar coverings. March 1996.





Repairs in progress. Exposed wire ends within horizontal band, left center of photograph and angle reinforcement in vertical column, center of photo. May 1996.



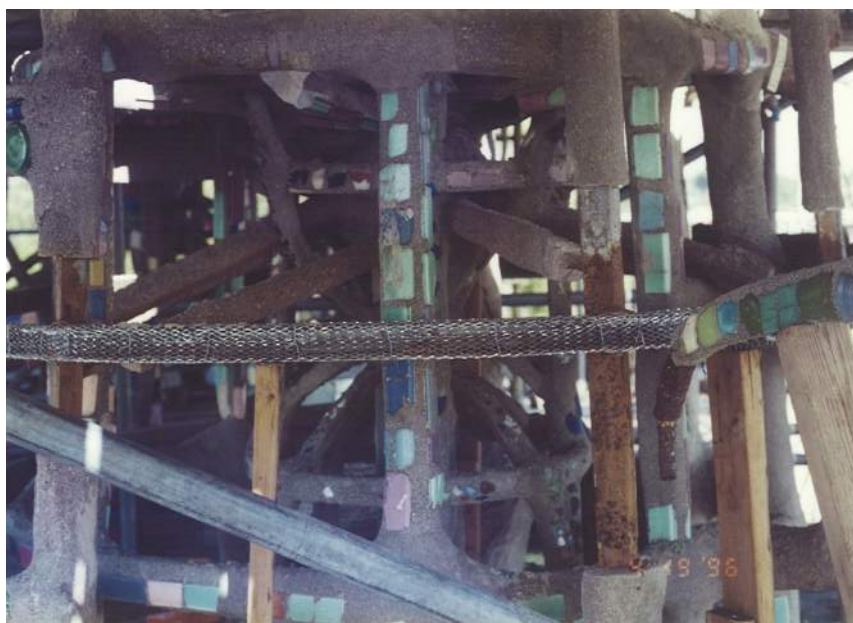
Repair in progress. New channel reinforcement for failed horizontal band and attachments design for columns to the band reinforcement and radials on the Center Tower. April 1996.



Repair in progress. Original band segments in place for installation over new reinforcement, right of photo. Major connector between Center Tower and East Tower shown at center left of photo. This connector is to be welded to column reinforcement, center of photo. April 1996.



Repair in progress. New steel channel for band has been welded in place to column reinforcements and wrapped with mesh in preparation for reinstalling Rodia coverings. April 1996





East Tower damage required repairs or replacement of reinforcements in five of six columns. At a critical junction, 19 feet above the base, the columns join the center column. The upper photo shows a typical steel collar around the center column and the lower photo shows a column reinforcement welded to the collar. The original Rodia covering was later restored. May 1996.





East Tower damage required repairs or replacement of reinforcements in five of six columns. At a critical junction, 19 feet above the base, the columns join the center column. The photo on the left shows a typical steel collar around the center column and the photo on the right, shows a column reinforcement welded to the collar. The original Rodia covering was later restored. May 1996.



East Tower damage required repairs or replacement of reinforcements on five of six columns. At a critical junction, 19 feet above the base, the columns join the center column. The photographs depict the steel around the center column welded to the reinforcements in the vertical columns. The original Rodia covering was later restored. May 1996.





A portion of the Center Tower base was opened to remove a damaged vertical column. Top photo. April 1996.



A new reinforcement was installed and welded to the original steel protruding from the base. Mesh was wrapped around the reinforcement and cored with cement mortar. Bottom photo. May 1996



New steel reinforcement installed in Center Tower above base. Mesh has been wrapped around the pipe (left photo) and the pipe has been welded to another pipe directly above it (right photo). May 1996.



Original band coverings ready for reinstallation over new steel channel reinforcement, wire mesh and cement mortar. Center Tower, May 1996.



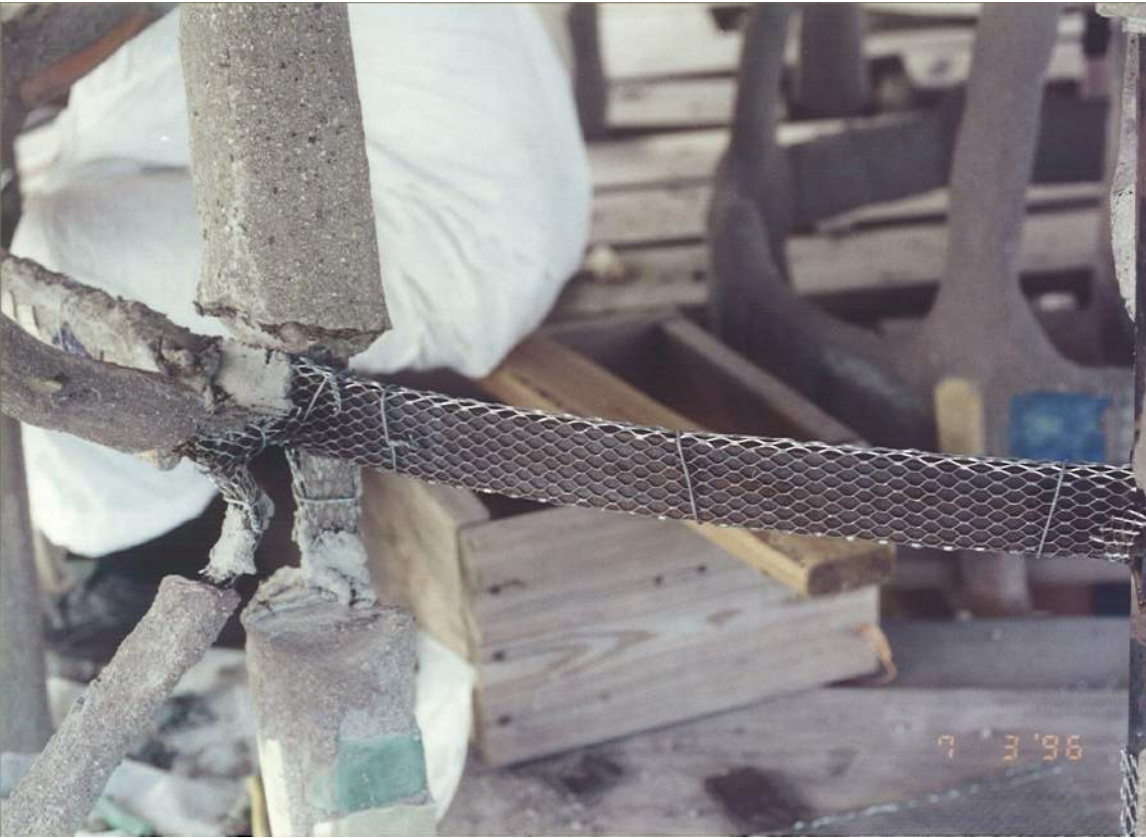


Installation nearing completion for Center Tower base (photo above) and vertical column repairs (left photo). May 1996





Original column and band reinforcement after opening failed coverings. May 1996



Typical preparation for repairs to failed columns, bands and joints. The damaged covers have been removed, reinforcements either repaired or replaced, wrapped with mesh and welded or bolted to adjacent members. July 1996.





Exposed joint showing failed horizontal band reinforcement at joint with vertical column. July 1996.

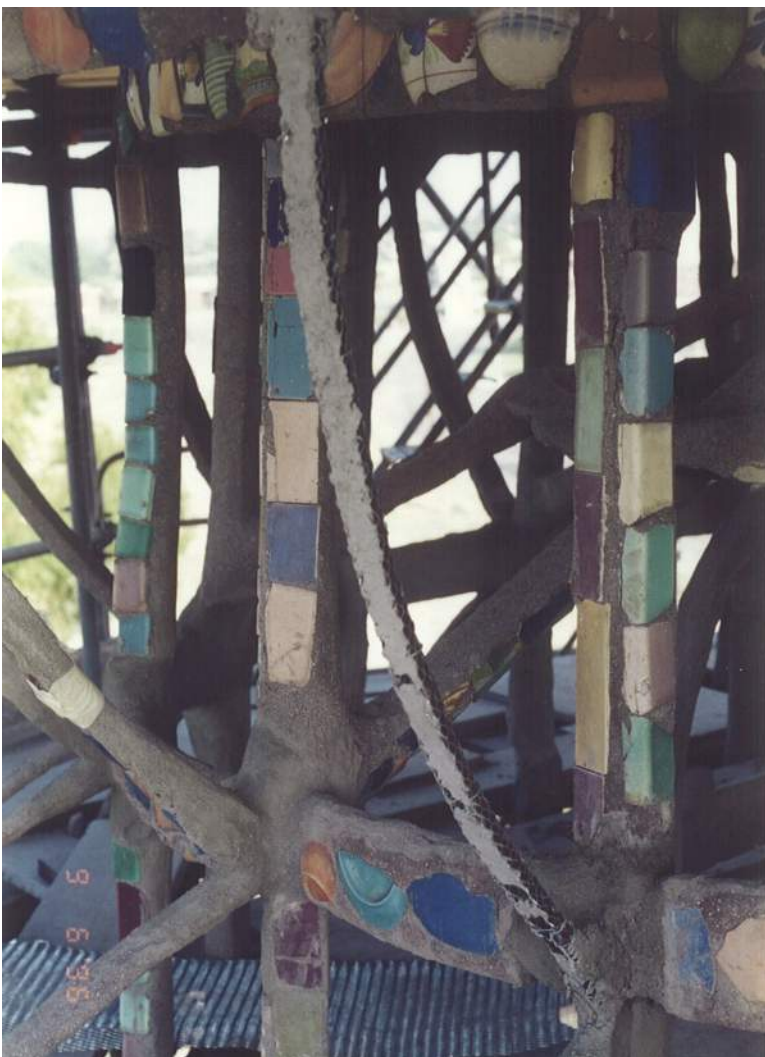


Original band covering with ornaments re-installed over repaired band reinforcement. July 1996.



Completed vertical columns. Ornaments had been covered by subsequent applications of repairs by Rodia and/or State. May and August 1996.





Repairs in progress on horizontal band and joints with vertical columns, radials to the center column and to outer arcs on the West Tower. September 1996.



Repairs in progress on horizontal band and joints with vertical columns, radials to the center column and to outer arcs on the West Tower. September 1996.





Repairs in progress on horizontal band and joints with vertical columns, radials to the center column and to outer arcs on the West Tower. September 1996.