CONSERVATION OF THE SHIP OF MARCO POLO
WATTS TOWERS CONSERVATION PROGRAM

This is a report on the conservation work performed by the Cultural Affairs Department, City of Los Angeles between January 1986 and February 1991 on the Ship of Marco Polo, one of 17 sculptures in the Towers of Simon Rodia State Historic Park at 1765 East 107th Street. The Ship is shown in Figure 1 as it was in 1959.

HISTORY

The Ship, under construction in about 1936, was a sculpture with a main spire about 15 feet high (Figure 2). A 1940 artist's drawing shows a much taller and larger main spire at that time, rising to its final height of 28 feet (Figure 3).

CONSERVATION PROGRAM SUMMARY

Background

In late 1985, the Ship was in poor condition. Mortar around the supporting base of the main spire was cracked through to the corrugated metal pipe reinforcement in many places (Figure 4). Vertical arcs and horizontal beams encircling the spire had broken and were supported by ropes (Figure 5). A large heart-shaped piece had become dislodged. The main spire swayed in the wind because mortar on the base of the spire had separated from the steel pipe which supports the spire. Two large earthquakes in October, 1987 caused a failure near the top of the spire, tilting it 15 degrees to the north (Figure 6).

Preliminary Phases

Scaffolding was erected in March 1988 (Figure 7). Emergency stabilization was performed from the scaffolding - nylon netting was wrapped around ornaments to hold them in place, rope restraints were installed on loose members, and large cracks were cleaned of debris and filled with urethane foam rods before being sealed with silicone. That same year a city consultant said the sculpture was "lost".

In December 1988, a survey was performed on the Ship and the other 5 tallest sculptures (3 tallest towers, Gazebo and Chimney) to determine their exact elevations and 3-dimensional "verticality". A detailed inspection in 1989 identified almost 300 cracks in the mortar, measuring a total of 280 feet in length, and documented 525 broken ornaments and 920 missing ornaments. Figures 8 through 16 show damages to horizontal bands, vertical arcs, junctions of vertical arcs with the

central column, bowls on the central column and the main spire top joint.

Materials Test Program
Following the inspection, a test program was established to select suitable conservation materials and techniques for replacing damaged reinforcements, preserving the remaining ornaments – about 3,000 on the Ship -, restoring the bonds between the mortar and ornaments and mortar and steel reinforcements, and cleaning and consolidating the ornament surfaces and protecting them from further deterioration (see Appendix, Towers Materials Tests). Engineering analyses and x-rays of the main spire base and other failed areas up in the main spire provided guidance in the design of suitable repairs. Historic records, photographs and aerial surveys from 1926 to 1950 were used to determine the evolution of the Ship structure. A staff of assistants was trained to perform the work under technical supervision of contract conservation and engineering consultants. The selected materials and processes were then applied to the Ship and instructions were incorporated into the controlling document, The Watts Towers Conservation Handbook.

Program Scope
In addition to major replacements of horizontal ring and vertical arc reinforcements and reconsolidation of the entire spire base, 450 cracks were filled; 250 glass ornaments were cleaned or reattached; 2,900 shells were cleaned, consolidated or reattached and 740 tiles were cleaned of reattached. Almost 400 pottery pieces were cleaned or reattached, also.

On an allocated basis, the conservation of the Ship of Marco Polo cost about $100,000 of the five-year program total of *$740,000.Estimated costs were: baseline photography $4,000; inspection $7,000; emergency stabilization $5,000; and, finally, application of conservation processes or structural conservation $84,000. This final effort included 3,000 hours of labor by Cultural Affairs staff and 1,100 hours by contract conservators and an engineer over a 15-month period. The processes were: ornament cleaning and rebonding to the mortar and/or reattaching broken ornament pieces; surface consolidation of ornaments; narrow crack filling and sealing; and treatment or replacement of reinforcements in broken, major load-carrying members. The results of the baseline photography, emergency stabilization and inspection operations have been documented previously, and reports and records are on file in the Watts Towers conservation office trailer.
*Does not include $110,000 cost for security.

Structural Conservation (See Figures 17 through 33)
Conservation materials treatments consisted of cleaning, rebonding broken ornament pieces together, rebonding loosened or detached ornaments to the mortar coverings, filling cracks around ornaments, rebonding mortar-to-mortar, and applying consolidants to ornament surfaces. Cleaning was normally accomplished using water. Glazed tile cleaning was performed using Brasso. Cleaning and removing rust and grease from steel was done with Duro naval jelly and acetone. ZRC was used as a coating where new and old steel were in contact. Rebonding glass-to-glass was accomplished using Dow Corning DC 3145 silicone. Rebonding ornaments to the original mortar was done with either Dow Corning DC 738 or 739 or GE 162 RTV. Rebonding mortar-to-mortar (where cement mortar was not used) was accomplished with GE 162 RTV or Sikadur 23 or 31 epoxies. The consolidant used for shells was a mixture of GE DF 104 and Acryloid B-72 (Bologna cocktail).

Small crack-filling around ornaments and in other, non-structural areas was performed using DC 738 or 739 and 50 percent sand and suitable pigments. Please see "Towers Materials Tests" and "Ship Conservation" tables in the Appendix.

Additional small crack filling was accomplished using injection of Jahn restoration mortar #M30 or, after opening the crack, by application of Jahn M70-18a (gray) or M70-11 (red) restoration mortar, purchased from Cathedral Stone Company, Washington, D.C.

Large crack filling was accomplished using Portland cement mortar. The sand used to mix the cement was #30 from June through mid-August 1990. This sand was discovered to be too coarse and not incompliance with that specified in the State report. From mid-August to mid-October a 1:1 mix of #16 and #60 sand was used and, finally, a 1:2:3 mix of #12, #16 and #60 was used to match that originally specified. The main spire base cement was a 1:1 mixture of white and gray cement for a closer color match with the original mortar.

Major member conservation on the Ship included a) replacements of reinforcements in portions of three large horizontal bands which were broken and where steel reinforcements were weakened by excessive corrosion; b) replacements of reinforcements in portions of five large vertical arcs which were similarly weakened; c) extensive removal of mortar covering, cleaning of the 8 1/2 inch corrugated pipe reinforcement, rewrapping of wire mesh around the pipe, application of new cement, and reinstallation or replacement of mortar replacement of mortar

coverings on the lowest five feet of the main spire base; d) removal of mortar coverings from both ends of each of four vertical arcs, rejoining and reinforcing the end connections to the center spire column with a new steel band, and restoring or replacing the mortar coverings; and e) removal and replacement of the top five feet of the main spire, reattaching it to the existing lower pipe reinforcement with splice plates and bolts.

Conservation Applications:
Cleaning with water/cotton swabs - 1,500 tiles; 250 glass; 480 pottery.

Cleaning and consolidation with DF104/B-72 - 1,950 shells.

Cleaning with Brasso - 1,250 tiles; 223 glass.

Rebonding glass-to-glass with Dow Corning DC 3145 silicone – 7 pieces of glass.

Rebonding ornaments to the original mortar with: Dow Corning DC 738 - 50 places; GE 162 RTV - 55 places

Rebonding mortar-to-mortar with: GE 162 RTV - 55 places Sikadur 23 or 31 - 31 places

CHRONOLOGY OF WATTS TOWERS CONSERVATION

1954 to 1959 no repairs after Rodia left.

1960 to 1971 crack-filling with cement and waterproofing.

1987
July: Cultural Affairs Department computer and software acquired/installed.

September: Vandals dislodged vertical arc on main spire and damaged east-west overhead east of Ship.

October: 6.1 and 5.5 earthquakes damaged top of main spire. Scaffolding erected on Gazebo for photography.

October to December: Baseline photographs taken.

December: Microfiche viewer/printer acquired/installed.

1988
January: 6 foot, chain-link security fence erected.

March: Ship scaffold erected, emergency stabilization started.

April: Start of staff training for inspection.

June: Gazebo scaffold erected for inspection/conservation.

July: Ship microfiche delivered.

December: Survey of Ship and 5 other tall sculptures completed.

1989
March to May: Ship inspection.

April and May: Filled large cracks with urethane foam up to 26 foot level on main spire, secured ornaments with nylon mesh coverings.

May: Start of conservation materials selection test program.

August: Start cleaning and consolidating sea shells and abalone shells.

September: Inspection of all sculptures completed.

October: Start filling of cracks with silicones, rebonding ornaments.

1990
January to March: Evaluation of conservation materials from test program.

March to August: Repair horizontal band 01 and minor vertical arcs.

July to September: Repair horizontal band 02 and minor vertical arcs.

August: Modify sand sieve sizes to match State specification.

August to October: Repair horizontal band 03 and minor vertical arcs.

September to December: Repair horizontal bands and arcs at D and E levels.
October to December: Repair base of main spire.

*Novembe*r: Reattach top of main spire.

November to December: Grind recesses around spire base repair areas.

1991
January: Final inspections by Cultural Affairs, local conservation experts.

February: Clean ornaments, consolidate shells, and fill minor cracks.

February 27: Remove scaffolding.

March: complete cleaning and minor crack-filling near base.

INSPECTION SUMMARY OF DATA
Inspection revealed broken ornaments in 50 of the 57 4' by 4' areas and missing ornaments in 49 areas. The numbers and types of ornaments and their distribution throughout the sculpture are shown in the following graphical analyses.

	Broken Tiles	**Broken Glass**	**Broken Shells**	**Broken Pottery**	**Missing Tiles**	**Missing Glass**	**Missing Shells**	**Missing Pottery**	**No. Cracks**	**Crack Length mm**
Ship	74	3	434	14	205	28	651	38	279	85,000
South	62	0	170	8	64	19	378	24	158	
North	12	3	264	6	118	2	273	14	109	

X-RAY RESULTS

Ship Spire base 12/28/89
The reinforcement in the tallest spire, Major Vertical 05, is a steel water or sewer pipe with circular, corrugated walls. The larger outside diameter is 9-inches, the smaller outside diameter is 8-inches. The condition of the steel appeared good but there are severe, through-cracks in the mortar cover.

Ship Spire
Corrugated (8″ sewer pipe)

Major Vertical 05 Base of Spire 37″ elev.		**X-ray 1**	**X-ray 2**	**X-ray 3**
	Max o.d.	8.9 n.e.	9.33 s	8.34 n.w.
	Min o.d	8.07	8.25	7.33

Bands 2/14/90
The reinforcements in horizontal bands are 1 3/8", 1 1/2", and 1 3/4" plates, between 1/8" and 3/8" thick. Splices seen show a 6 1/2" overlap of the plates tied in two places with wrappings of

wire. The spliced ends of the plate in #01 band at the junction with #02 vertical have become twisted and sheared apart.

Junctions between bands and vertical arcs 2/14/90
Broken mortar and separations of mortar from the reinforcements are found at the junctions of band #01 and vertical #02 and band 02 and vertical #02. There are no such failures at the junction of band #03 and vertical #06 which appears to be in good condition throughout.

Vertical arcs 2/14/90

X-ray #06/06A vertical #02 looks good, both views
X-ray #01 vertical #02 looks good, no 2nd view available
X-ray #10/10A vertical #05 looks good, both views
X-ray #09/09A vertical #06 looks good, both views

Bands 5/22 & 5/23/90
The reinforcements in horizontal band #03 appear OK in X-rays 1, 3 and 7 but appear marginal in X-ray 6 between arcs 08 and 05 near the north. Band rebar are about 1/8 inch thick by 1 inch to 1-1/4 inch bent plate sections.

The mortar shows separation from the rebar at all X-ray locations in the horizontal bands.

Junctions between bands and vertical arcs 5/22 & 5/23/90
No X-rays were taken of junctions.

Vertical arcs 5/22 & 5/23/90
The reinforcements in Arc 07 and 08 appeared OK except the steel below the location of X-ray 5 on Arc 08.

The mortar appeared to have a good bond to the reinforcement on Arc 07 at X-ray location 2 but not at X-ray location 4. There was mortar separation shown in Arc 08 at X-ray location 5 at the lower end of the area covered by the X-ray.

Bowl 07 11/6/90

Sculpture	**X-ray No.**	**Results of Analysis**
Ship of Marco Polo Bowl 7	1, 2, 3, 4	Below Bowl 7 is a large pipe. Large pipe exposed, corroded on outside 3 inch diameter by 0.092 inch wall; a 1.343 inch pipe with 0.092 inch wall is centered in the large pipe, ending .375 inch above it. A 1.635 inch diameter by 0.117 inch wall by 1.3 inch long sleeve covers the inner pipe, and connects to a 1.343 inch diameter by .092 inch wall upper pipe which continues above Bowl 7.

FIGURES ENCLOSED

Figure 1. Ship and main spire, 1959.

Figure 2. Watts Towers-short main spire in right foreground, circa 1936.

Figure 3. Watts Towers artist's drawing, circa 1940.

Figure 4. Base of main spire, October 1990 before conservation work.

Figure 5. Main spire broken horizontal band 01 and arcs 02 & 03, October 1987.

Figure 6. Top of main spire after earthquakes, October 1987.

Figure 7. Ship scaffolding being erected, March 1988.

Figure 8. Main spire horizontal ring 02, July 1990 before conservation work, from northwest.

Figure 9. Main spire horizontal ring 02, July 1990 before conservation work, from northeast.

Figure 10. Main spire horizontal ring 03, August 1990 before conservation work, from northeast

Figure 11. Main spire horizontal ring 03, August 1990 before conservation work, from northwest.

Figure 12. Main spire arc junction, 20 foot level, September 1990 before conservation work, from east.

Figure 13. Main spire arc junction, 20 foot level, September 1990 before conservation work, from southeast.

Figure 14. Main spire arc, July 1990 before conservation work, from south.

Figure 15. Bowl on main spire central column, October 1990 before conservation work, from northwest.

Figure 16. Main spire top support joint, October 1990 before final conservation work, from east.

Figure 17. Bowl on main spire central column, October 1990 after cleaning and wrapping with mesh.

Figure 18. Base of main spire, October 1990 during conservation work.

Figure 19. Base of main spire, October 1990 during conservation work.

Figure 20. Main spire horizontal ring 01, May 1990 during conservation work, from west.

Figure 21. Main spire horizontal ring 01, May 1990 during conservation work.

Figure 22. Main spire horizontal ring 02, July 1990 during conservation work, from northeast.

Figure 23. Main spire horizontal ring 02, August 1990 during conservation work, from north.

Figure 24. Main spire horizontal ring 03, September 1990 during conservation work.

Figure 25. Main spire arc ornament reattachment, October 1990 after conservation work, from southwest.

Figure 26. Main spire arc junction, 20 foot level, October 1990 during conservation work, from south.

Figure 27. Main spire arc junction, 20 foot level, November 1990 during conservation work, from north.

Figure 28. Base of Spire 01 during conservation work, November 1990.

Figure 29. Base of Spire 01 after conservation work.

Figure 30. Restoration of "heart", top of Major Vertical 04, January 1991.

Figure 31. Restoration of "heart", top of Major Vertical 04, January 1991.

Figure 32. Major Vertical 01 sea shells after cleaning and consolidation, February 1991.

Figure 33. Major Vertical 01 glazed tiles after cleaning, February 1991.

APPENDIX ENCLOSED

Towers Materials Tests - listing of conservation materials tested and start dates of tests.

Ship Conservation - Materials and techniques list 1, by elevation and photographic baseline reference location.

Ship Conservation - Materials and techniques list 2, by date and photographic baseline reference location.

Technical Findings

Database Printout of Ship of Marco Polo

November 6, 1990

TO : FILE- Watts Towers Conservation, Cultural Affairs Dept.
FROM : Bud Goldstone

SUBJECT: REINFORCEMENTS IN SHIP SPIRE & CENTER TOWER COLUMNS
FINDINGS FROM OCTOBER 25, 1990 X-RAYS.

Reference: a) 11/18/89 GOALS OF X-RAY PROGRAM
b) AFEs with Davis Quality Lab for X-rays
c) Set of 16 X-Rays 10/25/90
d) Lotus 1-2-3 File "X-RAYCALC.WK1"

SUMMARY
X-rays have shown: the sizes and shapes of reinforcements and joints in the East Tower, in South Wall posts and in horizontal bands and vertical, arched supports of the Ship; cracks and voids in the mortar; wire and wire mesh wrappings around the reinforcements and joints; and evidence of rusting in the steel reinforcements.

BACKGROUND
Mortar cracking failures have recurred in the East Tower many times since 1959. Recent cracks have appeared in the lower vertical columns of the Center and West Towers. In December 1989, and February 1990, x-rays were taken of the East Tower vertical columns and joints and the Ship spire column, horizontal bands and vertical arcs. In May 1990, x-rays were taken of reinforcements in the Ship Spire horizontal bands and vertical arcs and South Wall posts. See January 9, March 5, and May 25, 1990 reports.

In a further effort to resolve the cause of the failures and determine the extent of steel and mortar damage, X-rays were taken of the Ship Spire reinforcements at 20 feet elevation and of six damaged Center Tower vertical columns above the tower base. A total of 16 x-rays were taken on October 25 by Davis Quality Laboratory technicians, as listed below.

LOCATION # SCULPTURE	X-RAY #	APPROX. ELEVATION	BASELINE
SHIP			
BOWL 07	1,2,3,4	BELOW/ABOVE BOWL	SHI D
CENTER TOWER			
MC01 Column	5 & 6	4'6"	CTO B NNN O
EC02 Column	7 & 8	4'6"	CTO B ENE O

continued

LOCATION # SCULPTURE	X-RAY #	APPROX. ELEVATION	BASELINE
CENTER TOWER			
MC02 Column	11 & 12	4'6"	CTO B EEE O
MC03 Column	17 & 18	4'6"	CTO B EES O
EC08 Column	23 & 24	4'6"	CTO B NWN O
EC06 Column	27 & 28	4'6"	CTO B SWS O

RESULTS

Sculpture	X-ray No.	Results of analysis
SHIP OF MARCO POLO BOWL 07	1,2,3,4	Below Bowl 07 is a large pipe. Large pipe exposed, corroded on outside 3 inch diameter by 0.092 inch wall; a 1.343 inch pipe with 0.092 inch wall is centered in the large pipe, ending .375 inch above it. A 1.635 inch diameter by 0.117 inch wall by 1.3 inch long sleeve covers the inner pipe, and connects to a 1.343 inch diameter by .092 inch wall upper pipe which continues above Bowl 07.
CENTER TOWER MC01 Column	5 & 6	An oval shaped pipe contains an internal rebar, 0.392 inch in diameter. The oval is approx. 2.813 inch o.d. in the south view and 1.636 in the west view. The pipe thickness is about 0.125 inch.
EC02 Column	7 & 8	A "T"- or angle-section, legs of .462 and .744 inch in skewed views. rough edges, poor bond to mortar.
MC02 Column	11 & 12	Pipe in good condition, 2.290 inch o.d. by 0.112 inch wall. Cracks & voids in mortar. Bond varies from good to poor.
MC03 Column	17 & 18	Poor pipe condition 1 place; crack along pipe; poor bond, voids, cracks. Pipe o.d. 2.438 inch, wall 0.125 inch.

continued

RESULTS continued

Sculpture	X-ray No.	Results of analysis
EC08 Column	23 & 24	"T"-section, 1.086 inch by 1.214 by .407 inch thick. Mortar cracks, voids.
EC06 Column	27 & 28	Unsure of shape. Steel looks cracked, poor bond, voids, cracks in mortar. Large shaped "T" side 3.721 inch by .814 inch with rebar alongside 0.756 inch dia.

October 22, 1990

TO: File
FROM: Bud Goldstone

SUBJECT: MORTAR & PIGMENT TEST RESULTS
Reference: September 24, 1990 Smith Emery Company Report, same subject.

Smith-Emery Company report, SECo T-90-175, has shown no loss of strength in compression from the addition of red pigment to 1 part cement, 1/10 to 1/4 part lime, 3 parts sand (#30) and 300ml (approx.) water. In fact, SECo reported an increase in compression strength of about 30% for the samples tested with the pigment over those tested without the pigment. Therefore, the cause of the weakened, pigmented mortar remains unexplained at this time. The increase in strength may be due to the fact that fineness of the pigment contributed strength to the sand (#30) and cement combination. Our current sand, a mixture of #12, #15, and #60, has a higher percentage of fine grains than those tested.

For your information, the report data was as follows:

7 Days Compression Tests on 8/14/90-

Mix A (no pigment)			Mix B (pigment)		
Sample No.	Load (lbs)	Compression Strength (psi)	Sample No.	Load (lbs)	Compression Strength (psi)
1	7440	1860	1	9720	2430

28 Days Compression Tests on 9/4/90-

Mix A (no pigment)			Mix B (pigment)		
Sample No.	Load (lbs)	Compression Strength (psi)	Sample No.	Load (lbs)	Compression Strength (psi)
2	10100	2525	2	13500	3375
3	9800	2450	3	12800	3200

cc: Jay Oren
Rosa Lowinger
Zuleyma Whitehurst
File

October 11, 1990

TO: File
FROM: Bud Goldstone

SUBJECT: SAND SIEVE SIZES TEST RESULTS

Reference: August 8, 1990, TO: Those Listed, FROM: Bud Goldstone. SUBJECT: SAND FOR USE WITH CEMENT MORTAR

Smith-Emery Company report, SECo G-90-6473, has confirmed the referenced memo which indicated an improper mixture of sand was used by the OSA in mortar repairs made on one East Tower column. We are waiting for a second report which might indicate the loss of strength due to the improper mixture of sand. Apparently there is too much coarse aggregate in the mix.

Two samples were tested by Smith-Emery, one reported above on the OSA mortar and one on Rodia's mortar, also taken from the East Tower column. The test report stated that Rodia's sand mixture was "Fine-coarse grain quartzo-feldspatic aggregate. Angular grains 15+% composite grains. Higher percentage of relic cemented aggregate and composite grains are larger than in sample 1 (OSA mortar sample). Gap-graded."

The comparison of grain sizes with those specified in the Ehrenkrantz report is:

Sieve Size	Specified by Ehrenkrantz % passing	Sample 1 OSA Sand % passing	Sample 2 Rodia Sand % passing
4	100	98 (2% too coarse)	93 (7%)
8	95-100	85 (10% " ")	78 (17%)
12			
16	70-100	67 (3% too coarse)	60 (10%)
20			
30	40- 75	48 OK	43 OK
40			
50	20- 35	30 OK	28 OK
70			
100	2- 15	19 (4% too fine)	15 OK
140			
200	0- 2	13 (11% too fine)	7 (5%)

Those Listed: Jay Oren
Rosa Lowinger
Zuleyma Whitehurst
File

August 8, 1990

TO: Those Listed
FROM: Bud Goldstone

SUBJECT: SAND FOR USE WITH CEMENT MORTAR

For your information, the sand which we have been using to prepare "Ehrenkrantz" mortar is a "30" size sand from Cudahy Building Supplies, purchased by Cudahy from Cisco in Corona, California. The records of the Office of the State Architect and salesmen from Cudahy (where the OSA also bought their sand) claim that the same size was used by the State.

That size sand, however, does not meet the specifications for sand in the Ehrenkrantz reports.

To prepare the proper ratio of grain sizes for the sand, with a 3% variation possible only in sieve size 70 (see * below) either of the following mixes of Cisco sand may be used. Mix B has a slightly better match in the larger grain sizes. The mixtures selected and the conclusion are based on my calculations, which are available on request.

A) 1 part Cisco #16 to 1 part Cisco #60; or

B) 1 part Cisco #12, 2 parts Cisco #16, and 3 parts Cisco #60.

The comparison of grain sizes with those specified in the Ehrenkrantz report is:

Sieve Size	Ehrenkrantz % passing	Mix A % passing	Mix B % passing
4	100	100	100
8	95-100	100	99.3
12		99.95	87.3
16	70-100	80	70.5
20		52.45	51.6
30	40- 75	50.2	50.1
40		47.55	47.5
50	20- 35	32.5	32.5
70	2- 15	*18	*18
100		7.5	7.5
140		2	2
200	0- 2	1	1

Those Listed: Jay Oren
Rosa Lowinger
Zuleyma Whitehurst
File

May 25, 1990
TO : FILE- Watts Towers Conservation, Cultural Affairs Dept.
FROM : Bud Goldstone

SUBJECT: REINFORCEMENTS IN SHIP SPIRE HORIZONTALS & VERTICAL ARCS- AND SOUTH WALL POSTS - FINDINGS FROM MAY 22 & 23, 1990 X-RAY PROJECT

Reference: a) 11/18/89 GOALS OF X-RAY PROGRAM
b) AFE with Davis Quality Lab for X-rays
c) Set of 20 X-Rays
d) Lotus 1-2-3 File "X-RAYCALC.WK1"

SUMMARY
X-rays have shown: the sizes and shapes of reinforcements and joints between flat steel bands and U-shaped channels in South Wall posts and in horizontal bands and vertical, arched supports of the Ship; cracks and voids in the mortar; wire and wire mesh wrappings around the reinforcements and joints; and evidence of rusting in the steel reinforcements.

BACKGROUND
Mortar cracking failures have occurred in several South Wall and North Wall posts and in many of the horizontal bands, arched vertical supports, and in the main spire column of the Ship over the past 20 years. Questions had arisen in late 1989 about the stability of the tallest Ship spire and cracking of the mortar cover near the base of the spire which appeared to be caused due to spire movements observed under low level side loadings. In December 1989, and February 1990, x-rays were taken of the East Tower vertival columns and joints and the Ship spire column, horizontal bands and vertical arcs. See January 9 and March 5, 1990 reports.

In a further effort to resolve the cause of the failures and determine the extent of steel and mortar damage, X-rays were taken of two failed South Wall posts and of Ship horizontal bands, vertical arcs and center column intersections. A total of 20 x-rays were taken on May 22 and 23 by Davis Quality Laboratory technicians.

MAJOR FINDINGS

SOUTH WALL POSTS
The rebars in the wall at both the 52 inch and 59 elevations near the main gate appear to be OK although the post was not visible in the X-rays.

At the east end of the wall, the rebars also appeared OK although there are cracks within the mortar and the pipe is very deteriorated at the 79 inch elevation.

SUBJECT: REINFORCEMENTS IN SHIP SPIRE HORIZONTALS & VERTICAL ARCS-
AND SOUTH WALL POSTS - FINDINGS FROM MAY 22 & 23, 1990
X-RAY PROJECT

BANDS

The reinforcements in horizontal band #03 appear OK in X-rays 1, 3 and 7 but appear marginal in X-ray 6 between arcs 08 and 05 near the north. Band rebars are about 1/8 inch thick by 1 inch to 1-1/4 inch bent plate sections.

The mortar shows separation from the rebars at all X-ray locations in the horizontal bands.

JUNCTIONS BETWEEN BANDS AND VERTICAL ARCS

No X-rays were taken of junctions May 22/23 1990.

VERTICAL ARCS

The reinforcements in Arc 07 and 08 appeared OK except the steel below the location of X-ray 5 on Arc 08.

The mortar appeared to have a good bond to the reinforcement on Arc 07 at X-ray location 2 but not at X-ray location 4. There was mortar separation shown in Arc 08 at X-ray location 5 at the lower end of the area covered by the X-ray.

X-RAY PROJECT PLANS

SHIP OF MARCO POLO

Because of the urgency to repair the Ship and minimize the potential loss of ornaments and mortar coverings, additional x-rays are to be taken in critical areas of the Major Vertical 05 spire horizontal bands, vertical arcs, column and bowls. X-rays to assist in defining the limits for repairs already planned are:

Horizontal band 04
Minor Vertical arcs 09 through 12
Spire column joints

OTHER SCULPTURES

Additional x-rays will be planned for the Gazebo, South Wall, Garden Spire, Chimney and other sculptures after July 1990.

March 10, 1990
TO : FILE
FROM : Bud Goldstone

SUBJECT: ACTIONS RECOMMENDED TO REPAIR SHIP

REFERENCES
A) November 22, 1989 Report, ACTIONS RECOMMENDED TO REMEDY FUTURE DAMAGE DUE TO DEFLECTIONS OF SHIP, GARDEN SPIRE, AND "A" TOWER SPIRES OF WATTS TOWERS
B) January 9, 1990 Report, REINFORCEMENTS IN EAST TOWER COLUMNS AND SHIP SPIRE- FINDINGS FROM DECEMBER 28, 1989 X-RAY PROJECT
C) March 5, 1990, Report, REINFORCEMENTS IN SHIP SPIRE HORIZONTALS & VERTICAL ARCS- FINDINGS FROM FEBRUARY 14 & 15, 1990 X-RAY PROJECT
D) Schematic of Ship X-ray locations, March 5, 1990, enclosed.

SHIP MAJOR VERTICAL 05 BASE COLUMN (Reference A & B)

Note: As a result of reference A) and B) reports, the Ship Spire, major vertical #05 was supported by three tie-downs in January 1990 to prevent movements due to wind or earthquake forces.

Remaining to be accomplished are the following:

The Ship Spire mortar cover shows severe damage resulting from deflections in the 28 foot high vertical column.

Candidate permanent solutions- develop a method to cause the reinforcement and the mortar cover to act together in resisting side loads. Possibilities (feasibility to be determined) are: a) re-bond the mortar to the pipe exterior in selected areas at several elevations; and/or b) introduce lateral plugs through the mortar cover and pipe at selected elevations; and/or repair significant (deeper than 25 mm) cracks and spalls in Spire cover and provide structural bonding between the mortar cover and outside surface of the reinforcement.

Suggested temporary/permanent solution- apply structural grade repair material to all spalls and cracks. During repair, clean-out and open up area to the central pipe reinforcement. Obtain best possible structural bond between the repaired area and the reinforcement and add two (2) steel mesh layers between reinforcement and outer surface of mortar extending across the repaired areas.

SHIP HORIZONTAL BANDS #01 AND #02 (Reference C & D, enclosed)

The reinforcements in horizontal bands are 1 3/8", 1 1/2", and 1 3/4" plates, between 1/8" and 3/8" thick. Splices seen in the X-rays show a 6 1/2" overlap of the plates tied in two places with wrappings of wire. The spliced ends of the plate in #01 band at the junction with #02 vertical have become twisted and sheared apart. Severed locations in these bands require restoration of the

continued

continuity of the plate reinforcements which must then be spliced to existing plate ends which are free from damage in the original band on one or both sides of splices. Wire mesh must be wrapped around reinforcements before adding structural grade repair mortar. Covers which can be salvaged must be re-cemented with structural grade mortar or an equivalent strength epoxy or other repair material of equivalent strength.

JUNCTIONS BETWEEN BANDS AND VERTICAL ARCS

Broken mortar and separations of mortar from the reinforcements are found at the junctions of band #01 and vertical #02 and band #02 and vertical #02. There are no such failures at the junction of band #03 and vertical #06 which appears to be in good condition throughout.

Repairs of the joints will be designed after additional X-ray efforts and analyses of the results. Until that time, temporary crack-filling should be carried out.

In vertical arc #02 below and above the joint with band #01 (X-ray #06), there appears to be a good bond of the mortar with the channel reinforcement. Cleaning and sealing cracks in this arc should lengthen its life.

In vertical arc #06 above band #03 (X-rays 9 and 9A), there appears to be a good bond of the mortar with the channel reinforcement. Cleaning and sealing cracks in this arc should lengthen its life.

In vertical arc #05 above band #03 (X-rays 10 and 10A), there appears to be a good bond of the mortar with the channel reinforcement. Cleaning and sealing cracks in this arc should lengthen its life.

March 5, 1990
TO : FILE- Watts Towers Conservation, Cultural Affairs Dept.
FROM : Bud Goldstone

SUBJECT: REINFORCEMENTS IN SHIP SPIRE HORIZONTALS & VERTICAL ARCS- FINDINGS FROM FEBRUARY 14 & 15, 1990 X-RAY PROJECT
Reference: a) 11/18/89 GOALS OF X-RAY PROGRAM
b) AFE with Davis Quality Lab for X-rays
c) Set of 20 X-Rays
d) Lotus 1-2-3 File "X-RAYCALC.WK1"

SUMMARY
X-rays have shown: the sizes and shapes of reinforcements and joints between flat steel bands and U-shaped channels in horizontal bands and vertical, arched supports of the Ship; cracks and voids in the mortar; wire and wire mesh wrappings around the reinforcements and joints; and evidence of rusting in the steel reinforcements.

BACKGROUND
Mortar cracking failures have occurred in many of the horizontal bands, arched vertical supports, and spire column of the Ship over the past 20 years. Questions had also arisen in late 1989 about the stability of the tallest Ship spire and cracking of the mortar cover near the base which appeared to be caused due to spire movements observed under low level side loadings. In December 1989, x-rays were taken of the spire column. See January 9, 1990 report. In an effort to resolve the cause of the failures, four X-rays were taken of horizontal band #01; six x-rays of horizontal band #02; two of minor vertical arc #02 at each of its junctions with horizontal bands #01 and #02; two at 5 1/2 inches above horizontal band #03; two of minor vertical arc #05, 7 inches above horizontal band #03; and two of minor vertical arc #06 5 1/2 inches above horizontal band #03; a total of 20 x-rays taken on February 14 and 15 by Davis Quality Laboratory technicians. The quality of 16 of 20 x-rays was excellent.

MAJOR FINDINGS

BANDS

The reinforcements in horizontal bands are 1 3/8", 1 1/2", and 1 3/4" plates, between 1/8" and 3/8" thick. Splices seen show a 6 1/2" overlap of the plates tied in two places with wrappings of wire. The spliced ends of the plate in #01 band at the junction with #02 vertical have become twisted and sheared apart.

JUNCTIONS BETWEEN BANDS AND VERTICAL ARCS

Broken mortar and separations of mortar from the reinforcements are found at the junctions of band #01 and vertical #02 and band #02 and vertical #02. There are no such failures at the junction of band #03 and vertical #06 which appears to be in good condition throughout.

SUBJECT: REINFORCEMENTS IN SHIP SPIRE HORIZONTALS & VERTICAL ARCS-
FINDINGS FROM FEBRUARY 14 & 15, 1990 X-RAY PROJECT

VERTICAL ARCS

X-ray #06/06A vertical #02 looks good, both views
X-ray #01 vertical #02 looks good, no 2nd view available
X-ray #10/10A vertical #05 looks good, both views
X-ray #09/09A vertical #06 looks good, both views

X-RAY PROJECT PLANS

SHIP OF MARCO POLO

Because of the urgency to repair the Ship and minimize the potential loss of ornaments and mortar coverings, additional x-rays are to be taken in critical areas of the Major Vertical 05 spire horizontal bands, vertical arcs, column and bowls. X-rays to assist in defining the limits for repairs already planned are:

Horizontal band 01, 02, 03, 04
Minor Vertical arcs 01 through 12
Bowls 01 through 09
Spire column joints

OTHER SCULPTURES

Additional x-rays will be planned for the Gazebo, South Wall, Garden Spire, Chimney and other sculptures after July 1990.

January 9, 1990
TO : FILE- Watts Towers Conservation, Cultural Affairs Dept.
FROM : Bud Goldstone

SUBJECT: REINFORCEMENTS IN EAST TOWER COLUMNS AND SHIP SPIRE-
FINDINGS FROM DECEMBER 28, 1989 X-RAY PROJECT
Reference: a) 11/18/89 DRAFT-GOALS OF X-RAY PROGRAM
b) AFE with Davis Quality Lab for X-rays
c) Set of 21 X-Rays
d) Lotus 1-2-3 File "X-RAYCALC.WK1"

SUMMARY
X-rays have shown the sizes and shapes of reinforcements (steel pipes) in four vertical supports of two of the sculptures, one connection between two reinforcements within a vertical support, cracks and voids in the mortar, wire and wire mesh wrappings around the reinforcements, re-bars in horizontal members at their junction with vertical supports, and evidence of rusting in the steel reinforcements, particularly at the lower elevations.

BACKGROUND
Repetitive mortar cracking failures have occurred in some of the vertical supports of the East Tower after major repair work done in 1979 and 1985. Questions had also arisen in late 1989 about the stability of the tallest Ship spire and cracking of the mortar cover near the base which appeared to be caused due to spire movements observed under low level side loadings. A decision was made in November 1989 to x-ray the members, along with one member which had not shown any failures, in an effort to resolve the cause of the anomalies. X-rays were taken from three directions at two elevations, 4 feet and 8 feet, on three columns of the East Tower, 2 which have previously failed and one which has remained undamaged; and at the 3-foot elevation, near the base of the Ship Spire, to examine the size, shape and conditions of the reinforcements and the joints in the reinforcements, if possible. A total of 21 x-rays were taken on December 28 by Davis Quality Laboratory technicians. The quality of the x-rays was excellent.

MAJOR FINDINGS
Reinforcement Sizes and Conditions
East Tower IC02 and IC06 severely cracked columns
The reinforcements in two of the eight inner vertical columns, IC02 and IC06, are 1-inch inside diameter steel pipes near the tower cylindrical base (4-foot elevation) and, on one, 1 1/4-inch inside diameter pipe at the 8-foot elevation where the second inner horizontal ring joins the columns. The connections of the lower pipe to the upper pipe were not shown by the x-rays. Considerable rust accumulations and probable rust-throughs holes are present in the thin walls of the pipes at the lower level, particularly in IC06, and at the 8-foot elevation in IC06. The condition of the steel in IC02 at the 8-foot elevation appears good but cracking in the mortar cover is evident. Scaling effects due to the x-ray sizes make all dimensions approximations. The measurements also indicate that the pipes are not exactly round.

Continued

SUBJECT: REINFORCEMENTS IN EAST TOWER COLUMNS AND SHIP SPIRE-
FINDINGS FROM DECEMBER 28, 1989 X-RAY PROJECT

MAJOR FINDINGS

East Tower OC04 undamaged column

The reinforcement in OC04, one of the six outer vertical columns, is a 2 1/2-inch inside diameter pipe at the base and a 1 1/2-inch inside diameter at the 8-foot elevation. The connection between the lower and upper pipes at the 7 1/2-foot elevation can be seen in the x-rays. The condition of the steel and mortar appears good. The consistency of the measurements indicate that this pipe is round.

Ship Spire base

The reinforcement in the tallest spire, Major Vertical 05, is a steel water or sewer pipe with circular, corrugated walls. The larger outside diameter is 9-inches, the smaller outside diameter is 8-inches. The condition of the steel appeared good but there are severe, through-cracks in the mortar cover.

X-RAY PROJECT PLANS

Ship of Marco Polo

Because of the urgency to repair the Ship and minimize the potential loss of ornaments and mortar coverings, additional x-rays are to be taken in critical areas of the Major Vertical 05 spire horizontal bands, vertical arcs, column and bowls. X-rays to assist in defining the limits for repairs already planned are:

Horizontal ring 01, 02, 03, 04
Minor Vertical arcs 01 through 12
Bowls 01 through 09
Spire column joints

Gazebo

Repetitive cracking has occurred in some of the arched legs of the Gazebo and urgent repairs are planned for many of the minor horizontal bands and vertical arcs on the Gazebo spire. Additional x-rays will be taken in critical areas of this sculpture, in the summer of 1990, as funds are available.

East, Center and West Towers

Additional x-rays will be taken in critical areas of this sculpture, in the fall of 1990, as funds are available.

Garden Spire, Chimney, A & B Towers

Additional x-rays will be taken in critical areas of this sculpture, in the fall of 1990, as funds are available.

South & North Walls

Perhaps a dozen "posts" on the two walls have shown evidence of instability. Additional x-rays will be taken in critical areas of the walls, in the fall of 1990, as funds are available.

Continued

SUBJECT: REINFORCEMENTS IN EAST TOWER COLUMNS AND SHIP SPIRE-
FINDINGS FROM DECEMBER 28, 1989 X-RAY PROJECT

DETAILED FINDINGS

Measurements
All measurements are scaled from the x-rays and are approximate. The possibility that the pipes are not completely round is high, leading to differences found in the measurements taken from the x-rays and their three views. The pipe reinforcements in IC02 and IC06 appear to have thinner wall thicknesses (30% to 50%) than standard, seamless tubing.

note: n.e.=northeast
s = south
n.w.=northwest

		X-ray 1 inches	X-ray 2 inches	X-ray 3 inches	Probable Pipe Size
East Tower					
					1"
Column IC02	o.d.	1.14n.e.	1.11s	1.14n.w.	1.32
4 ft. elev.	i.d.	1.05	1.01	1.00	1.05
	wall thk	.043	.053	.068	.13
					1"
Column IC02	o.d.	1.11n.e.	1.35s	1.28n.w	1.32
8 ft. elev.	i.d.	.98	1.20	1.11	1.05
	wall thk	.066	.077	.083	.13
					1"
Column IC06	o.d.	n/an.e.	1.20s	1.12n.w.	1.32
4 ft. elev.	i.d.	n/a	1.10	.98	1.05
	wall thk	n/a	.06	.07	.13
					1 1/4"
Column IC06	o.d.	1.64n.e.	1.57s	1.50n.w	1.66
8 ft. elev.	i.d.	1.33	1.39	1.30	1.38
	wall thk	.15	.09	.10	.14
					2 1/2"
Column OC04	o.d.	3.04n.e.	3.16s	2.97n.w.	2.88
4 ft. elev.	i.d.	2.82	2.93	2.75	2.47
	wall thk	.110	.115	.110	.20
					2 1/2"
Column OC04	o.d.	2.93n.e.	2.86s	3.00n.w	2.88
8 ft. elev.	i.d.	n/a	n/a	n/a	2.47
Lwr Col.	wall thk	n/a	n/a	n/a	.20
					1 1/2"
Column OC04	o.d.	1.90n.e.	2.06s	1.95n.w.	1.90
8 ft. elev.	i.d.	1.56	1.75	1.65	1.61
Uppr Col.	wall thk	.170	.152	.150	.145
Ship Spire					
					corrugated
Major Vertical 05					8" sewer pipe
Base of spire	Max o.d.	8.98n.e.	9.33s	8.34n.w.	
37" elev.	Min o.d.	8.07	8.25	7.33	

cc: Jay Oren, Rosa Lowinger, Zuleyma Whitehurst

November 22, 1989

TO : Jay Oren, Rosa Lowinger, Zuleyma Whitehurst, File
FROM : Bud Goldstone

SUBJECT: ACTIONS RECOMMENDED TO REMEDY FUTURE DAMAGE DUE TO DEFLECTIONS OF SHIP, GARDEN SPIRE, AND "A" TOWER SPIRES OF WATTS TOWERS

PLEASE REVIEW THIS AND RESPOND WITH YOUR COMMENTS

A simple test on November 17 showed that the Ship Spire moved laterally, both north-south and east-west, under relatively small side loads at the 15-foot elevation, apparently moving the entire spire about a pivot point near the base. On November 21, a similar test was performed on the Garden Spire, applying a side load in an east-west direction at the top of the spire, 19 feet elevation. This spire also deflected, apparently rotating about a point near the base. Zuleyma Whitehurst reported that during inspection of the "A" Tower, its spire, 19 feet high, had shown a similar deflection characteristic. Because of their design, no other sculpture has a similar problem.

In an effort to understand the behavior of these spires, calculations were performed November 18 making two assumptions: 1.) that the Ship reinforcement was a steel pipe, 6 inches in outside diameter with a 1/4 inch wall thickness, and 2.) that the outside diameter was 5 inches with 1/4 inch wall. The results showed a deflection characteristic similar to that observed on the Ship Spire. Therefore, it may be assumed that the spires do contain steel pipes about 5 inches in diameter, anchored into the ground through the bases of the sculptures; and further, that the mortar covering over the steel reinforcement does not restrain the spire against small lateral forces, i.e. the pipe acts like an unrestrained mast supported at its base.

Preliminary Conclusion

The calculations show that the spires' lateral deflection behavior is consistant with those of vertical pipes. Apparently the mortar covers over the pipes on the three sculptures currently do little to restrain deflections under small (less than 30 pounds) side loads. Cracks in these mortar covers may well be evidence that bonding between the outside surface of the covers and the mortar enclosure have failed sometime after the artist applied the covers and that subsequent deflection of the spire has initiating both horizontal and vertical cracks in the covers.

Preliminary Recommendations

SHIP - the Ship Spire mortar cover shows severe damage resulting from deflections in the 28 foot high vertical column.

1. Reduce deflections under wind and quake loads to minimize future damage to the cover and decorations.

Suggested temporary solution- attach guy ropes from one or more elevations on the spire to the fence. This should be done by January 1, 1990.

continued

Candidate permanent solutions- develop a method to cause the reinforcement and the mortar cover to act together in resisting side loads. Possibilities (feasibility to be determined) are: a) re-bond the mortar to the pipe exterior in selected areas at several elevations; b) introduce lateral plugs through the mortar cover and pipe at selected elevations; and/or c) introduce permanent guying at selected locations.

2. Repair significant (deeper than 25 mm) cracks and spalls in Spire cover and provide structural bonding between the mortar cover and outside surface of the reinforcement.

Suggested temporary/permanent solution- apply structural grade repair material to all spalls and cracks. During repair, clean-out and open up area to the central pipe reinforcement. Obtain best possible structural bond between the repaired area and the reinforcement and add two (2) steel mesh layers between reinforcement and outer surface of mortar extending across the repaired areas.

GARDEN SPIRE and A TOWER - the 19 foot high Garden Spire and 25 foot high A Tower mortar cover shows some damage resulting from deflections in their vertical columns.

1. Reduce deflections under wind and quake loads to minimize future damage to the cover and decorations.

Suggested temporary solution- attach guy ropes from one or more elevations on the spires to the fence and adjacent sculptures. This should be done by January 1, 1990.

Candidate permanent solutions- develop a method to cause the reinforcement and the mortar cover to act together in resisting side loads. Possibilities (feasibility to be determined) are: a) re-bond the mortar to the pipe exterior in selected areas at several elevations; b) introduce lateral plugs through the mortar cover and pipe at selected elevations; and/or c) introduce permanent guying at selected locations.

2. Repair significant (deeper than 25 mm) cracks and spalls in Spire cover and provide structural bonding between the mortar cover and outside surface of the reinforcement.

Suggested temporary/permanent solution- apply structural grade repair material to all spalls and cracks. During repair, clean-out and open up area to the central pipe reinforcement. Obtain best possible structural bond between the repaired area and the reinforcement and add two (2) steel mesh layers between reinforcement and outer surface of mortar extending across the repaired areas.

Watts Towers Project
Preliminary Project Report (1.0)
Treatment Proposal: Ship of Marco Polo
6/30/89

I. Condition Report

The Ship of Marco Polo is in need of immediate conservation treatment. Its core of steel rebar has, in many places, decayed completely, and in decaying has caused the total disintegration of mortar cladding and consequent disengagement of surficial decorative elements. There are several cracks in the mortar cladding, most exceeding a foot in length, culminating in actual breaks in the rings surrounding the Ship's central membe

II. Treatment Proposal

Beginning work from the lowest level up, erect nets or plastic sheeting to catch detached fragments.

(1) Adhere surficial decorative elements to protect from loss during treatment.
(2) Cut ring sections where the steel rebar is either broken or more than 30% mineralized.
(3) Mechanically remove residual steel and/or corrosion products.
(4) Degrease remaining steel.
(5) Coat remaining steel with either zinc chromate-based primer, Exxon Rust-Ban 392, or 5% tannic and phosphoric acid solution in water. Variations will be tested for comparison.
(6) Replace steel rebar where it is more than 30% mineralized. Steel will be stainless steel of grade determined in Ehrenkrantz report. All loose steel corrosion products will be cleaned off mechanically with tools.
(7) Readhere surface cladding on of a number of materials for testing including: 1. The mortar composition recommended in the Ehrenkrantz report; 2.A structural epoxy (commercial grade) which will be used along the interior only to hold sections together. The surface will be free of epoxy and surface cracks will be filled with silicone; 3. The same system as in #2 except that a commercial latex filled mortar will be used in place of the epoxy.
(8) Possibly waterproof entire structure. Waterproofing materials to be tested (products to be tested: Conservare, Bologna). Possibly consolidate crumbling and spalling mortar prior to waterproofing with compatible material (TBD).
(9) Fill residual cracks in mortar with silicones and/or mortar. (see above)
(10) Adhere loose surface fragments with suitable product, most probably epoxy-based, silicone-based, or acrylic resin-based (TBD).
(11) Investigate associated treatment problems: (a) mortar overflow onto decorative elements; (b) staining of decorative elements (i.e., dirt, rust, from previous work or environmental deterioration); (c) surface damage repair or mitigation, from vandalism or environmental deterioration.
(12) Address spalling on base of ship with materials which will be used for the repair to the rings. The same materials can also be employed to repair the major connection at the base of the spire. The main material

which needs to be researched further is the steel. Measurements will need to be taken for purchase of the appropriate arc and size.

III. Material, equipment requirements

(please see attached requisition list)

Watts Towers Project
Preliminary Report (1.0)
Materials requisition: Watts to order
7/14/89
cc: Zuleyma Whitehurst

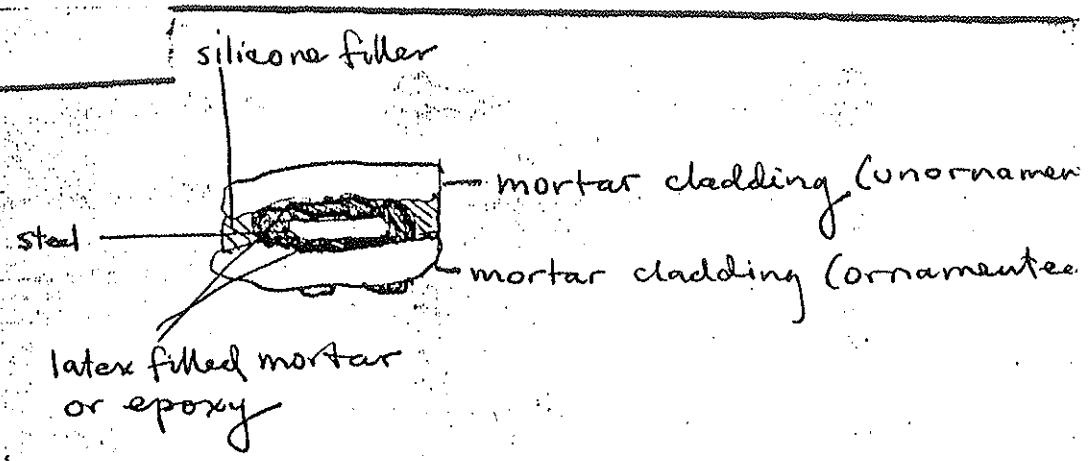
Equipment	Quantity (=1, unless otherwise specified)
Vacuum	
Chisels	1 set flat, 1 set pin punch
Mallets	3, rubber, 2" diameter head
Electric hand saw	
Saws	(already on order)
Wire cutters	
Wrenches	
Screwdrivers	1 set, heavy duty, manual
Files	1 set of 12 small
Measuring cups (plastic and pyrex)	from smallest to 1 gal.
Measuring spoons (plastic and metal)	sets of assorted sizes
Buckets	2 each, plastic, 1/2 gal.-3 gal.
Neoprene gloves	6 pair each M and L, flock lined
Surgical gloves	1 box
Scale (measuring)	triple beam balance
Spatulas (Minarette tools)	1 each, small sizes
Bamboo skewers	6 pkgs.
Bulk cotton (not sterilized)	
Masking tape	12 rolls, 6 each 1/2", 1"
Duct tape	12 rolls
Nylon strapping	see Ehrenkrantz, p.52
Band clamps	6 Pony Band/Web clamps
Steel wool (0-0000)	
Natural bristle brushes	
Dental tools or small picks	"
Wet/dry sandpaper (120-600 grit)	5 pkgs. each
Goggles	6 pair, clear
Glass jars (with lids)	assorted
Solvent bottles	" (the spigot type avail. at art stores)
Plastic jars (with lids)	" (urine sample type, screw top)
Cans of pressurized air	12 (photography use type)
Thermometer	
Barometer	
Round adjustable wire brushes	4 with 10 refills

Materials	Quantity
Solvents	5 gal. each
Acetone	
Mineral spirits	
Ethanol	
Dry pigments	
Grey	
White	
Black	
Yellow ochre	
Raw umber	
Burnt umber	
Film (color slide: Ektachrome ASA 200)	
Robm and Haas Acryloid (B-72 and B-48N)	100% solids

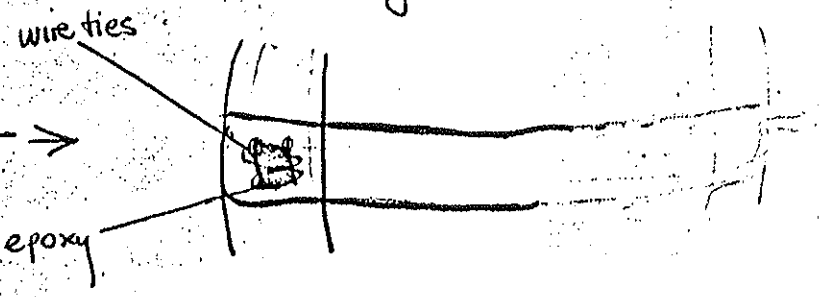
SCULPTURE CONSERVATION STUDIO
2046 BROADWAY SANTA MONICA, CA 90404 213 828-0200

I. Repair method - 1

CROSS SECTION →

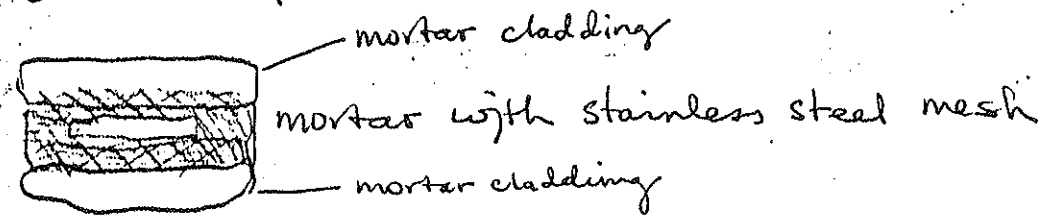


Attachment →

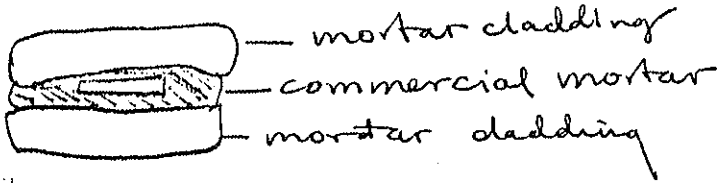


II. Repair Method - 2 [Ehrenkrantz Mortar type]

CROSS SECTION →



III. Repair Method - 3



March 24, 1988

258 S. Rexford Drive
Beverly Hills, CA 90212

TO : Earthquake File
FROM : Bud Goldstone
SUBJECT: WATTS TOWERS CONSERVATION-SHIP OF MARCO POLO

Reference:
1) Special Report, 10/17/87, Earthquake Damage 10/1 to 10/6/87 & Vandalism Damage 9/14/87, prepared by N.J. Goldstone.
2) Wind/Rain Damage Report, 1/16-18,88, 1/24/88, prepared by N.J. Goldstone.
3) Postcard Watts Tower (sic), H-2119, Columbia Wholesale Supply, 11401 Chandler, No. Hollywood, CA. circa 1961.
4) In Celebration of Ourselves, A California Living Book, photographs by Seymour Rosen, pg. 16, right lower portion, photograph circa 1959.

Perhaps the Ship has now become our emergency stabilization top priority sculpture (because of the referenced vandalism on or about September 14, 1987, the earthquakes in early October 1987, and the high winds and rain in January and February 1988.) Although the wrappings applied will serve to retain loosened ornaments and portions of mortar, no additional structural support has been provided to restore load-carrying capability to the spire which has lost supporting members nor to joints further weakened by complete separation failures at connections of horizontal and vertical members at several locations on the Ship's spire.

The loss of major parts of the spire on the Ship is a real possibility because of references 1) and 2). Two major previous losses occurred, with original pieces shown in references 3) and 4) photographs, taken from 1959 to 1961, which are both now gone. The photographs show two large spires which are no longer parts of the Watts Towers. One was formerly attached to the Ship and the other to the wall near the Ship.

Reference 1) describes damage caused by vandalism in September 1987 and the October earthquakes; Reference 2) describes the loss of some shards on the Ship; References 3) and 4) photographs (near the west end of the ship) show a 4-foot spire topped with a heart which fell or was removed in the early 1960's. Another spire, 5 to 6 feet high, topped with a heart (also fallen or removed) is shown in the photographs, rising from the top of the east junction of the north and south walls. One of these two spires, badly damaged, is stored in the container on site.

Serious consideration should be given to providing near-term additional support to the weakened Ship spire to resist side loads from wind, vibration, and/or earthquake forces, and to inspecting all joints for signs of excessive rust-out, similar to that found on the 22-inch vertical support piece which fell in February. Inspection yesterday, 3/24/88, showed that the metal reinforcement in the fallen vertical member, originally a 3/4" channel section, 3/16" thick with 5/16" legs, had lost its web and one leg to rust-out at each end before it fell during a high wind. The loss of that vertical support piece caused horizontal member number 3 to separate at its northernmost connection and almost fall before you could apply emergency stabilization in the form of the plastic mesh.

March 24, 1988

258 S. Rexford Drive
Beverly Hills, CA 90212

TO : Earthquake File
FROM : Bud Goldstone
SUBJECT: WATTS TOWERS CONSERVATION-SHIP OF MARCO POLO

If the Ship rises (or has risen) to number 1 priority for emergency stabilization over the Gazebo, the number 1 priority for subsequent inspection should also be changed to the Ship from the Gazebo. We should start inspection at the earliest possible time.

Currently, the major deterrents to inspection of the Ship are the lack of trained inspectors and lack of spire baseline photographs and microfiche of the Ship. To initiate inspection earlier, we could use the available forms and graphics on the Assignment Sheets as an acceptable substitute to capture the information while we can, encode it into the database, and perform the analysis necessary to decide what is happening and perhaps why.

Pending a thorough inspection, my near-term concerns are the potential loss of the spire or parts thereof, as follows:

A. The top portion which was bent during the 2nd October earthquake. Victor indicated that the connection at its base to the lower part of the spire is "weak". Consideration should be given to bracing this part by securing it to the lower portion of the spire.

B. The upper 15 feet of the spire above horizontal member number 2, which includes horizontal member number 3, now supported by plastic mesh to the portion of the center column. Consideration should be given to bracing this portion of the spire by securing it to the lower section and providing lateral ties to resist overturning, lateral forces from wind, vibration, and earthquake.

C. Overhead connectors to the spire, including the one damaged in September. Consideration should be given to wrapping each overhead with plastic mesh and providing bracing to those sections where the joints have been weakened through rusted reinforcements or separations.

Enclosures:

Photographs of failed portions of Ship 2/19/88
Photographs of emergency stabilization wrappings - to be added

Fig. 1. Ship Spire, Watts Towers. Photo taken 2/19/88, looking up and east; showing horizontal #3 separated from north connection due to failure of reinforcement from excessive rusting losses.

Fig. 2. Ship Spire, Watts Towers. Photo taken 2/19/88, looking up and west; showing 48" long section of horizontal member #3 which had separated from remaining section at northmost joint due to failure of reinforcement from excessive rusting losses.

Fig. 3. Fallen vertical support 2/19/88. Support is 22" long with reinforcing channel 3/4" high.

Fig. 1. Ship Spire, Watts Towers. Photo taken 2/19/88, looking up and east; showing horizontal #3 separated from north connection due to failure of reinforcement from excessive rusting losses.

Fig. 2. Ship Spire, Watts Towers. Photo taken 2/19/88, looking up and west; showing 48" long section of horizontal member #3 which had separated from remaining section at northmost joint due to failure of reinforcement from excessive rusting losses.

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Fig. 1. Ship Spire, Watts Towers. Photo taken 2/19/88, looking up and east; showing horizontal #3 separated from north connection due to failure of reinforcement from excessive rusting losses.

Fig. 2. Ship Spire, Watts Towers. Photo taken 2/19/88, looking up and west; showing 48" long section of horizontal member #3 which had separated from remaining section at northmost joint due to failure of reinforcement from excessive rusting losses.

Fig. 3. Fallen vertical support 2/19/88. Support is 22" long with reinforcing channel 3/4" high.

August 11, 1989

WATTS TOWERS CONSERVATION PROGRAM
CULTURAL AFFAIRS DEPARTMENT-CITY OF LOS ANGELES
SHIP INSPECTION RESULTS

Reference: a) Computer data file SHIINSP March 1989 -May 1989
b) Inspection sheets
c) Microfiche records
d) Letter, Watts Towers Conservation-Ship of Marco Polo, March 24, 1988, enclosed.

The information presented below is based on inspections made by the inspection staff from March 9, 1988 to May 11, 1989. Information is presented in 5 sections; 1. Rusted/exposed wire, mesh and rebars; 2. Loose parts; 3. Broken/missing major & minor load carrying members; 4. Cracks; and 5. Broken/missing ornaments. The enclosed charts resulted from a computer-generated search of the SHIINSP data base.

SECTION 1. RUSTED/EXPOSED WIRE, MESH AND REBARS

Inspection revealed some exposed, rusted wire, mesh or rebars in 31 of the 57 4' by 4' areas as follows:

TABLE 1
SHIP RUSTED METAL AREAS

ELEVATION CODE	DIRECTION	ASPECT
A (0-4')	01	N
A	01	S
B (4-8')	01	S
B	03	N
C (8-12')	01 (Spire)	NE
C	01	EEE
C	01	NW
C	01	SW
C	03	NNN
C	03	NW
C	03	SE
C	03	SSS
C	03	SW
C	04	SW
D (12-16')	01 (Spire)	SE
D	01	SW
D	01	NE
D	02	SSS
D	04	SSS
E (16-20')	01 (Spire)	NE
E	01	NW
E	01	SE
E	01	SW

continued

SHIP INSPECTION RESULTS
SECTION 1. RUSTED/EXPOSED WIRE, MESH AND REBARS
Continued

TABLE 1
SHIP RUSTED METAL AREAS
Continued

ELEVATION CODE	DIRECTION	ASPECT
F (20-24')	01	NE
F	01	NW
F	01	SE
F	01	SW
G (24-Top)	01	NE
G	01	NW
G	01	SE
G	01	SW

SECTION 2. LOOSE PARTS

See SECTION 5. BROKEN/MISSING ORNAMENTS for graphical computer-generated analyses of the Ship ornamentation. Inspection revealed loose parts in 22 of the 57 4' by 4' areas. Loose tiles, mortar, pottery and sculpted members were identified.

SECTION 3. BROKEN/MISSING MAJOR & MINOR LOAD CARRYING MEMBERS

Inspection revealed several broken or missing load-carrying members, most on the Spire (Major Vertical 05). See Reference d), enclosed.

SECTION 4. CRACKS

Inspection revealed 279 cracks in 47 of the 57 4' by 4' areas. Twenty two (22) cracks, 8 per cent, of the 279 were greater than 25.4 mm deep, with the deepest measuring 42, 50, 56 and 160 mm deep. The depths of up to 3 cracks (depth1, depth2, depth3) and the number of cracks in the various areas of the sculptures are displayed in the following charts:

Numbers of Cracks and Depths of Cracks

Chart 1. SHIP A LEVEL bar chart shows the distribution of numbers and depth of cracks at the A, 0-4', level.

Chart 2. SHIP B LEVEL bar chart shows the distribution of numbers and depth of cracks at the B, 4-8', level.

Chart 3. SHIP C LEVEL bar chart shows the distribution of numbers and depth of cracks at the C, 8-12', level.

Chart 4. SHIP SPIRE bar chart shows the distribution of numbers and depth of cracks on the Spire, Major Vertical 05, from the C through G, 8-28', level.

August 11, 1989
NJG

SECTION 5. BROKEN/MISSING ORNAMENTS

Inspection revealed broken ornaments in 50 of the 57 4′ by 4′ areas and missing ornaments in 49 areas. The numbers and types of ornaments and their distribution throughout the sculpture are shown in the following graphical analyses.

Summary of Data

	BROKEN				MISSING				NO.	CRACK
	TILES	GLASS	SHELLS	POTTERY	TILES	GLASS	SHELLS	POTTERY	CRACKS	LENGTH MM
Ship of Marco Polo	74	3	434	14	205	28	651	38	279	85,000
(south side	62	0	170	8	64	19	378	24	158)	
(north side	12	3	264	6	118	2	273	14	109)	

Chart 5. SHIP A LEVEL bar chart shows the distribution of numbers and types of ornaments missing on the A, 0-4′, level.

Chart 6. SHIP A LEVEL bar chart shows the distribution of numbers and types of ornaments broken on the A, 0-4′, level.

Chart 7. SHIP B LEVEL bar chart shows the distribution of numbers and types of ornaments missing on the B, 4-8′, level.

Chart 8. SHIP B LEVEL bar chart shows the distribution of numbers and types of ornaments broken on the B, 4-8′, level.

Chart 9. SHIP C LEVEL bar chart shows the distribution of numbers and types of ornaments missing on the C, 8-12′, level.

Chart 10. SHIP C LEVEL bar chart shows the distribution of numbers and types of ornaments broken on the C, 8-12′, level.

Chart 11. SHIP SPIRE bar chart shows the distribution of numbers and types of ornaments missing on the Spire from the C, 8-12′, to the G, 24-28′ level.

Chart 12. SHIP SPIRE bar chart shows the distribution of numbers and types of ornaments broken on the Spire from the C, 8-12′, to the G, 24-28′ level.

SHIP OF MARCO POLO NOMENCLATURE

The Ship of Marco Polo consists of an oval base with 3 oval tiers on the base, levels 01, 02 and 03. The Ship lies in an east-towest position at the east end of the Towers site. Five spires rise from the base and tiers, major verticals 01, 02, 03, 04 and 05, from west to east. The tallest spire is the main spire, major vertical 05 at the east end of the base.

The main spire is divided vertically into 7 levels of elevation, each 4 feet in height. Level A is from the ground to 4 feet; B is from 4 to 8 feet; C from 8 to 12 feet; D from 12 to 16 feet; E from 16 to 20 feet; F from 20 to 24 feet; and G from 24 feet to the top, 28 feet. There are 6 minor horizontal bands on the main spire and a set of 4 minor vertical arcs intersecting the bands at each of 5 levels. The main spire base and a set of bowls on the main spire column are other items on the sculpture.

SHIP
ELEVATION
LEVELS

—
G
—
F
BAND 06
—
BAND 05
E
BAND 04
—
D
BAND 03
—
BAND 02
C
BAND 01
—
B

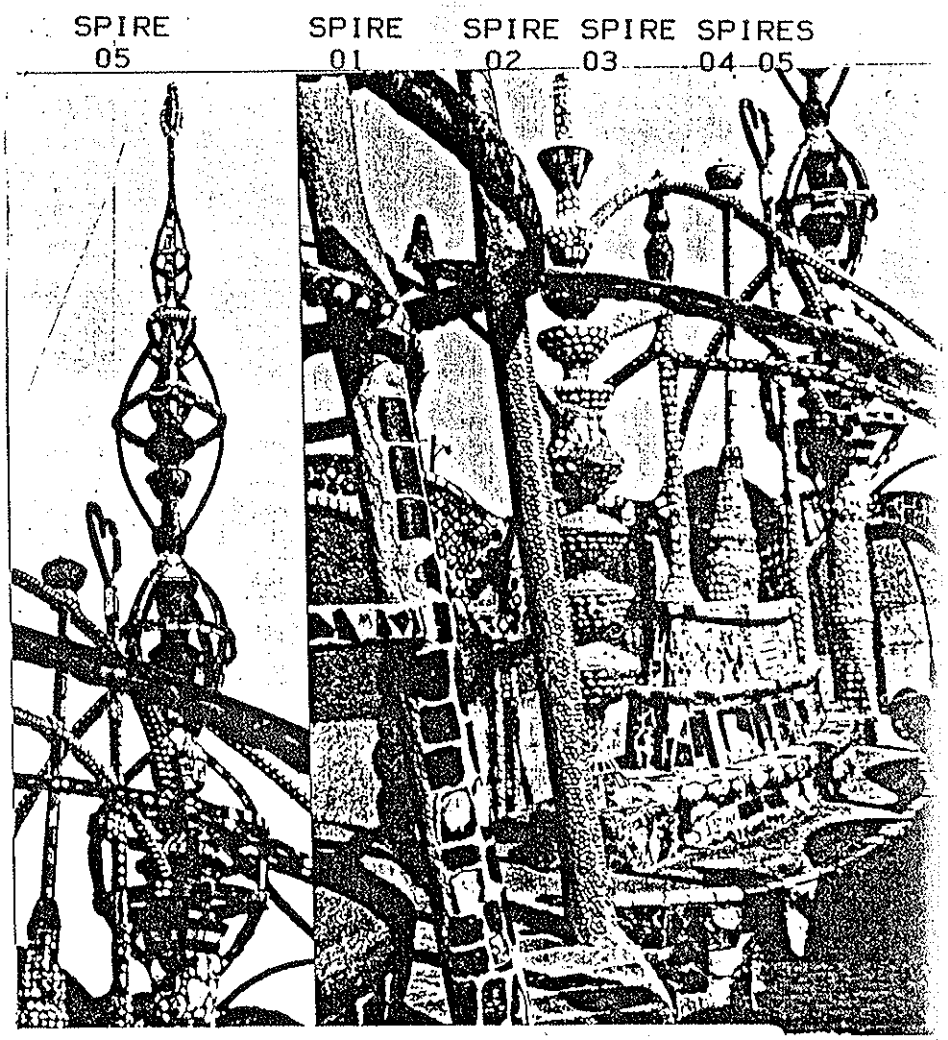


Figure 1.
Ship. Main spire in left photograph and on right of right photograph. (1959)

Recuerdo. Tebro. SAM. Radia
Diciembre. 1936 Watts Calif.

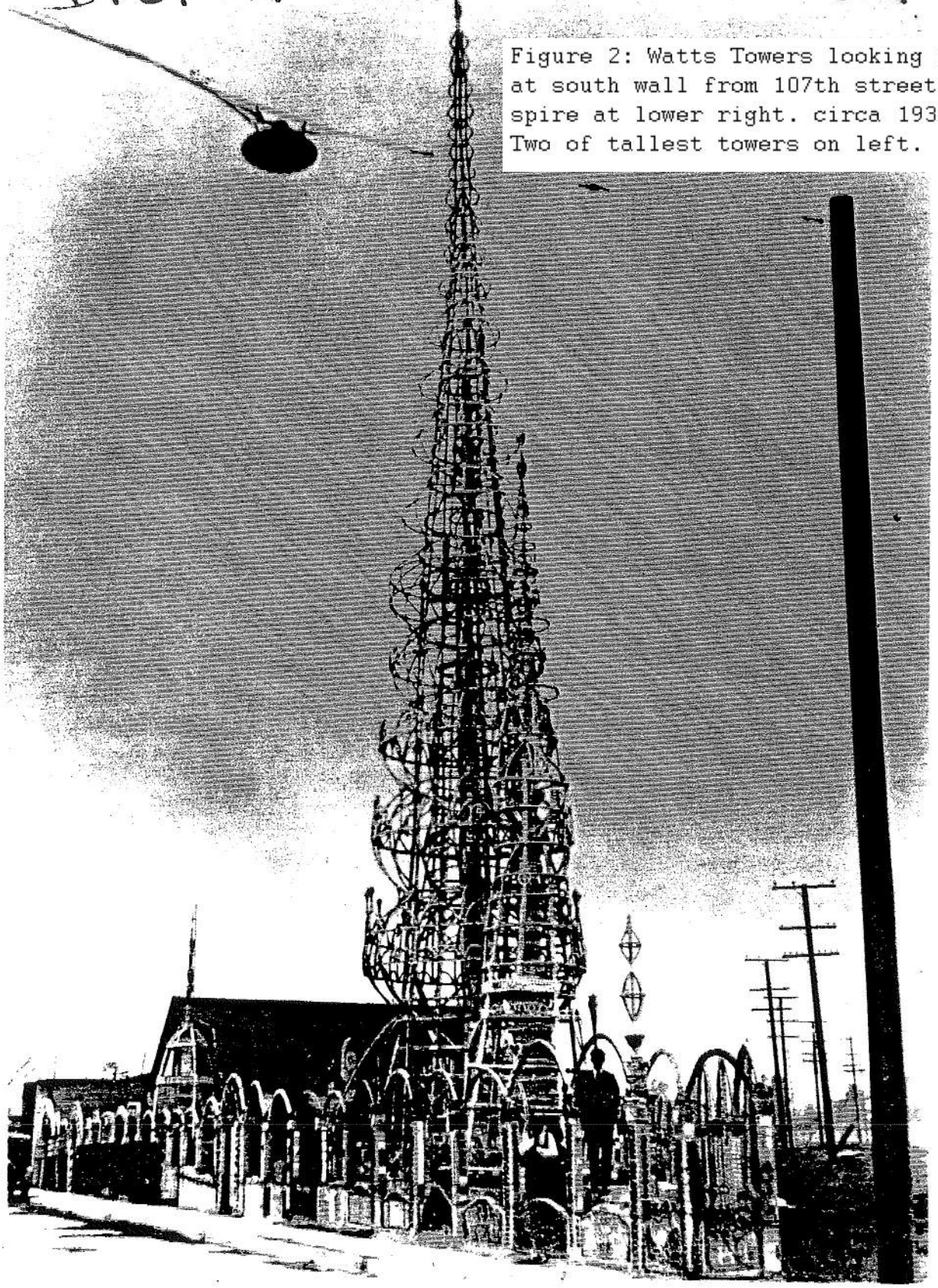


Figure 2: Watts Towers looking northwest at south wall from 107th street. Main spire at lower right. circa 1936 Two of tallest towers on left.

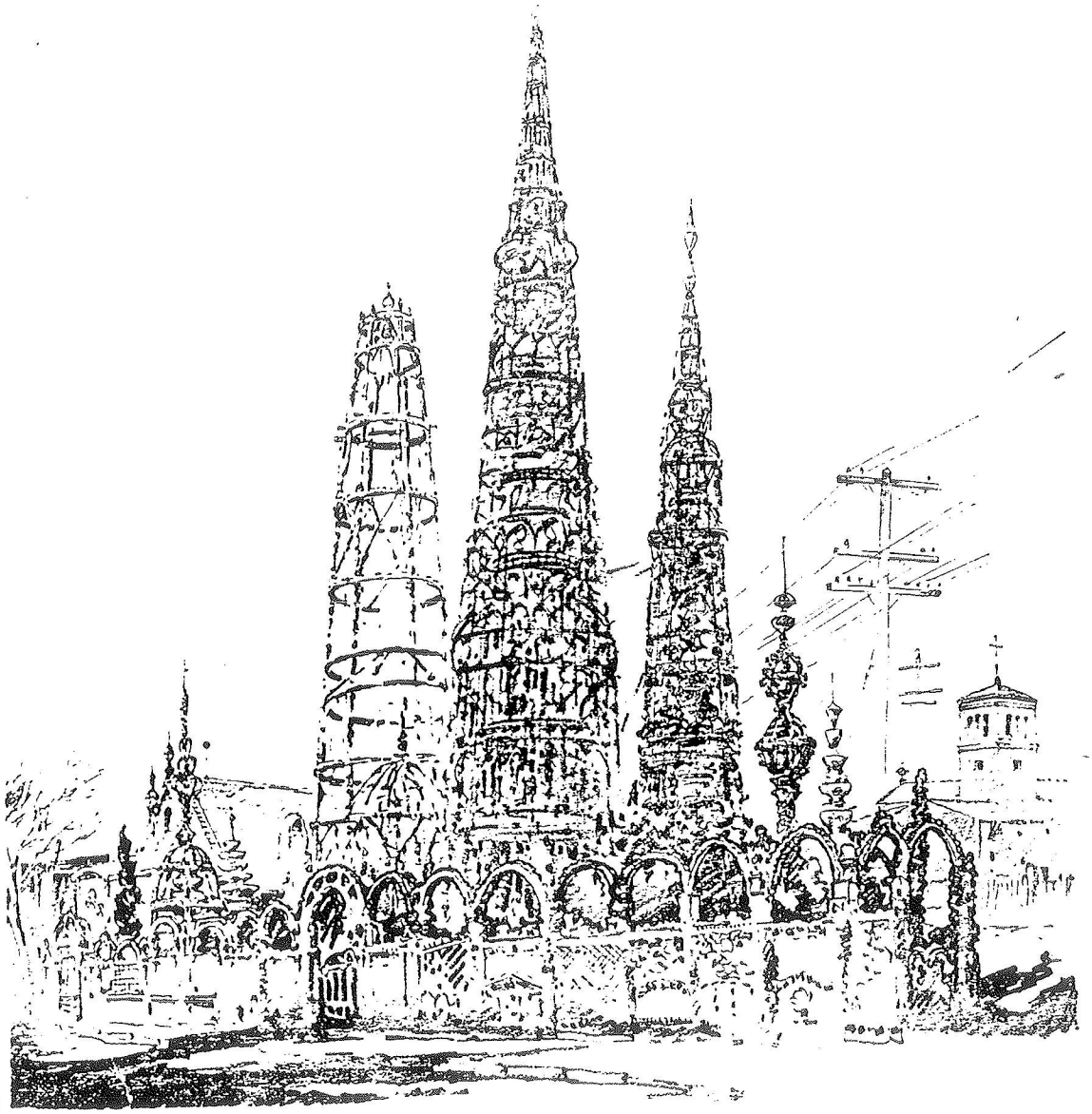


Figure 3: Artist's drawing looking
north at south wall. Main spire on
lower right. circa 1940.
2 tallest towers on left.

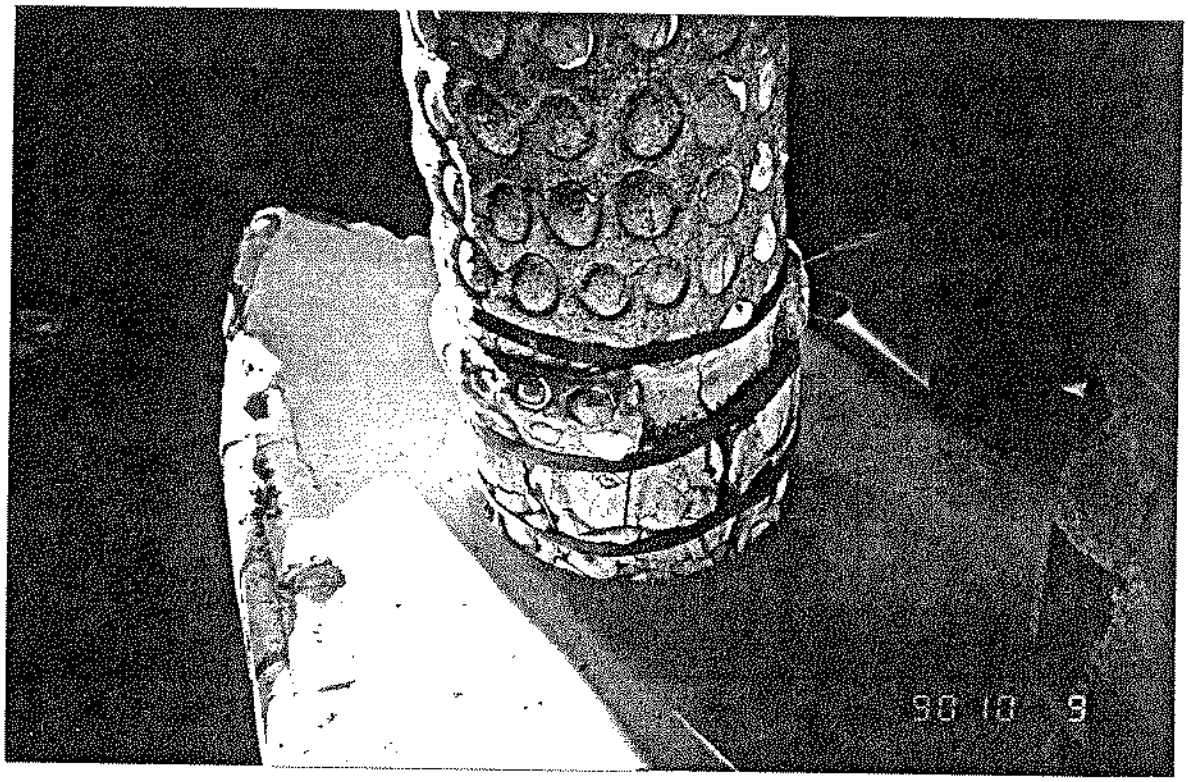
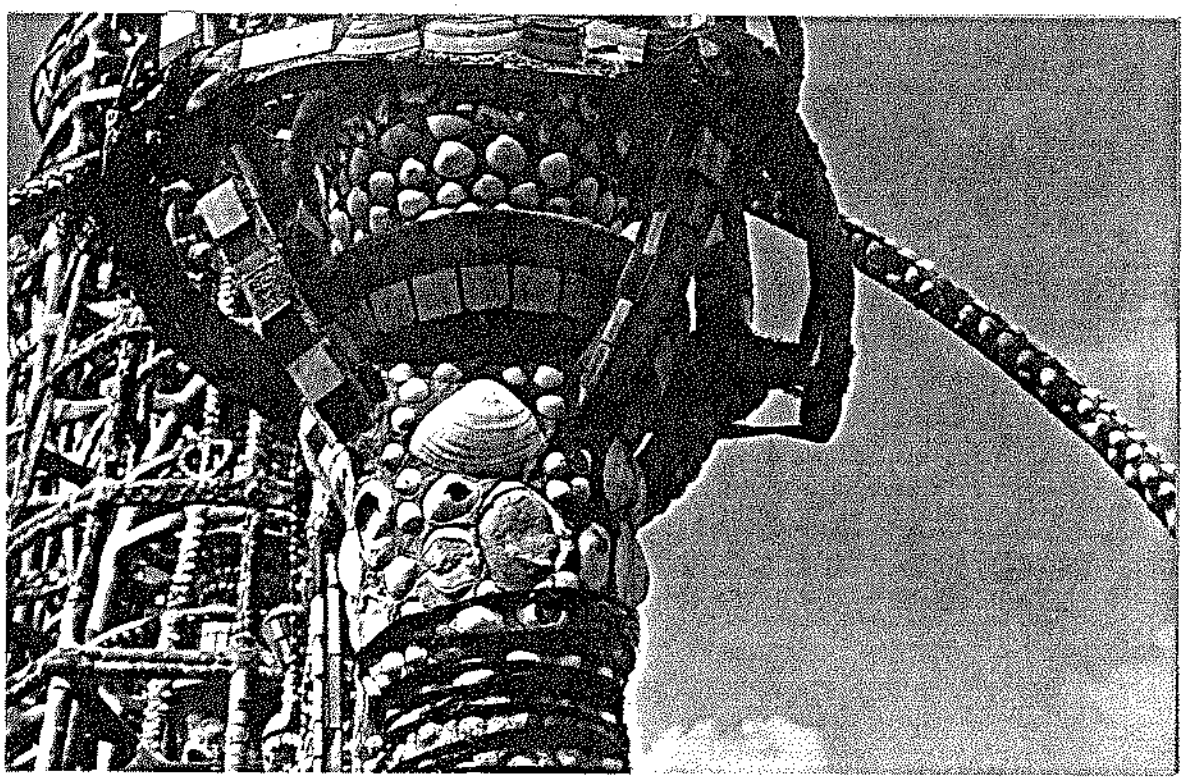


Figure 4.
Baseline photo of main spire base.
Note straps holding mortar in place.
1990.
Temporary stabilization.

Figure. 5.
Main spire horizontal band 01, top of photo. Note breakage on right.
1987.
Band tied with rope for support.



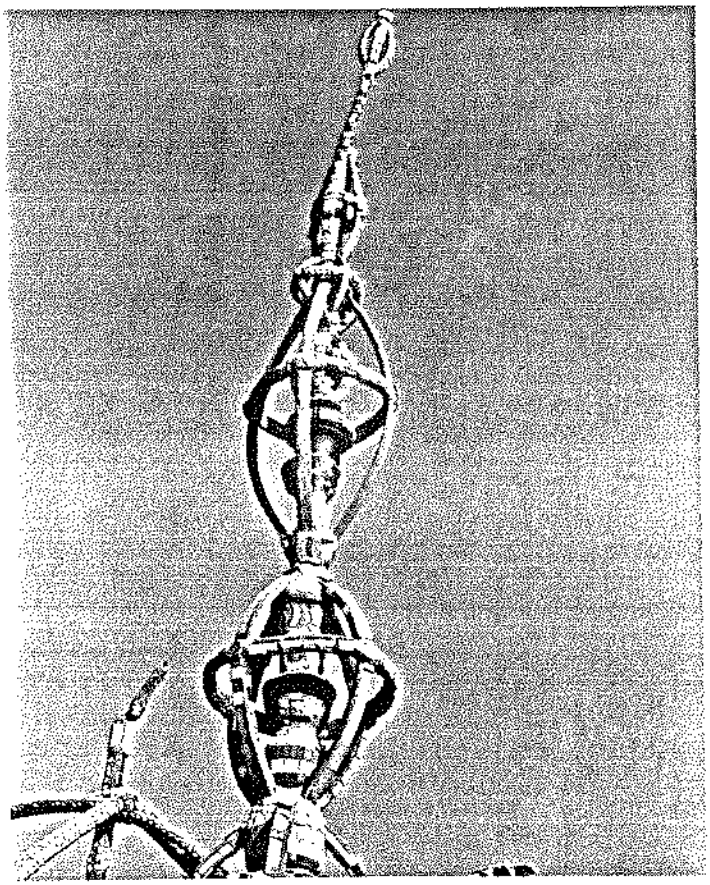
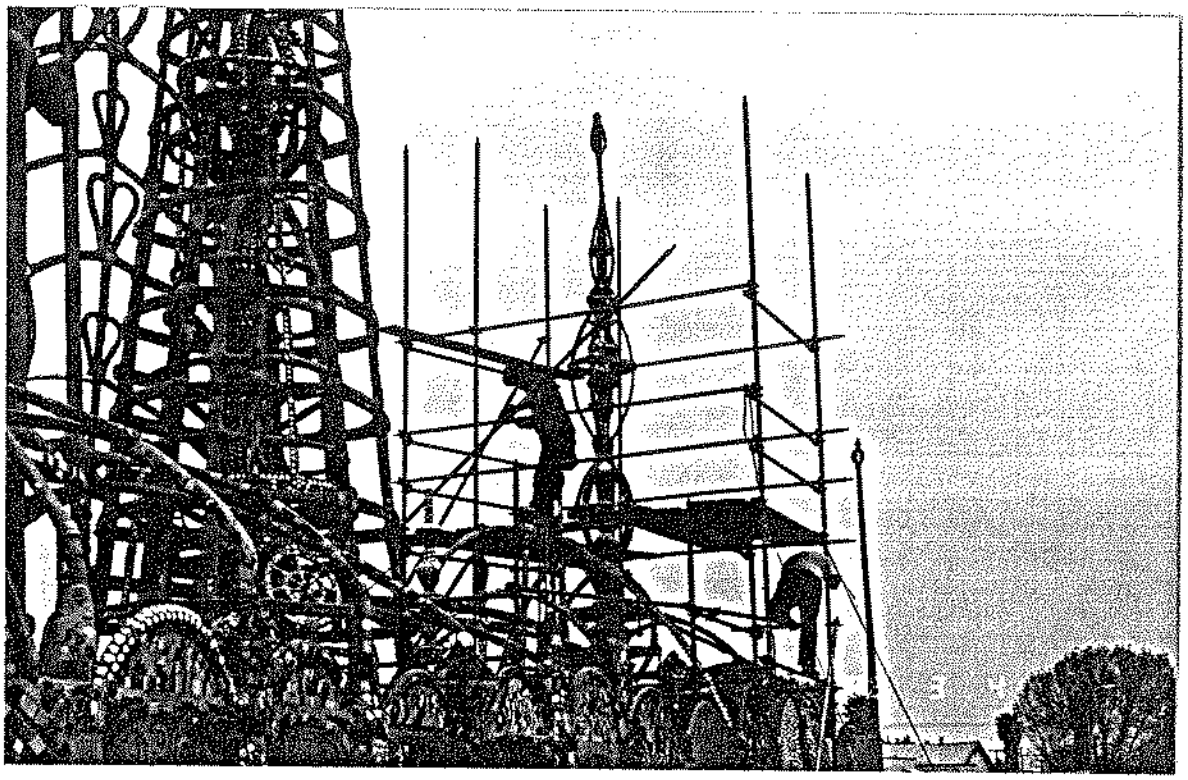


Figure 6.
Top of main spire after earthquake.
Note tilt of upper portion.
Oct 1987.
Top was supported by sleeve
for temporary stabilization.

Figure 7.
Ship scaffolding under erection.
Mar 1988.



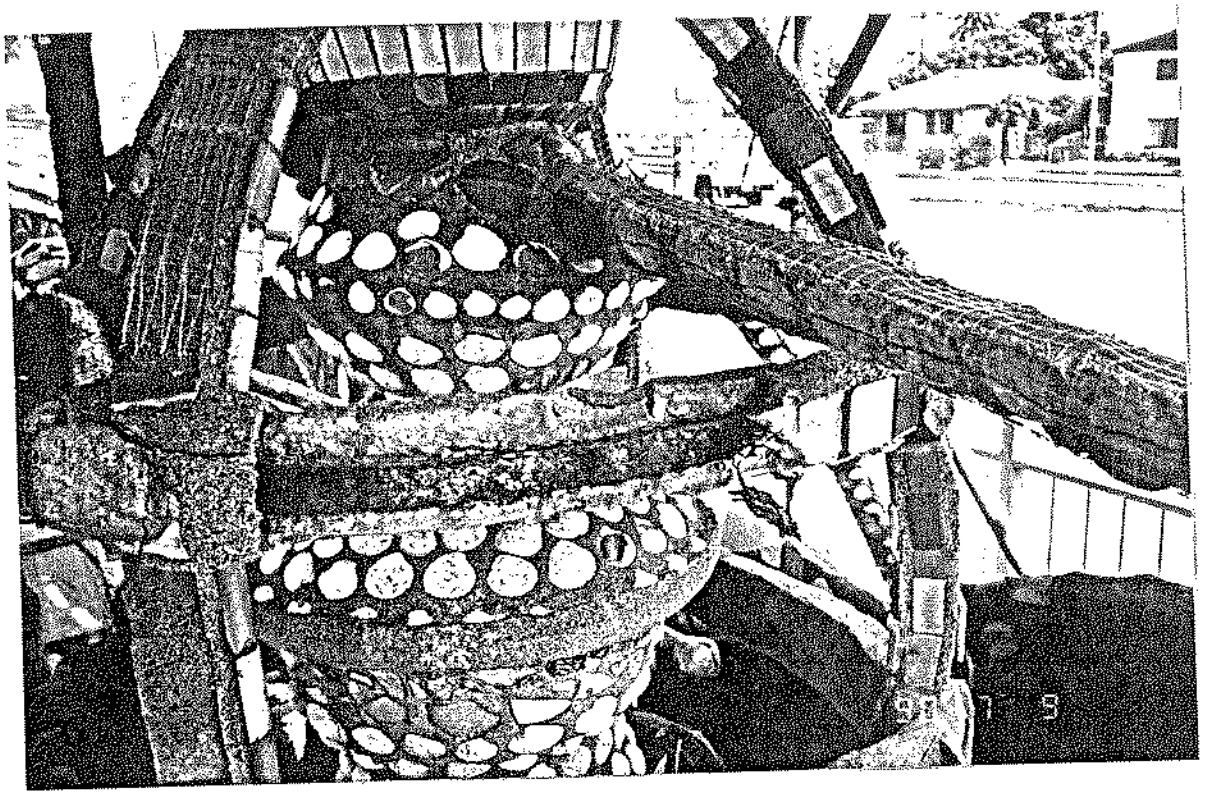
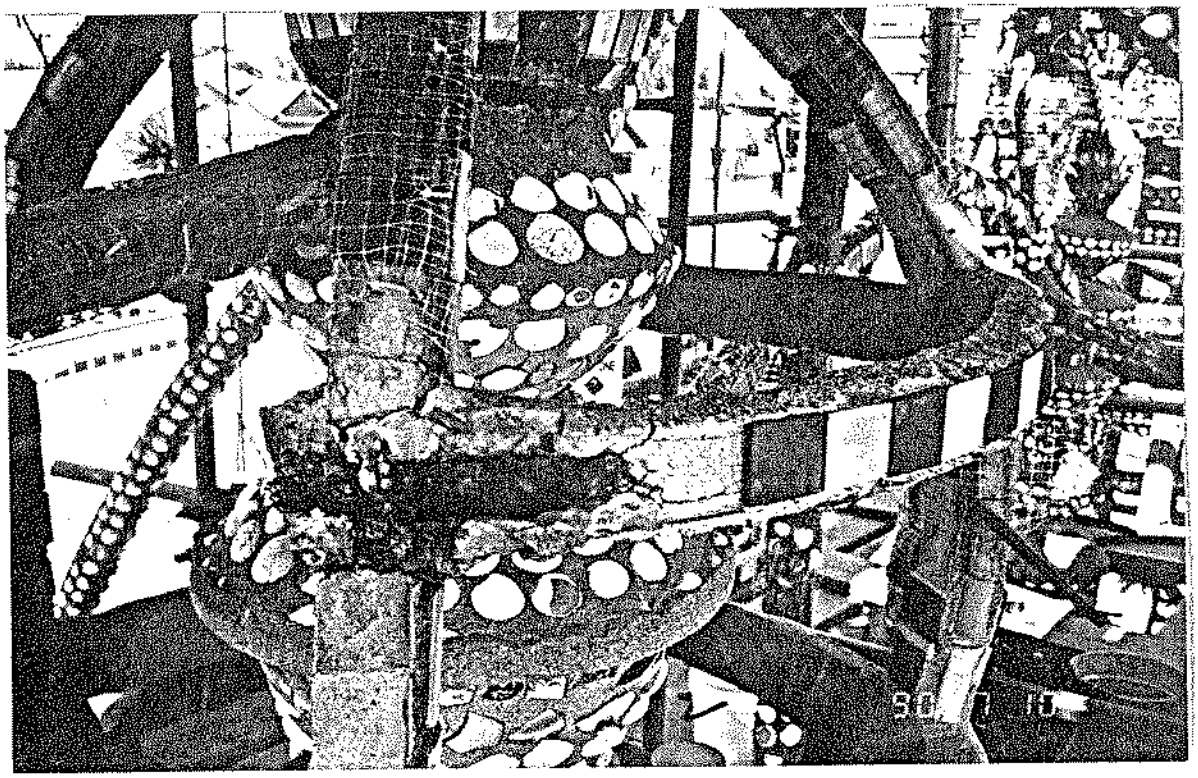


Figure 8.
Main spire band 02 showing rust, mortar & ornament losses.
Jul 1990.
Start of conservation.

Figure 9.
Main spire band 02 showing loss of mortar & ornaments.
Jul 1990.
Start of conservation work.



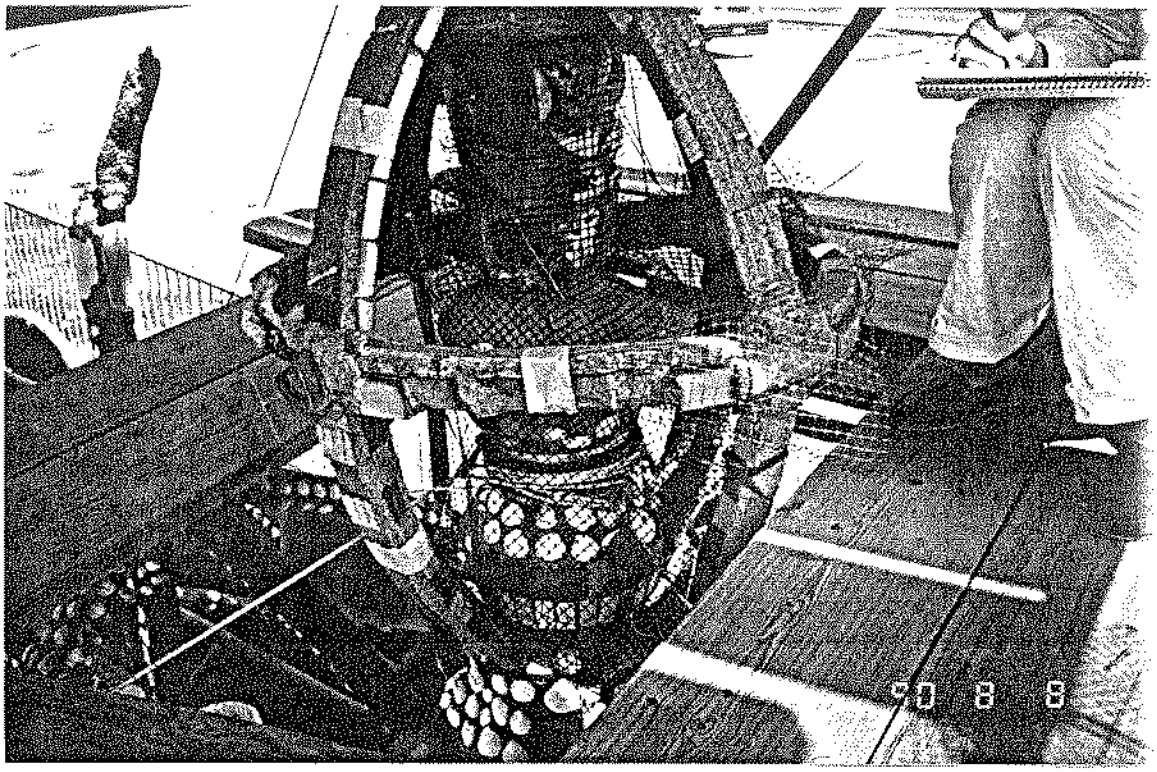


Figure 10.
Main spire band 03 showing mortar cracks and spalls.
Aug 1990.
Start of conservation work.

Figure 11.
Main spire band 03 and broken arc.
Note temporary rope supports.
Aug 1990.
Start of conservation work.

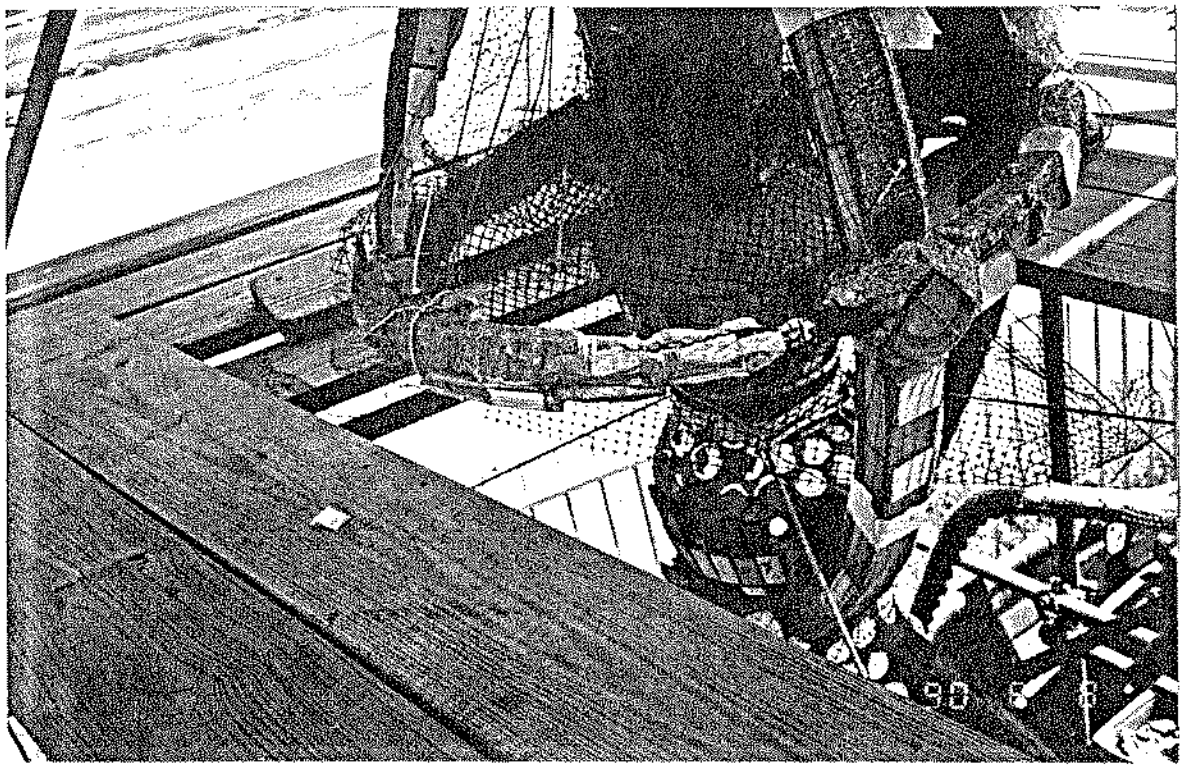


Figure 12.
Main spire arc junction showing failures of mortar and separations of arc ends.
Sep 1990.
Start of conservation.

Figure 13.
Main spire arc junction showing failures of mortar, and end separation.
Sep 1990.
Start of cnservation.

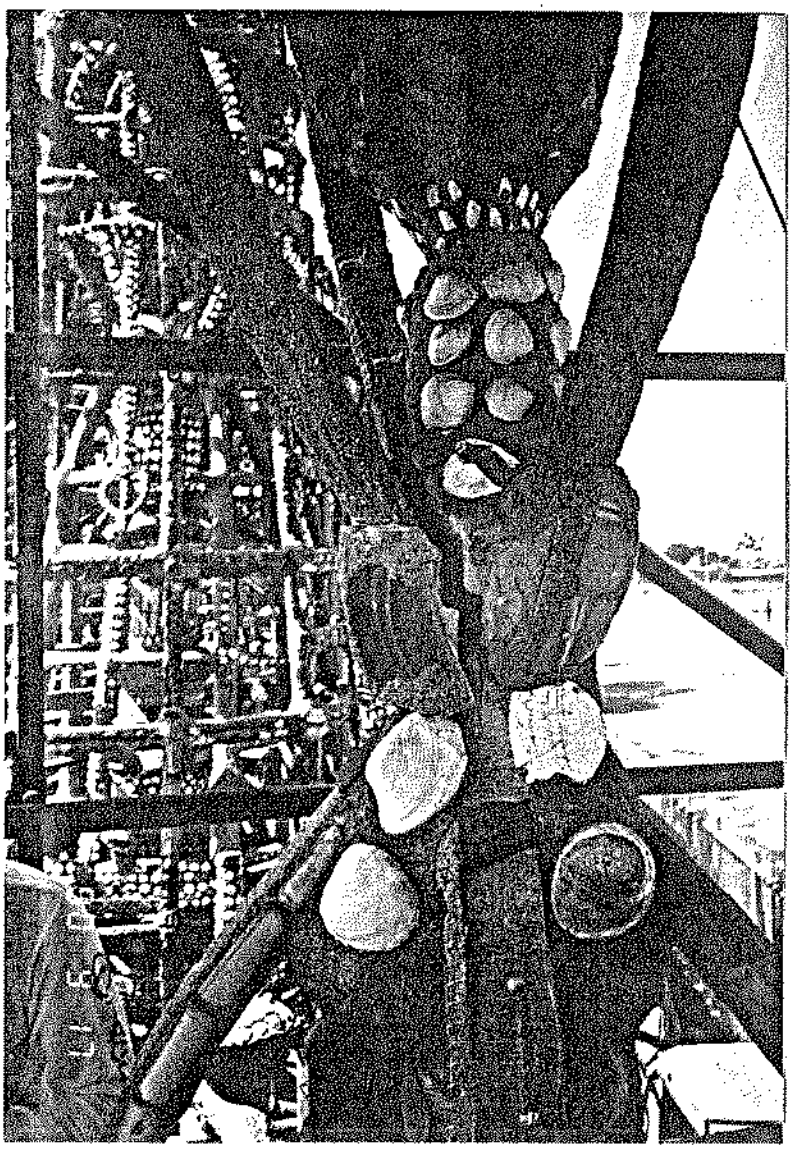


Figure 14.
Main spire arc showing mortar separation from reinforcement.
Jul 1990.
Before conservation, south view.

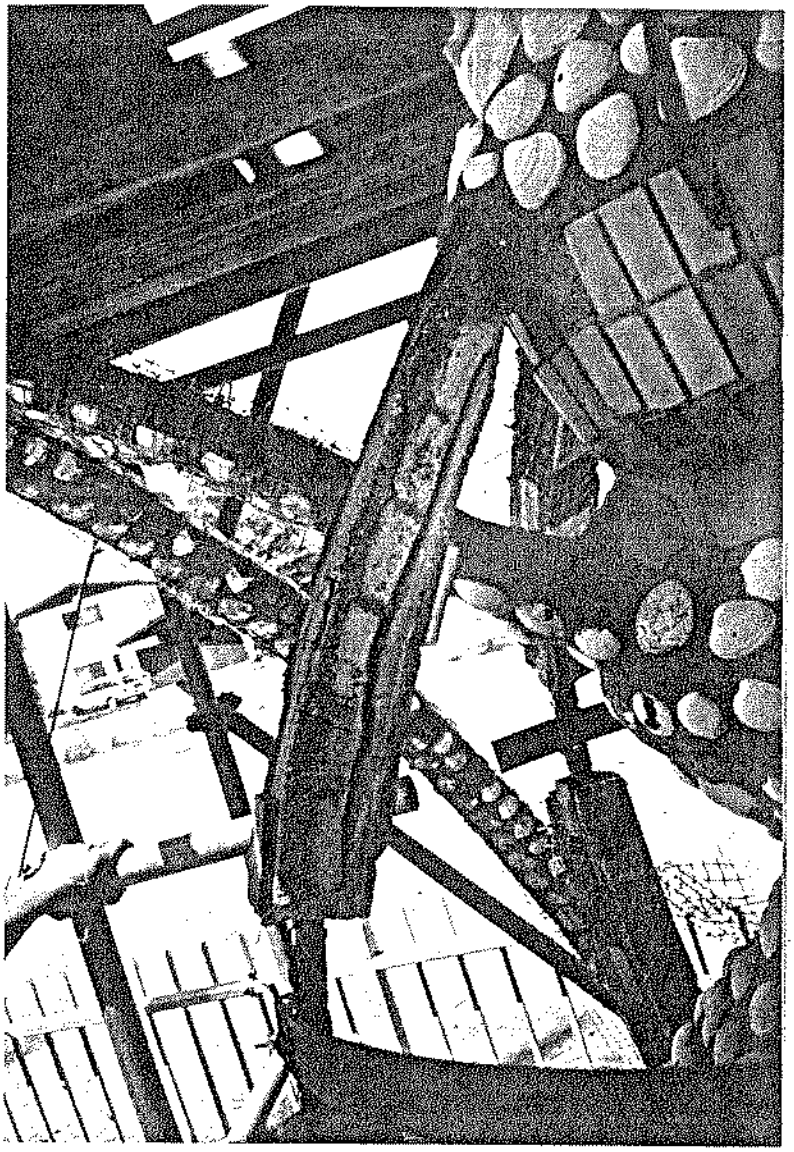


Figure 15.
Bowl on main spire central column, northwest view.
Oct 1990.
Start of conservation work.

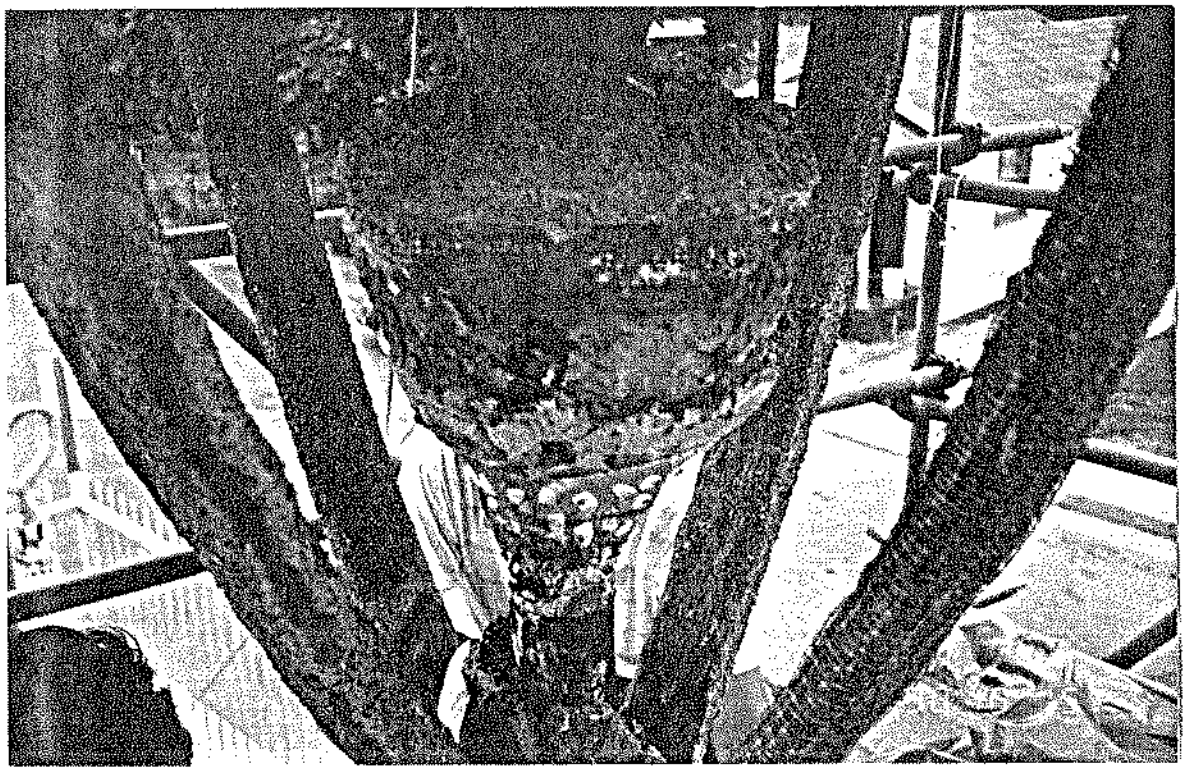


Figure 16.
Main spire top support joint showing exposed pipe and new mesh.
Oct 1990.
Before conservation completion.

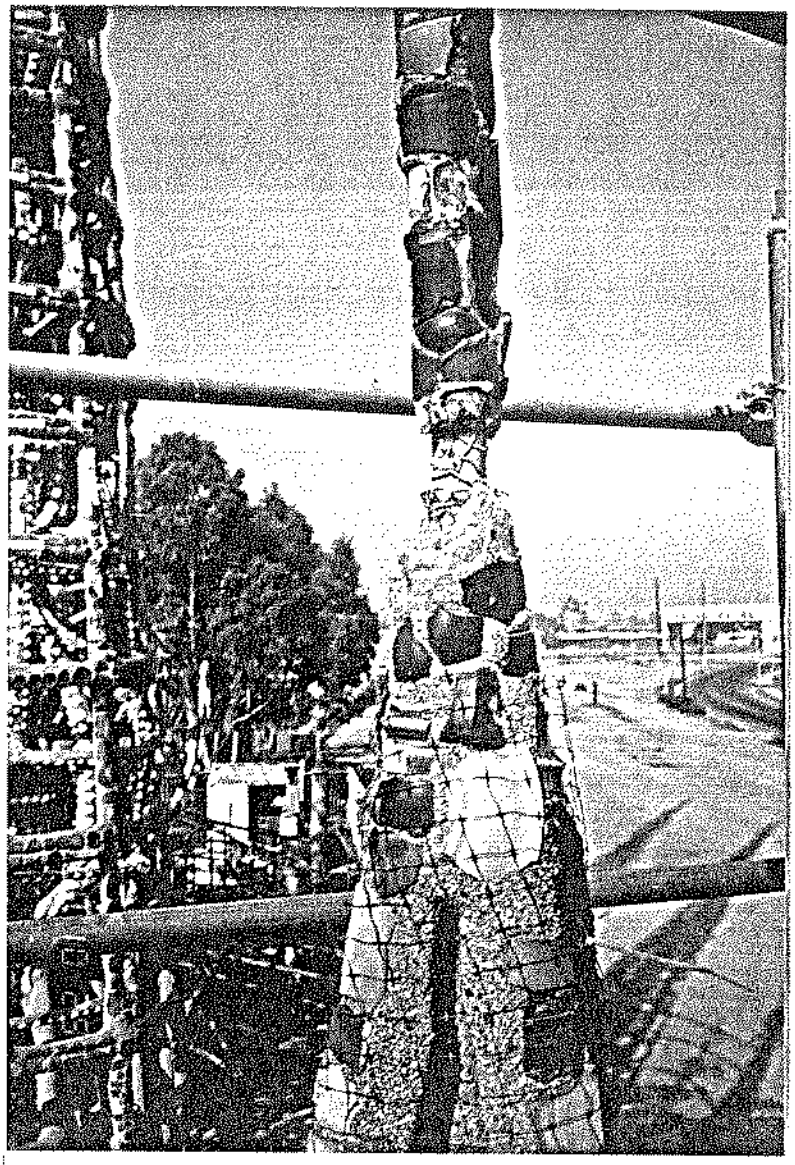


Figure 17.
Bowl 07 of main spire central column. New mesh added over cement before re-attaching original covering.
Ocy 1990.
Before completion of conservation.

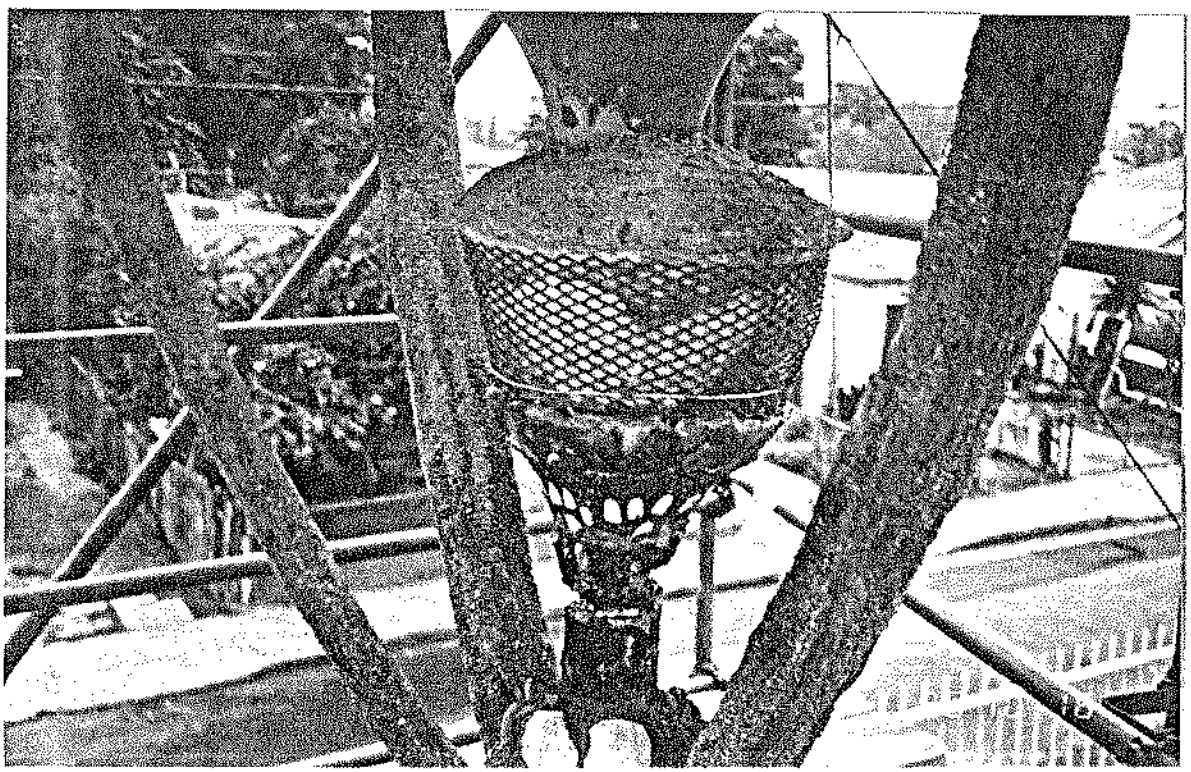
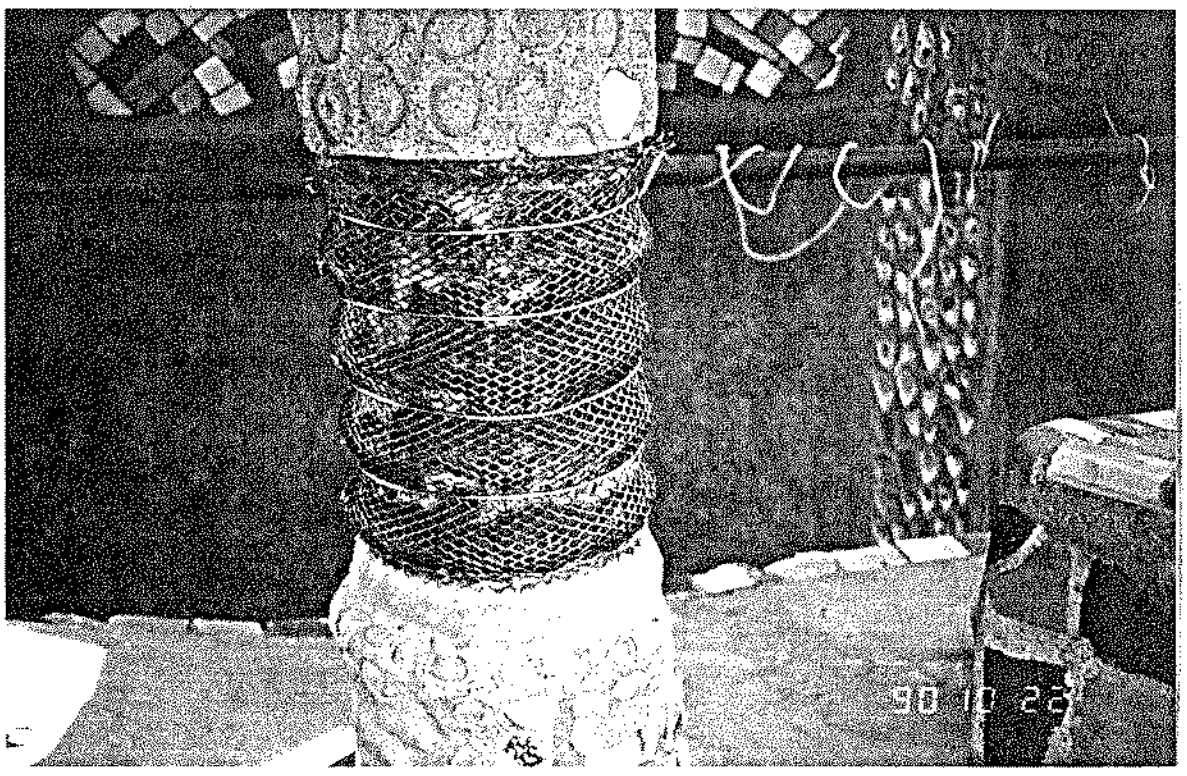


Figure 18.
Base of main spire with restored area (bottom center), and exposed pipe (center) prior to derust with Duro.
Oct 1990.
Mortar cover was removed, saved.

Figure 19.
Base of main spire showing new mesh over derusted/degreased pipe. Next was adding new cement over mesh.
Oct 1990.
Note wire tied around mesh & pipe.



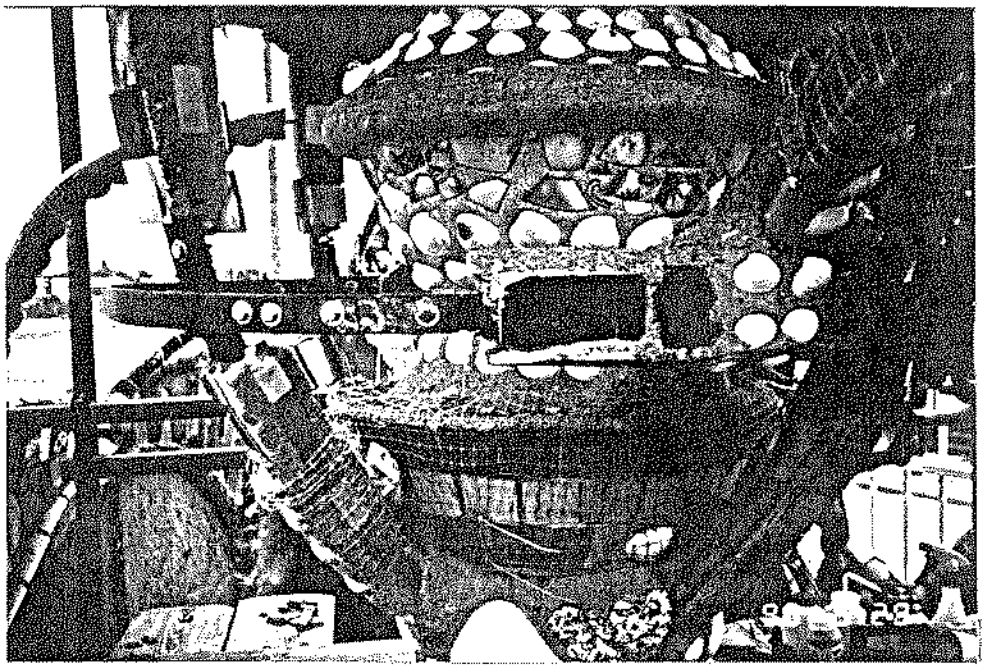
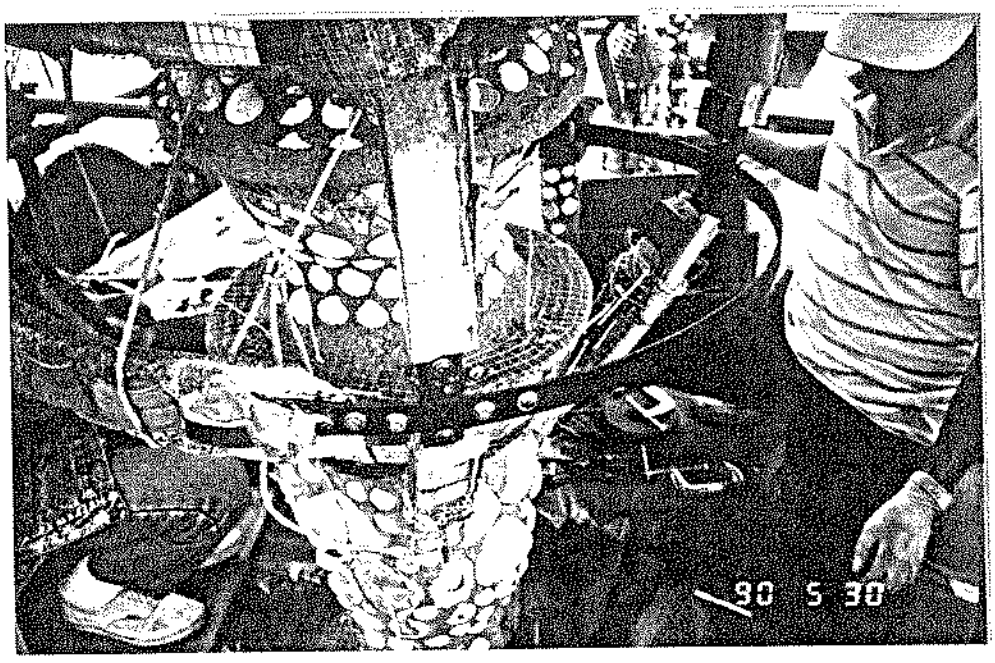


Figure 20.
Main spire band 01 showing new steel reinforcements and arc connections to original portions.
May 1990.
Before completion of work.

Figure 21.
Main spire band 01 showing new steel reinforcement and arc connections.
May 1990.
Before completion of work.



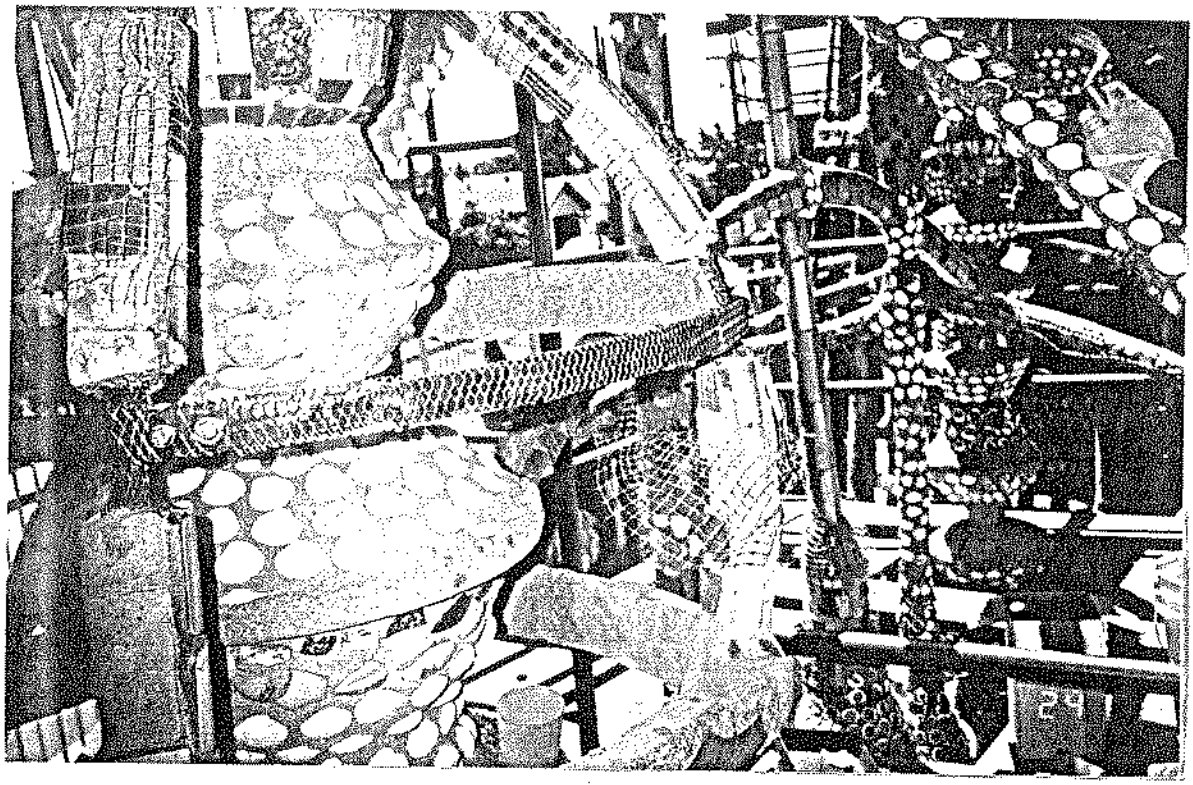
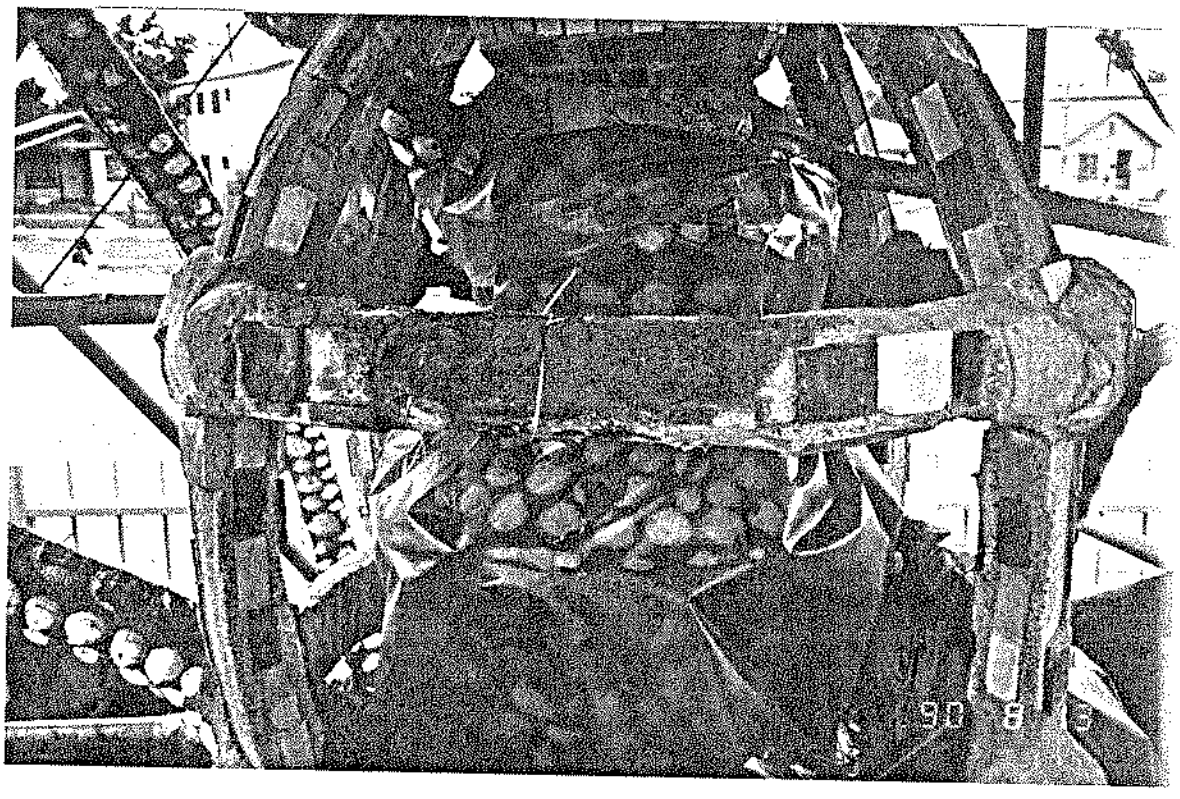


Figure 22.
Main spire band 02 showing new mesh around new steel reinforcement, and connections to arcs.
Jul 1990.
Before completion of work.

Figure 23.
Main spire band 02 nearing completion. Ornaments are reattached over new cement, mesh and reinforcement.
Aug 1990.
Recessing repairs to be done.



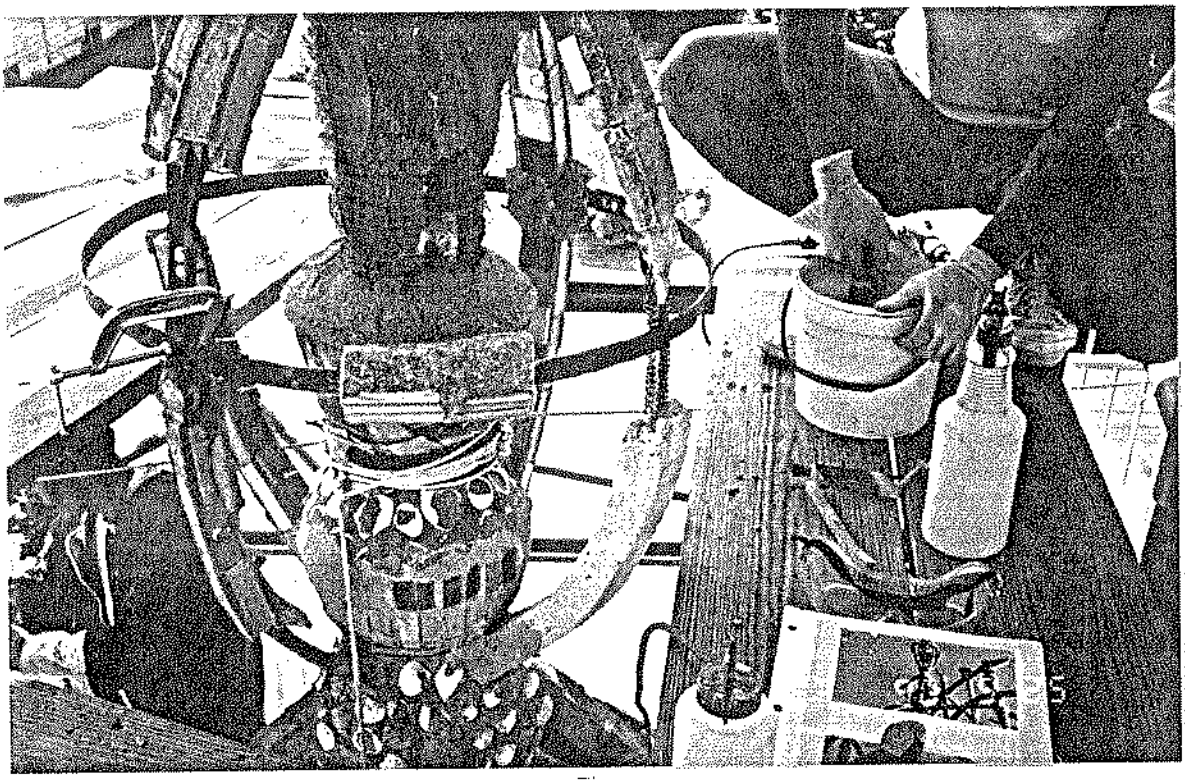


Figure 24.
Main spire band 03 showing new reinforcements and connectors to arcs.
Sep 1990.
During conservation work.

Figure 25.
Main spire ornaments on arc shown reattached with GE 162 in original locations.
Oct 1990.
Near completion of work.

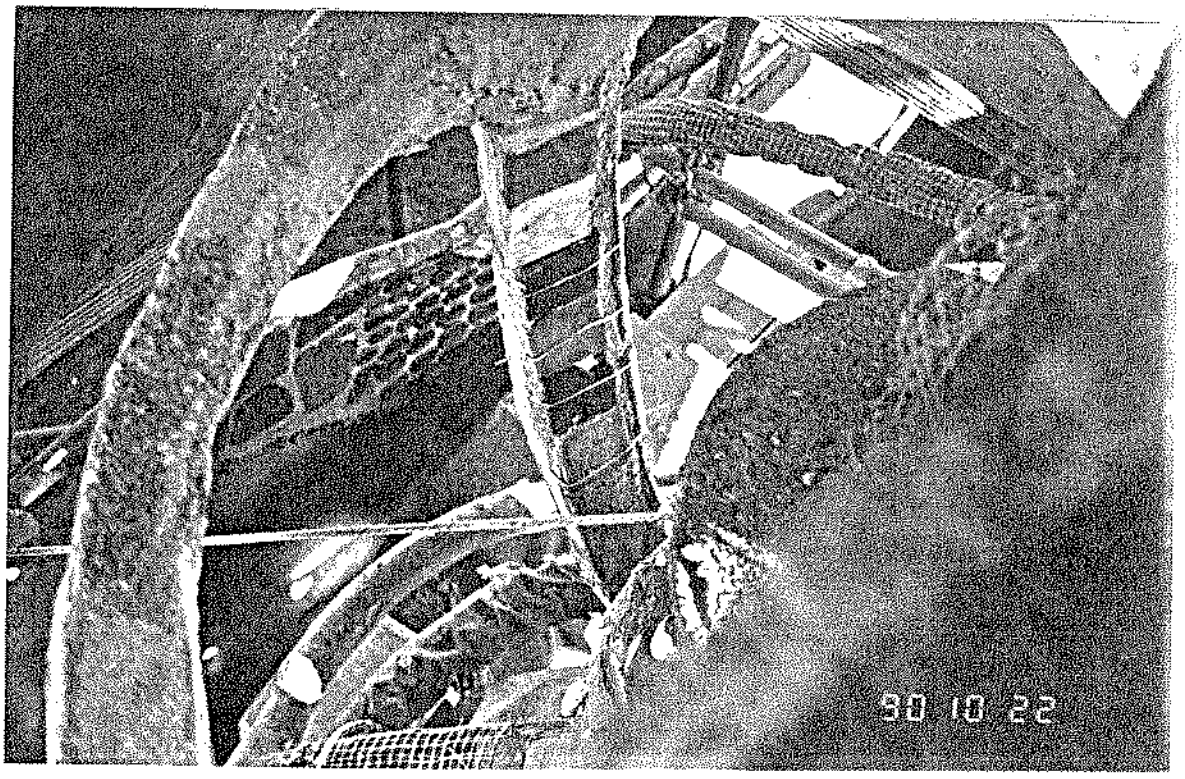


Figure 26.
Main spire arc junction under repair and reattachment to central column.
Oct 1990.

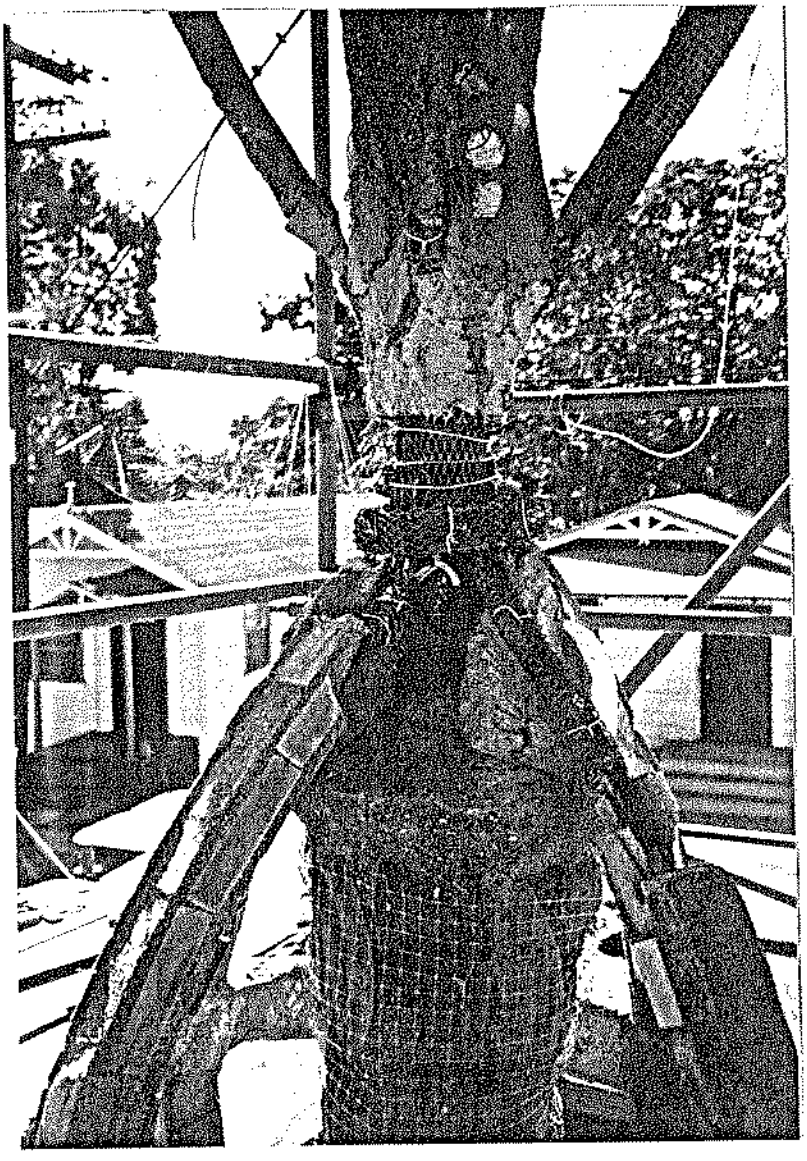


Figure 27.
Main spire arc junction repair using steel collar around the four arc ends to prevent separation from column.
Nov 1990.

PRODUCT NAME	OPERATION/PROCESS	PRODUCT TYPE	DATE INIT
ABLEBOND EPOXY			
ACRYLOID B-72 IN ACETONE	ADHESION/ORNAMENTS	CONSOLIDANT	9/26/89
ACRYLOID B-72 IN ACETONE(60%)	ADHESION/ORNAMENTS	CONSOLIDANT	9/26/89
ACRYLOID B-72 IN XYLENE 10%	CONSOLIDATION	CONSOLIDANT	7/27/89
ACRYLOID B-72 IN XYLENE 5%	CONSOLIDATION	CONSOLIDANT	7/27/89
ACRYLOID B-72 IN XYLENE 5%	CONSOLIDATION	CONSOLIDANT	7/27/89
ACRYLOID B-72 IN XYLENE 5%	CONSOLIDATION	CONSOLIDANT	7/27/89
ACRYLOID B-72 IN XYLENE 5%	CONSOLIDATION	CONSOLIDANT	8/29/89
ACRYLOID B-72 IN XYLENE 5%	CONSOLIDATION 3 SMPL	CONSOLIDANT	8/29/89
ACRYLOID B-72 IN XYLENEX 5%	ADHESION/ORNAMENTS	CONSOLIDANT	7/27/89
B-48N ADHESIVE	ADHESIVE		9/01/89
BRASSO	CLEANING AGENT	METAL POLISH	2/27/90
BRASSO	CLEANING AGENT	METAL POLISH	2/27/90
BRASSO	CLEANING AGENT	METAL POLISH	2/27/90
CHEMTRETE BSM 40D	CONSOLIDATION	H2O PROOFING AGT	7/27/89
CHEMTRETE BSM 40D	CONSOLIDATION	H2O PROOFING AGT	7/27/89
CHEMTRETE BSM 40D	CONSOLIDATION	H2O PROOFING AGT	7/27/89
CHEMTRETE BSM 40D	CONSOLIDATION	H2O PROOFING AGT	8/22/89
CHEMTRETE BSM 40D	WATERPROOFING AGENT	H2O PROOFING AGT	8/22/89
CHEMTRETE BSM 40D	WATERPROOFING AGENT	H2O PROOFING AGT	8/22/89
CONSERVARE H PROSOCO	CONSOLIDATION	CONSOLIDANT	7/27/89
CONSERVARE H PROSOCO	CONSOLIDATION	CONSOLIDANT	9/22/89
CONSERVARE H PROSOCO	CONSOLIDATION	CONSOLIDANT	9/22/89
CONSERVARE OH PROSOCO	CONSOLIDATION	CONSOLIDANT	7/27/89
CONSERVARE OH PROSOCO	CONSOLIDATION	CONSOLIDANT	9/22/89
DC 3145 SILICONE	CRACK-FILLING		7/07/89
DC 3145 SILICONE	CRACK-FILLING		7/07/89
DC 3145 SILICONE	CRACK-FILLING	CRACK-FILLER	10/06/89

PRODUCT NAME	OPERATION/PROCESS	PRODUCT TYPE	DATE INIT
DC 3145 SILICONE	CRACK-FILLING	CRACK-FILLER	10/06/89
DC 3145 SILICONE (PIGMENTED)	CRACK-FILLING		7/07/89
DC 737	ADHESIVE/FILL		9/01/89
DC 737	DECORATION ADHESION	SILICONE ADHESIVE	10/24/89
DC 738 W/30% SAND,W/PIGMENTS	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 738 W/PIGMENT,30% SAND	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 738 W/PIGMENTS/	CRACK-FILLING	CRACK-FILLER	
DC 738 W/PIGMENTS/	CRACK-FILLING	CRACK-FILLER	
DC 738 W/PIGMENTS/	CRACK-FILLING	CRACK-FILLER	
DC 738 W/PIGMENTS/	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 738 W/PIGMENTS/	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 738 W/PIGMENTS/	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 738 W/SAND & PIGMENTS	CRACK-FILLING	CRACK-FILLER	10/06/89
DC 739 W/PIGMENTS	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 739 W/PIGMENTS	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 739 W/PIGMENTS	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 739 W/PIGMENTS	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 739 W/PIGMENTS/	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 739 W/PIGMENTS/	CRACK-FILLING	CRACK-FILLER	9/12/89
DC 739 W/PIGMENTS/30% SAND	CRACK-FILLING	CRACK-FILLER	9/12/89
DC-738 SILICONE 50% SAND	CRACK-FILLING	CRACK-FILLER	3/20/90
GE 160			
GE 161			
GE 162	ADHESION	ADHESIVE/ SILICONE	10/24/89

PRODUCT NAME	OPERATION/PROCESS	PRODUCT TYPE	DATE INIT
GE 167 SILICONE	CRACK-FILLING	CRACK-FILLER	9/26/89
GE 167 SILICONE	CRACK-FILLING	CRACK-FILLER	9/26/89
GE 167 SILICONE	CRACK-FILLING	CRACK-FILLER	9/26/89
GE 167 SILICONE	CRACK-FILLING	CRACK-FILLER	9/26/89
GE 167 SILICONE	CRACK-FILLING	CRACK-FILLER	9/26/89
GE 167 SILICONE	CRACK-FILLING	CRACK-FILLER	9/26/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	7/27/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	7/27/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	7/27/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	7/27/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION 2 SMPL	CONSOLIDANT/H20 PROOFING AGT	7/27/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	8/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	8/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	8/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	8/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	8/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	8/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	8/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	8/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	8/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	8/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOL/WATERPR AGENT	CONSOLIDANT/H20 PROOFING AGT	9/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	9/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	9/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION	CONSOLIDANT/H20 PROOFING AGT	9/22/89
GE DF 104/ACRYLOID B-72 MIX	CONSOLIDATION REPAIR	CONSOLIDANT/H20 PROOFING AGT	9/22/89
GE SILPRUF	FILL MATERIAL		9/01/89
GRAY PORTLAND CEMENT TYPF '	CEMENT-COLOR	BONDING	10/15/90
HXTAL NYL-1 EPOXY ADHESIVE			
HXTAL NYL-1 EPOXY ADHESIVE	ADHESION/ORNAMENTS		5/04/89
JAHN M30	CRACK-FILLING	INJECTION MORTAR	11/27/90
MAGNESIUM TRISILICATE	CLEANING POULTICE		2/27/90
MONSANTO BUTVAR B-90	WOOD CONSOLIDANT	WOOD CONSOLIDANT	7/03/90
NOXON	CLEANING AGENT	METAL CLEANER	2/27/90
NOXON	CLEANING AGENT/POLIS	METAL CLEANER	2/27/90

PRODUCT NAME	OPERATION/PROCESS	PRODUCT TYPE	DATE INIT
NOXON	CLEANING AGENT/POLIS	METAL CLEANER	2/27/90
SIKADUR 31 HI MOD GEL EPOXY	ADHESIVE	EPOXY	8/06/90
SIKATOP 122	MORTAR REPLACEMENT	MORTAR, COMMERCIAL	10/24/89
TRIMETHOXY SILANE ???			
UV-CURING PRODUCTS			
WESTTECH EPOXY W/MICROBALLOONS	ADHESIVE/FILL		9/01/89
WHITE PORTLAND CEMENT TYPE I	CEMENT-COLOR	BONDING	10/02/90
WHITE/GRAY CEMENT TYPE I MIX	CEMENT-COLOR	BONDING	10/16/90

ELEV CODE	MATERIALS TECHNOLOGY	TECHNIQUE	DIR SEQ NO.	VIEW ASPECT	DATE
A	CEMENT MORTAR	ADD COAT OF CEMENT MORTAR	01	N	11/13/90
A	GRINDER, DURO, ACETONE	REMOVE FRAGS,DERUST,DEGREASE	01	N	11/13/90
A	WIRE/WIRE MESH	ADD WIRE/MESH AROUND PIPE	01	N	11/13/90
A	GRINDER	GRIND INSIDE OF FRAGS	01	N	11/14/90
A	DURO,WATER	GRIND/CHISEL OFF MORTAR FRAGS	01	S	10/09/90
A	WIRE MESH/WIRE	WRAP MESH/TIE W/WIRE AROUND	01	S	10/09/90
A	SIKADUR 23	REBOND FRAGMENTS	01	S	10/15/90
A	ETHANOL/WATER	CLEAN TILES/SHELLS	04	N	9/20/89
B	DURO,DISTILLED WATER	GRIND/CHISEL OFF MORTAR FRAGS	01	N	10/09/90
B	WIRE MESH/WIRE	WRAP MESH, TIE W/WIRE AROUND	01	N	10/09/90
B	SIKADUR 23	REBOND MORTAR-TO-MORTAR FRAGS	01	N	10/10/90
B	CEMENT MORTAR (#12,#16,#60SAND	APPLY 1ST COATING ON BASE	01	N	10/16/90
B	CEMENT MORTAR OK SAND MIX	APPLY 2ND COAT,REBOND ORNAMNTS	01	N	10/16/90
B	DURO, WATER,DISTILLED WATER	DERUST STEEL PIPE,REMOVE MORTR	01	N	10/22/90
B	MESH,WIRE,ACETONE	CLEAN,WRAP/TIE W/MESH & WIRE	01	N	10/22/90
B	CEMENT MORTAR	APPLY FINAL CEMENT COAT(OK SND	01	N	10/23/90
B	GRINDER MAKITA	GRIND MORTAR FRAGS FOR REINSTL	01	N	10/24/90
B	CEMENT (WHT/GRAY)	REBOND MORTAR FRAGMENTS	01	N	10/29/90
B	CEMENT MORTAR (WHT/GRAY)	REBOND LAST FRAGMENT OF MORTAR	01	N	10/30/90
B	GRINDER	DETACH MORTAR FRAGMENTS	01	N	10/30/90
B	CEMENT MORTAR WHT/GRAY	REBOND MORTAR FRAGMENT TO PIPE	01	N	11/05/90
B	DURO,WATER,ACETONE	DERUST/DEGREASE STEEL PIPE	01	N	11/05/90
B	GRINDER	REMOVE MORTAR FRAGMENTS	01	N	11/05/90
B	MESH.WIRE	ADD MESH/WIRE AROUND PIPE	01	N	11/05/90
B	CEMENT MORTAR	REBOND MORTAR FRAGMENTS	01	N	11/06/90
B	GRINDER	GRIND MORTAR FRAGMENT	01	N	11/06/90
B	CEMENT MORTAR	REBOND MORTAR FRAGS	01	N	11/19/90
B	CEMENT MORTAR	REBOND MORTAR FRAGS	01	N	11/21/90
B	DURO, MESH, WIRE	DETACH FRAGS, CLEAN, ADD MESH	01	N	11/26/90
B	MESH/WIRE	ADD MESH, TIE W/WIRE TO PIPE	01	N	11/26/90
B	GRINDER	GRIND FRAGS INSIDE FOR REI[illegible]	01	N	11/27/90
B	CEMENT (OK SAND), WHITE/GRAY	APPLY 1ST CEMENT COAT	01	S	10/16/90
B	CEMENT MORTAR (OK SAND)	REATTACH MORTAR FRAGS/2ND COAT	01	S	10/16/90
B	CEMENT MORTAR	GRIND FRAGS,APPLY CEMENT MORTR	01	S	10/22/90
B	DURO, GRINDER	DERUST,DETACH MORTAR FRAGS	01	S	10/22/90
B	DURO,ACETONE,MESH/WIRE	DERUST,ADD MESH/WIRE	01	S	10/22/90
B	CEMENT MORTAR	APPLY FINAL CEMENT COAT	01	S	10/24/90
B	GRINDER	DERUST BACK OF MORTAR FRAGS	01	S	10/24/90
B	WHT/GRAY CEMENT (OK SAND)	REBOND MORTAR FRAGMENT	01	S	10/24/90
B	CEMENT MORTAR WHT/GRAY	REBOND MORTAR FRAGMENT	01	S	10/29/90
B	GRINDER	DETACH MORTAR FRAGS	01	S	10/30/90
B	DURO,WATER,ACETONE	DERUST/DEGREASE PIPE	01	S	11/05/90
B	MESH,WIRE	ADD MESH/WIRE AROUND PIPE	01	S	11/05/90
B	CEMENT WHT/GRAY	REBOND MORTAR FRAGMENT	01	S	11/06/90
B	GRINDER	GRIND FRAGS FROM SPIRE BASE	01	S	11/06/90
B	CEMENT MORTAR WHT/GRAY	REBOND MORTAR FRAGMENTS	01	S	11/07/90
B	CEMENT MORTAR	ADD COAT OF CEMENT MORTAR	01	S	11/13/90
B	DURO, ACETONE	DETACH FRAGS,DERUST,DEGREASE	01	S	11/13/90

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B	WIRE/MESH	ADD MESH,TIE W/WIRE	01	S	11/13/90
B	GRINDER	GRIND INSIDE SURFACE OF FRAGS	01	S	11/14/90
B	CEMENT MORTAR	REBOND FRAGS TO SPIRE BASE	01	S	11/19/90
B	CEMENT MORTAR	REBOND MORTAR FRAGS	01	S	11/21/90
B	DURO,ACETONE,GRINDER	DETACH FRAGS,DERUST PIPE	01	S	11/26/90
B	MESH/WIRE	ADD MESH.TIE W/WIRE TO PIPE	01	S	11/26/90
B	CEMENT	ADD CEMENT, REBOND FRAGS	01	S	11/27/90
B	GRINDER	GRIND INSIDE OF FRAGS	01	S	11/27/90
B	DURO,MESH,SIKADUR 23,GE 162	DETACH MORTAR,DERUST,REBOND	02	N	11/26/90
B	GE DF104/B-72 BOL.COCKTAIL	CONSOLIDATE SEA SHELLS 2 COATS	03	N	10/05/89
B	ETHANOL/WATER	CLEAN ABALONE SHELLS	03	S	B/07/89
B	ACETONE,DC738	CLEAN/FILL CRACKS	03	S	5/30/90
B	ACETONE,DURO,FOAM,GE162,DC738	REBOND MORTAR,CLEAN/FILL CRACK	03	S	5/31/90
B	FOAM, ACETONE, DC 738	CLEAN,ADD FOAM, SEAL W/SILICON	03	S	6/14/90
B	ACETONE,DC 738	CLEAN/FILL CRACKS	04	S	6/18/90
C	ETHANOL/WATER	CLEAN SEA SHELLS	01	EEE	B/09/89
C	ETHANOL & BRUSH	CLEAN SHELLS/REMOVE LOOSE MORT	01	EEE	9/1B/89
C	ETHYL ALCOHOL	CLEAN/DEGREASE FOR ADHESIVES	01	EEE	10/19/89
C	GE 162 SILICONE ADHESIVE/FILLR	ADHESIVE ON TILES/MORTAR	01	EEE	10/25/89
C	GE RTV 162 WHITE	ADHESIVE/FILL CRACKS BOND TILE	01	EEE	10/26/89
C		OPEN CRACK,REMOVE COVERING	01	EEE	3/26/90
C	DURO	REMOVE COVER/DERUST	01	EEE	5/15/90
C	GE 162	REBOND TILES	01	EEE	5/29/90
C	GE 162,ACETONE,H20	REBOND MORTAR	01	EEE	6/04/90
C	GE RTV 162 SILICONE	CLEAN/BOND TILES	01	EEE	6/05/90
C	CEMENT MORTAR	REBOND TILES,FILL CRACKS	01	EEE	6/07/90
C	GE RTV 162 SILICONE	REBOND TILES	01	EEE	6/11/90
C	CEMENT MORTAR	REBOND ORNAMENTS/BOND JOINT	01	EEE	6/12/90
C	CEMENT MORTAR,NEW STEEL BAND	REBOND TILE/POTTERY/MORTAR	01	EEE	6/12/90
C	ETHANOL,H20,CEMENT MORTAR	CLEAN,REBOND TILE	01	EEE	6/13/90
C	GE 162	REBOND TILE	01	EEE	6/26/90
C	STEEL RING,MESH,BOLTS	REMOVE,REPLACE MAJH02 STEEL	01	EEE	7/17/90
C	GE RTV 162 SILICONE	REBOND MORTAR FRAGMENTS	01	EEE	7/25/90
C	ACETONE	CLEAN TILES/POTTERY	01	EEE	B/01/90
C	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	EEE	B/06/90
C	SIKADUR 31 HI-MOD EPOXY,ACETON	CLEAN,REBOND MORTAR FRAGMENTS	01	EEE	B/06/90
C	ACETONE, DC 3145 RTV SILICONE	CLEAN,REATTACH TILES	01	EEE	B/07/90
C	DURO	CUT DAMAGED BAND,DE-RUST	01	EEE	B/08/90
C	ACETONE, GE 162 SILICONE	CLEAN,REBOND TILES TO MORTAR	01	EEE	8/13/90
C	CEMENT MORTAR 1:1 16/60 SAND	BUILD-UP MORTAR COVER	01	EEE	B/13/90
C	CEMENT MORTAR,NEW MESH	ADD NEW MESH,REATTACH MORTAR	01	EEE	B/13/90
C	CEMENT MORTAR 1:1 16/60 SAND	REBOND TILE TO MORTAR	01	EEE	B/15/90
C	CEMENT MORTAR	REBOND MORTAR/ORNAMENT COVER	01	EEE	B/20/90
C	CEMENT MORTAR	ADD 1/4" COAT OF CEMENT MORTAR	01	EEE	B/21/90
C	CEMENT MORTAR	ADD 1/4" CEMENT MORTAR COAT	01	EEE	B/22/90
C	GE 162,ACETONE	CLEAN,REBOND ORNAMENTS	01	EEE	9/04/90
C	GE 162 SILICONE	REBOND TILES TO MORTAR	01	EEE	9/05/90
C	GE RTV 162 SILICONE	REBOND POTTERY FRAGMENTS	01	NE	6/01/90
C	GE RTV 162 SILICONE	REBOND TILE	01	NE	6/07/90

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C	ZRC,CEMENT MORTAR,REBAR,MESH	REPLACE REBAR,MESH,REBOND ORIG	01	NE	6/12/90
C	GE162,CEMENT MORTAR	ADD CEMENT MORTAR TO JT,REBOND	01	NE	6/14/90
C	DIST.H2O,GE 162	CLEAN/REBOND TILES	01	NE	6/26/90
C	CEMENT MORTAR/#16 & 60 SAND	REBOND MORTAR FRAGMENT	01	NE	7/30/90
C	CEMENT MORTAR 1:1 SAND 16/60	REBOND MORTAR/ORNAMENTS	01	NE	8/14/90
C	CEMENT MORTAR	GRIND,REBOND MORTAR/ORNAMENTS	01	NE	8/20/90
C	CEMENT MORTAR	REBOND TILES TO NEW MESH	01	NE	9/10/90
C	WATER/ETHANOL	CLEAN LARGE/SMALL SHELLS	01	NW	8/09/89
C	WATER/ALCOHOL/BOLOGNA COCKTAIL	CLEAN/CONSOLIDATE SHELLS	01	NW	9/18/89
C	GE RTV 162 SILICONE	ADHESIVE/FILL MORTAR/REBAR	01	NW	10/25/89
C	GE 162 SILICONE/ACETONE	CLEAN/BOND POTTERY FRAGS	01	NW	3/28/90
C	DURO	DISSEMBLE MAJH01,DERUST	01	NW	5/16/90
C	BRASSO,DISTILLED WATER	DETACH/CLEAN TILES	01	NW	5/21/90
C	DURO,STEEL BOLTS/NUTS	DERUST/TEMP REATTACH MAJH01	01	NW	5/21/90
C	GE 162,ACETONE	CLEAN/REBOND TILES	01	NW	5/24/90
C	ACETONE, GE 162	CLEAN/REBOND TILES	01	NW	5/29/90
C	ACETONE,H2O,GE 162	REBOND MORTAR	01	NW	6/04/90
C	CEMENT MORTAR	REBOND MORTAR TO MEMBER	01	NW	6/04/90
C	STEEL,MESH,CEMENT MORTAR,DURO	REASSEMBLE MORTAR TO MEMBER	01	NW	6/07/90
C	STEEL,4 BOLTS,CEMENT MORTAR	REPLACE REBAR/MESH IN BAND	01	NW	6/12/90
C	CEMENT MORTAR,REBAR,MESH	RESTORE BAND COVERINGS	01	NW	6/13/90
C	DIST.H2O,ACETONE,GE 162	CLEAN/REBOND TILES	01	NW	6/26/90
C	JAHN M70, GE 162	REBOND TILE,FILL CRACKS	01	NW	6/27/90
C	DURO,STEEL RING,MESH,BOLTS	REPLACE RING SECTION	01	NW	7/18/90
C	ACETONE,DC 3145 RTV	REBOND CHINA GLASS	01	NW	7/25/90
C	CEMENT MORTAR #30 SAND	REBOND MORTAR FRAGMENTS	01	NW	7/25/90
C	ACETONE,GE 162	REBOND TILES	01	NW	7/31/90
C	CEMENT MORTAR SAND 1:1,MESH	CLEAN,ADD NEW MESH,REBOND MRTR	01	NW	8/13/90
C	CEMENT MORTAR	ADD 1/4" CEMENT MORTAR COAT	01	NW	8/21/90
C	WATER/ETHANOL BRUSH/COTTON SWA	CLEAN SEA SHELLS	01	SW	8/09/89
C	ETHANOL/ACETONE	CLEAN SEA SHELLS/TILES	01	SW	9/25/89
C	GE RTV 162 SILICONE	ADHESIVE FOR TILES/MORTAR FRAG	01	SW	10/25/89
C	GRINDER BLADE	CUT OPEN COVERING OF BAND	01	SW	5/29/90
C	BRASSO,ETHANOL	CLEAN TILES/MORTAR	01	SW	5/30/90
C	BRASSO,ETHANOL,H2O	CLEAN TILES/MORTAR	01	SW	5/30/90
C	BRASSO,ETHANOL,H2O	CLEAN TILES/MORTAR	01	SW	5/30/90
C	CEMENT MORTAR	CLEAN/REBOND MORTAR/TILES	01	SW	6/04/90
C	GE 162,ETHANOL,H2O	REBOND TILE/MORTAR	01	SW	6/04/90
C	GE RTV 162,ACETONE	CLEAN,REBOND MORTAR/POTTERY	01	SW	6/05/90
C	DURO,WATER	REPLACE STEEL REINFORCEMENT	01	SW	6/06/90
C	CEMENT MORTAR	REBOND TILES	01	SW	6/07/90
C	CEMENT MORTAR	REBOND TILES,FILL GAPS	01	SW	6/11/90
C	CEMENT MORTAR	REBOND TILES,FILL GAPS	01	SW	6/12/90
C	DURO,CEMENT MORTAR	DISSEMBLE,DERUST,REBOND/REMESH	01	SW	6/13/90
C	ETHANOL,ACETONE,GE #162	CLEAN,REBOND TILES	01	SW	6/26/90
C	GE 162	REBOND TILE	01	SW	6/27/90
C	WATER/STEEL BRUSH	CLEAN MORTAR/ORNAMENTS	01	SW	7/09/90
C	STEEL RING,MESH,BOLTS	REPLACE STEEL REINFORCEMENT	01	SW	7/13/90
C	ACETONE,GE 162	CLEAN,REBOND MORTAR FRAGMENTS	01	SW	7/23/90
C	ACETONE,GE 162	CLEAN/REBOND MORTAR FRAGMENTS	01	SW	7/23/90
C	CEMENT MORTAR,STEEL MESH	REASSEMBLE MINV ARC W/CEMENT	01	SW	7/23/90

ELEV CODE	MATERIALS TECHNOLOGY	TECHNIQUE	DIR SEQ NO.	VIEW ASPECT	DATE
C	GE 162 RTV SILICONE	REBOND MORTAR FRAGMENTS	01	SW	7/23/90
C	ACETONE,GE 162	REBOND MORTAR,TILE,POTTERY	01	SW	7/24/90
C	ACETONE,GE 162	REBOND TILE/POTTERY	01	SW	7/31/90
C	CEMENT MORTAR W/#30 SAND	REBOND MORTAR FRAGS W/CEMENT	01	SW	7/31/90
C	CEMENT MORTAR/#30 SAND,ACETONE	OPEN MINV02,CLEAN REBAR,FILL	01	SW	7/31/90
C	CEMENT MORTAR W/#60 SAND	REBOND MORTAR/POTTERY	01	SW	8/01/90
C	ACETONE,GRINDER	CLEAN,RECESS REPAIR MORTAR	01	SW	8/06/90
C	GRINDER	CLEAN-UP REPAIRS,RECESS SURFAC	01	SW	8/06/90
C	GE 162, BRASSO,ETHANOL,H2O	CLEAN TILE,REBOND TO MORTAR	01	SW	8/07/90
C	CEMENT MORTAR 1:1,WIRE/MESH	REBOND MORTAR COVER,RE-MESH	01	SW	8/13/90
C	CEMENT MORTAR-#16/#60 SAND 1:1	REBOND MORTAR TO MORTAR	01	SW	8/13/90
C	ACETONE,CEMENT MORTAR 1:1 SND	CLEAN, REBOND MORTAR FRAGMENTS	01	SW	8/15/90
C	CEMENT MORTAR	ADD 1/4" CEMENT MORTAR COAT	01	SW	8/20/90
C	CEMENT MORTAR	ADD 1/4"CEMENT MORTAR COAT	01	SW	8/22/90
C	GE 162 SILICONE,ACETONE	CLEAN,REBOND TILES TO MORTAR	01	SW	9/04/90
C	ACETONE,DC 738	CLEAN/FILL CRACKS	04	NNW	6/04/90
C	ACETONE,FOAM,DC 738	CLEAN/ADD FOAM,FILL W/SILICONE	04	NNW	6/11/90
C	ACETONE,DC 738	CLEAN/FILL CRACKS W/SILICONE	04	NW	6/05/90
C	DC738 & 1/2"FOAM	REBOND/FILL CRACKS	04	SE	10/10/89
C	GE DF104/ACRYLOID B-72	CONSOLIDATION OF SHELLS	04	SSS	10/09/89
C	ACETONE,DC 738	CLEAN/FILL CRACKS	04	SSS	6/12/90
C	ACETONE,DC 738	CLEAN/FILL CRACKS W/SILICONE	04	SW	6/12/90
D	FOAM, DC 738,ACETONE	CLEAN,ADD FOAM/FILL W/SILICONE	01	NE	2/26/90
D	SIKADUR 31	DETACH/REATTACH MORTAR W/EPOXY	01	NE	8/14/90
D	CEMENT MORTAR	REBOND MORTAR/TILES W/CEMENT	01	NE	9/12/90
D	ACETONE,GE 162	CLEAN,REBOND TILES	01	NE	9/17/90
D	CEMENT MORTAR	REATTACH MORTAR FRAGMENTS	01	NE	10/11/90
D	GE RTV 162 ADHESIVE	BOND TILES/SHELLS & FILL CRCKS	01	NW	10/25/89
D	ACETONE,SIKADUR 23,GE 162	REBOND MORTAR(SIKA23),TILE(162	01	NW	8/13/90
D	ACETONE, SIKADUR 23	CLEAN,REBOND MORTAR FRAGMENTS	01	NW	8/14/90
D	ACETONE,SIKADUR 23 LO MOD GEL	REBOND MORTAR FRAGMENTS	01	NW	8/27/90
D	ACETONE,SIKADUR 23 LO MOD GEL	CLEAN,REBOND MORTAR FRAGMENTS	01	NW	8/28/90
D	ACETONE,SIKADUR 23 LO MOD GEL	REBOND MORTAR FRAGMENTS	01	NW	9/05/90
D	ACETONE,SIKADUR 23	CLEAN,REBOND MORTAR FRAGMENTS	01	NW	9/10/90
D	CEMENT MORTAR	CLEAN,REBOND TILES	01	NW	9/10/90
D	ACETONE,SIKADUR 23	CLEAN,REBOND MORTAR FRAGMENTS	01	NW	9/11/90
D	ACETONE,SIKADUR 23	CLEAN/REBOND MORTAR FRAGMENTS	01	NW	9/12/90
D	ACETONE,SIKADUR 23	CLEAN/REBOND MORTAR FRAGMENTS	01	NW	9/17/90
D	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	NW	9/18/90
D	ACETONE,GE RTV 162	REBOND TILES	01	NW	10/16/90
D	ACETONE,GE RTV162,CEMENT MORTR	CLEAN,REATTACH TILES/REBOND	01	NW	10/23/90
D	GRINDER,DURO,MESH/WIRE	REMOVE MORTAR,DERUST,ADD MESH	01	NW	11/05/90
D	ACETONE,DC 738	CLEAN, FILL W/SILICONE	01	SE	2/20/90
D	ACETONE,SIKADUR 23	REBOND MORTAR FRAGMENTS	01	SE	8/14/90
D	ACETONE,BRASSO,ETHANOL	GRIND,CLEAN DAMAGED BAND,TILE	01	SE	8/15/90
D	WATER, CEMENT MORTAR 1:1 SAND	FILL GAPS/CLEAN RESIDUES	01	SE	10/02/90
D	CEMENT MORTAR,WIRE TIES	TIE, REATTACH MORTAR FRAGMENTS	01	SE	10/11/90
D	CEMENT MORTAR/WIRE TIES	REATTACH MORTAR FRAGMENTS	01	SE	10/11/90
D	ETHANOL,SIKADUR23,GE RTV 162	DETACH,CLEAN,REBOND MORTAR/TIL	01	SW	8/08/90

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D	ACETONE,SIKADUR 23 LO MOD GEL	REBOND MORTAR FRAGMENTS	01	SW	8/29/90
D	BRASSO,ACETONE,SIKADUR 23	CLEAN TILES,REBOND MORTAR	01	SW	8/29/90
D	ACETONE,GE 162	CLEAN/REBOND TILES	01	SW	9/12/90
D	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	SW	9/24/90
D	SIKADUR 23,CEMENT MORTAR 1:1	REAFFIX FRAGMENTS/REBOND	01	SW	10/01/90
D	CEMENT MORTAR	CLEAN & FINISH COAT OF MORTAR	01	SW	10/07/90
D	WATER	GRIND ROUGH EDGES, CLEAN W/H2O	01	SW	10/11/90
D	BOLOGNA COCKTAIL	CONSOLIDATE SHELLS	03	SSS	10/18/89
D	ACRYLOID B-72,DC 738 SILICONE	CLEAN,BOND TILE,FILL CRACK	04	SSS	10/12/89
D	BOLOGNA COCKTAIL	CONSOLIDATE SHELLS	04	SSS	10/18/89
E	FOAM,DC739	CLEAN FILL CRACK W/FOAM/739	01	NE	11/15/89
E	DC 738, W/50% SAND/PGMT ACETON	CLEAN,FILL,ADD SAND	01	NE	3/19/90
E	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	NE	9/18/90
E	CEMENT MORTAR	REBOND SEA SHELLS	01	NE	11/05/90
E	FOAM,GE RTV 162	FILL W/FOAM/162,REBOND MORTAR	01	NW	5/24/90
E	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	NW	9/24/90
E	GRINDER.CHISEL,CUTTER	REMOVE RUSTY MORTAR,MESH,WIRE	01	NW	10/29/90
E	DURO,WATER,GRINDER,MESH,WIRE	DERUST,CLEAN,GRIND PIPE,REWIRE	01	NW	10/30/90
E	MESH,WIRE,STEEL,CEMENT MORTAR	ADD STEEL,CEMENT MORTAR,FRAGS	01	NW	10/31/90
E	SIKADUR23;DC3145;RTV162	BOND FRAGS;GLASS;POTTERY	01	NW	11/07/90
E	FOAM, DC738	CLEAN,ADD FOAM/FILL W/SILICONE	01	SE	11/01/89
E	DC 738, W/50% SAND/PIGMENT	CLEAN,FILL W/FOAM,SILICONE	01	SE	11/02/89
E	RTV 738 PURE FROM TUBE	ADHESIVE FOR POTTERY/MORTAR	01	SE	11/02/89
E	RTV 162 FROM TUBE	ADHESIVE TO POT/MORTAR/GLASS	01	SE	11/07/89
E	GE RTV 162 CRACK-FILLING	CLEAN/DEGREASE,FOAM,SILICONE	01	SE	11/10/89
E	DC 739 SILICONE W/SAND/PIGMENT	CLEAN,ADD FOAM,CRACK-FILLING	01	SE	11/15/89
E	DC 738 SILICONE W/50% SAND	CLEAN/FILL CRACKS	01	SE	3/19/90
E	MESH,CEMENT (OK SAND)	ADD MESH,APPLY CEMENT	01	SE	10/16/90
E	GE RTV 162 W/50%SAND/PIGMENT	CLEAN,ADD FOAM/FILL1" RTV COAT	01	SW	11/01/89
E	DC 738, W/50% SAND/PIGMENTS	REMOVE 7 GLASS,FILL,REPLACE	01	SW	11/03/89
E	GE RTV #162	BOND MORTAR IN PLACE	01	SW	11/07/89
E	GE RTV #162 1/4" COAT	FILL/SEAL CRACKS	01	SW	11/10/89
E	DC 738 AND DC739 ADHESIVE	FILL CRACKS,BOND GLASS/MORTAR	01	SW	11/15/89
E	RTV162/GLASS;RTV739/MORTAR	ADHESION FOR MORTAR/GLASS	01	SW	11/15/89
E	NONE	CUT/OPEN/INSPECT ARC BASE/PIPE	01	SW	9/17/90
E	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	SW	9/18/90
E	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	SW	9/24/90
E	CEMENT MORTAR,WIRE TIES	APPLY 2 COATS CEMENT TO FRAGS	01	SW	10/17/90
E	DC 3145,DIST WATER	CLEAN SEA SHELLS	01	SW	11/07/90
E	DURO	REMOVE CRACKED MORTAR,CLEAN	01	SW	11/14/90
E	MESH,CEMENT MORTAR	ADD MESH, ADD COAT OF CEMENT	01	SW	11/21/90
F	ACETONE/GE 162	CLEAN RE-BOND POTTERY	01	NE	5/09/90
F	ACETONE/DC738	CLEAN/FILL CRACKS W/SILICONE	01	NE	5/14/90
F	ACETONE/DC738	CLEAN/FILL CRACK W/SILICONE	01	NE	5/15/90
F	ACETONE,DC 738	CLEAN FILL CRACKS	01	NE	5/16/90
F	DC 738, ACETONE	CLEAN/FILL CRACKS	01	NE	5/21/90
F	ACETONE,FOAM,DC-738 W/SAND #30	CLEAN,ADD FOAM-1 CRACK,FILL	01	NW	5/08/90

ELEV CODE	MATERIALS TECHNOLOGY	TECHNIQUE	BIR SEQ NO.	VIEW ASPECT	DATE
F	DC 738;XYLENE/DF104/B-72	FILL CRACK;CLEAN/CONSOLIDATE O	01	NW	5/09/90
F	ACETONE,DC738	CLEAN/FILL CRACKS	01	NW	5/14/90
F	DC 738;DF104/B-72	FILL CRACK;CLEAN/CONSOLIDATE O	01	NW	5/14/90
F	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	NW	5/15/90
F	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	NW	5/16/90
F	DC 738 SILICONE	CLEAN/FILL CRACK	01	NW	5/21/90
F	FOAM,DC 738/ACETONE	CLEAN,ADD FOAM,FILL W/SILICONE	01	SE	5/07/90
F	DC738/ACETONE	CLEAN/FILL CRACK W/SILICONE	01	SE	5/08/90
F	GE 162;DC 738	BOND POTTERY,CLEAN/FILL CRACKS	01	SE	5/09/90
F	DC 738 SILICONE,ACETONE	CLEAN/FILL CRACKS	01	SE	5/14/90
F	FOAM,ACETONE,DC 738	TEMP FILL,CLEAN FILL CRACKS	01	SE	5/15/90
F	ACETONE, DC 738	CLEAN/FILL CRACK	01	SE	5/16/90
F	ACETONE, DC 738	CLEAN/FILL CRACK	01	SE	5/21/90
F	STEEL REBAR,BOLTS,MESH,CEMENT	REATTACH TOP OF SPIRE	01	SE	11/08/90
F	FOAM,DC 738	CLEAN,ADD FOAM,FILL W/SILICONE	01	SW	5/07/90
F	DC738	CLEAN/FILL CRACK W/SILICONE	01	SW	5/08/90
F	DC738;DF104/B-72	FILL CRACK;CLEAN/CONSOLIDATE O	01	SW	5/09/90
F	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	SW	5/14/90
F	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	SW	5/15/90
F	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	SW	5/16/90
F	ACETONE, DC 738	CLEAN/FILL CRACKS	01	SW	5/21/90
G	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	NE	5/09/90
G	ACETONE, DC 738	CLEAN/FILL CRACK	01	NE	5/16/90
G	ACETONE,DC738	CLEAN/FILL CRACK W/SILICONE	01	SE	5/14/90
G	ACETONE, DC 3145	CLEAN,REBOND ORNAMENTS	01	SE	11/14/90

DATE	MATERIALS TECHNOLOGY	TECHNIQUE	DIR SEQ NO.	VIEW ASPECT
A ELEVATION				
11/13/90	CEMENT MORTAR	ADD COAT OF CEMENT MORTAR	01	N
11/13/90	GRINDER, DURO, ACETONE	REMOVE FRAGS,DERUST,DEGREASE	01	N
11/13/90	WIRE/WIRE MESH	ADD WIRE/MESH AROUND PIPE	01	N
11/14/90	GRINDER	GRIND INSIDE OF FRAGS	01	N
10/09/90	DURO,WATER	GRIND/CHISEL OFF MORTAR FRAGS	01	S
10/09/90	WIRE MESH/WIRE	WRAP MESH/TIE W/WIRE AROUND	01	S
10/15/90	SIKADUR 23	REBOND FRAGMENTS	01	S
9/20/89	ETHANOL/WATER	CLEAN TILES/SHELLS	04	N
B ELEVATION				
10/09/90	DURO,DISTILLED WATER	GRIND/CHISEL OFF MORTAR FRAGS	01	N
10/09/90	WIRE MESH/WIRE	WRAP MESH, TIE W/WIRE AROUND	01	N
10/10/90	SIKADUR 23	REBOND MORTAR-TO-MORTAR FRAGS	01	N
10/16/90	CEMENT MORTAR (#12,#16,#60SAND	APPLY 1ST COATING ON BASE	01	N
10/16/90	CEMENT MORTAR OK SAND MIX	APPLY 2ND COAT,REBOND ORNAMNTS	01	N
10/22/90	DURO, WATER,DISTILLED WATER	DERUST STEEL PIPE,REMOVE MORTR	01	N
10/22/90	MESH,WIRE,ACETONE	CLEAN,WRAP/TIE W/MESH & WIRE	01	N
10/23/90	CEMENT MORTAR	APPLY FINAL CEMENT COAT(OK SND	01	N
10/24/90	GRINDER MAKITA	GRIND MORTAR FRAGS FOR REINSTL	01	N
10/29/90	CEMENT (WHT/GRAY)	REBOND MORTAR FRAGMENTS	01	N
10/30/90	CEMENT MORTAR (WHT/GRAY)	REBOND LAST FRAGMENT OF MORTAR	01	N
10/30/90	GRINDER	DETACH MORTAR FRAGMENTS	01	N
11/05/90	CEMENT MORTAR WHT/GRAY	REBOND MORTAR FRAGMENT TO PIPE	01	N
11/05/90	DURO,WATER,ACETONE	DERUST/DEGREASE STEEL PIPE	01	N
11/05/90	GRINDER	REMOVE MORTAR FRAGMENTS	01	N
11/05/90	MESH.WIRE	ADD MESH/WIRE AROUND PIPE	01	N
11/06/90	CEMENT MORTAR	REBOND MORTAR FRAGMENTS	01	N
11/06/90	GRINDER	GRIND MORTAR FRAGMENT	01	N
11/19/90	CEMENT MORTAR	REBOND MORTAR FRAGS	01	N
11/21/90	CEMENT MORTAR	REBOND MORTAR FRAGS	01	N
11/26/90	DURO, MESH, WIRE	DETACH FRAGS, CLEAN, ADD MESH	01	N
11/26/90	MESH/WIRE	ADD MESH, TIE W/WIRE TO PIPE	01	N
11/27/90	GRINDER	GRIND FRAGS INSIDE FOR REINSTL	01	N
10/16/90	CEMENT (OK SAND), WHITE/GRAY	APPLY 1ST CEMENT COAT	01	S
10/16/90	CEMENT MORTAR (OK SAND)	REATTACH MORTAR FRAGS/2ND COAT	01	S
10/22/90	CEMENT MORTAR	GRIND FRAGS,APPLY CEMENT MORTR	01	S
10/22/90	DURO, GRINDER	DERUST,DETACH MORTAR FRAGS	01	S
10/22/90	DURO,ACETONE,MESH/WIRE	DERUST,ADD MESH/WIRE	01	S
10/24/90	CEMENT MORTAR	APPLY FINAL CEMENT COAT	01	S
10/24/90	GRINDER	DERUST BACK OF MORTAR FRAGS	01	S
10/24/90	WHT/GRAY CEMENT (OK SAND)	REBOND MORTAR FRAGMENT	01	S
10/29/90	CEMENT MORTAR WHT/GRAY	REBOND MORTAR FRAGMENT	01	S
10/30/90	GRINDER	DETACH MORTAR FRAGS	01	S
11/05/90	DURO,WATER,ACETONE	DERUST/DEGREASE PIPE	01	S
11/05/90	MESH,WIRE	ADD MESH/WIRE AROUND PIPE	01	S
11/06/90	CEMENT WHT/GRAY	REBOND MORTAR FRAGMENT	01	S
11/06/90	GRINDER	GRIND FRAGS FROM SPIRE BASE	01	S
11/07/90	CEMENT MORTAR WHT/GRAY	REBOND MORTAR FRAGMENTS	01	S
11/13/90	CEMENT MORTAR	ADD COAT OF CEMENT MORTAR	01	S
11/13/90	DURO, ACETONE	DETACH FRAGS,DERUST,DEGREASE	01	S

DATE	MATERIALS TECHNOLOGY	TECHNIQUE	DIR SEQ NO.	VIEW ASPECT
B ELEVATION				
11/13/90	WIRE/MESH	ADD MESH,TIE W/WIRE	01	S
11/14/90	GRINDER	GRIND INSIDE SURFACE OF FRAGS	01	S
11/19/90	CEMENT MORTAR	REBOND FRAGS TO SPIRE BASE	01	S
11/21/90	CEMENT MORTAR	REBOND MORTAR FRAGS	01	S
11/26/90	DURO,ACETONE,GRINDER	DETACH FRAGS,DERUST PIPE	01	S
11/26/90	MESH/WIRE	ADD MESH.TIE W/WIRE TO PIPE	01	S
11/27/90	CEMENT	ADD CEMENT, REBOND FRAGS	01	S
11/27/90	GRINDER	GRIND INSIDE OF FRAGS	01	S
11/26/90	DURO,MESH,SIKADUR 23,GE 162	DETACH MORTAR,DERUST,REBOND	02	N
10/05/89	GE DF104/B-72 BOL.COCKTAIL	CONSOLIDATE SEA SHELLS 2 COATS	03	N
8/07/89	ETHANOL/WATER	CLEAN ABALONE SHELLS	03	S
5/30/90	ACETONE,DC738	CLEAN/FILL CRACKS	03	S
5/31/90	ACETONE,DURO,FOAM,GE162,DC738	REBOND MORTAR,CLEAN/FILL CRACK	03	S
6/14/90	FOAM, ACETONE, DC 738	CLEAN,ADD FOAM, SEAL W/SILICON	03	S
6/18/90	ACETONE,DC 738	CLEAN/FILL CRACKS	04	S
C ELEVATION				
8/09/89	ETHANOL/WATER	CLEAN SEA SHELLS	01	EEE
9/18/89	ETHANOL & BRUSH	CLEAN SHELLS/REMOVE LOOSE MORT	01	EEE
10/19/89	ETHYL ALCOHOL	CLEAN/DEGREASE FOR ADHESIVES	01	EEE
10/25/89	GE 162 SILICONE ADHESIVE/FILLR	ADHESIVE ON TILES/MORTAR	01	EEE
10/26/89	GE RTV 162 WHITE	ADHESIVE/FILL CRACKS BOND TILE	01	EEE
3/26/90		OPEN CRACK,REMOVE COVERING	01	EEE
5/15/90	DURO	REMOVE COVER/DERUST	01	EEE
5/29/90	GE 162	REBOND TILES	01	EEE
6/04/90	GE 162,ACETONE,H2O	REBOND MORTAR	01	EEE
6/05/90	GE RTV 162 SILICONE	CLEAN/BOND TILES	01	EEE
6/07/90	CEMENT MORTAR	REBOND TILES,FILL CRACKS	01	EEE
6/11/90	GE RTV 162 SILICONE	REBOND TILES	01	EEE
6/12/90	CEMENT MORTAR	REBOND ORNAMENTS/BOND JOINT	01	EEE
6/12/90	CEMENT MORTAR,NEW STEEL BAND	REBOND TILE/POTTERY/MORTAR	01	EEE
6/13/90	ETHANOL,H2O,CEMENT MORTAR	CLEAN,REBOND TILE	01	EEE
6/26/90	GE 162	REBOND TILE	01	EEE
7/17/90	STEEL RING,MESH,BOLTS	REMOVE,REPLACE MAJH02 STEEL	01	EEE
7/25/90	GE RTV 162 SILICONE	REBOND MORTAR FRAGMENTS	01	EEE
8/01/90	ACETONE	CLEAN TILES/POTTERY	01	EEE
8/06/90	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	EEE
8/06/90	SIKADUR 31 HI-MOD EPOXY,ACETON	CLEAN,REBOND MORTAR FRAGMENTS	01	EEE
8/07/90	ACETONE, DC 3145 RTV SILICONE	CLEAN,REATTACH TILES	01	EEE
8/08/90	DURO	CUT DAMAGED BAND,DE-RUST	01	EEE
8/13/90	ACETONE, GE 162 SILICONE	CLEAN,REBOND TILES TO MORTAR	01	EEE
8/13/90	CEMENT MORTAR 1:1 16/60 SAND	BUILD-UP MORTAR COVER	01	EEE
8/13/90	CEMENT MORTAR,NEW MESH	ADD NEW MESH,REATTACH MORTAR	01	EEE
8/15/90	CEMENT MORTAR 1:1 16/60 SAND	REBOND TILE TO MORTAR	01	EEE
8/20/90	CEMENT MORTAR	REBOND MORTAR/ORNAMENT COVER	01	EEE
8/21/90	CEMENT MORTAR	ADD 1/4" COAT OF CEMENT MORTAR	01	EEE
8/22/90	CEMENT MORTAR	ADD 1/4" CEMENT MORTAR COAT	01	EEE
9/04/90	GE 162,ACETONE	CLEAN,REBOND ORNAMENTS	01	EEE
9/05/90	GE 162 SILICONE	REBOND TILES TO MORTAR	01	EEE
6/01/90	GE RTV 162 SILICONE	REBOND POTTERY FRAGMENTS	01	NE
6/07/90	GE RTV 162 SILICONE	REBOND TILE	01	NE

DATE	MATERIALS TECHNOLOGY	TECHNIQUE	DIR SEQ NO.	VIEW ASPECT
C ELEVATION				
6/12/90	ZRC,CEMENT MORTAR,REBAR,MESH	REPLACE REBAR,MESH,REBOND ORIG	01	NE
6/14/90	GE162,CEMENT MORTAR	ADD CEMENT MORTAR TO JT,REBOND	01	NE
6/26/90	DIST.H2O,GE 162	CLEAN/REBOND TILES	01	NE
7/30/90	CEMENT MORTAR/#16 & 60 SAND	REBOND MORTAR FRAGMENT	01	NE
8/14/90	CEMENT MORTAR 1:1 SAND 16/60	REBOND MORTAR/ORNAMENTS	01	NE
8/20/90	CEMENT MORTAR	GRIND,REBOND MORTAR/ORNAMENTS	01	NE
9/10/90	CEMENT MORTAR	REBOND TILES TO NEW MESH	01	NE
8/09/89	WATER/ETHANOL	CLEAN LARGE/SMALL SHELLS	01	NW
9/18/89	WATER/ALCOHOL/BOLOGNA COCKTAIL	CLEAN/CONSOLIDATE SHELLS	01	NW
10/25/89	GE RTV 162 SILICONE	ADHESIVE/FILL MORTAR/REBAR	01	NW
3/28/90	GE 162 SILICONE/ACETONE	CLEAN/BOND POTTERY FRAGS	01	NW
5/16/90	DURO	DISSEMBLE MAJH01,DERUST	01	NW
5/21/90	BRASSO,DISTILLED WATER	DETACH/CLEAN TILES	01	NW
5/21/90	DURO,STEEL BOLTS/NUTS	DERUST/TEMP REATTACH MAJH01	01	NW
5/24/90	GE 162,ACETONE	CLEAN/REBOND TILES	01	NW
5/29/90	ACETONE, GE 162	CLEAN/REBOND TILES	01	NW
6/04/90	ACETONE,H2O,GE 162	REBOND MORTAR	01	NW
6/04/90	CEMENT MORTAR	REBOND MORTAR TO MEMBER	01	NW
6/07/90	STEEL,MESH,CEMENT MORTAR,DURO	REASSEMBLE MORTAR TO MEMBER	01	NW
6/12/90	STEEL,4 BOLTS,CEMENT MORTAR	REPLACE REBAR/MESH IN BAND	01	NW
6/13/90	CEMENT MORTAR,REBAR,MESH	RESTORE BAND COVERINGS	01	NW
6/26/90	DIST.H2O,ACETONE,GE 162	CLEAN/REBOND TILES	01	NW
6/27/90	JAHN M70, GE 162	REBOND TILE,FILL CRACKS	01	NW
7/18/90	DURO,STEEL RING,MESH,BOLTS	REPLACE RING SECTION	01	NW
7/25/90	ACETONE,DC 3145 RTV	REBOND CHINA GLASS	01	NW
7/25/90	CEMENT MORTAR #30 SAND	REBOND MORTAR FRAGMENTS	01	NW
7/31/90	ACETONE,GE 162	REBOND TILES	01	NW
8/13/90	CEMENT MORTAR SAND 1:1,MESH	CLEAN,ADD NEW MESH,REBOND MRTR	01	NW
8/21/90	CEMENT MORTAR	ADD 1/4" CEMENT MORTAR COAT	01	NW
8/09/89	WATER/ETHANOL BRUSH/COTTON SWA	CLEAN SEA SHELLS	01	SW
9/25/89	ETHANOL/ACETONE	CLEAN SEA SHELLS/TILES	01	SW
10/25/89	GE RTV 162 SILICONE	ADHESIVE FOR TILES/MORTAR FRAG	01	SW
5/29/90	GRINDER BLADE	CUT OPEN COVERING OF BAND	01	SW
5/30/90	BRASSO,ETHANOL	CLEAN TILES/MORTAR	01	SW
5/30/90	BRASSO,ETHANOL,H2O	CLEAN TILES/MORTAR	01	SW
5/30/90	BRASSO,ETHANOL,H2O	CLEAN TILES/MORTAR	01	SW
6/04/90	CEMENT MORTAR	CLEAN/REBOND MORTAR/TILES	01	SW
6/04/90	GE 162,ETHANOL,H2O	REBOND TILE/MORTAR	01	SW
6/05/90	GE RTV 162,ACETONE	CLEAN,REBOND MORTAR/POTTERY	01	SW
6/06/90	DURO,WATER	REPLACE STEEL REINFORCEMENT	01	SW
6/07/90	CEMENT MORTAR	REBOND TILES	01	SW
6/11/90	CEMENT MORTAR	REBOND TILES,FILL GAPS	01	SW
6/12/90	CEMENT MORTAR	REBOND TILES,FILL GAPS	01	SW
6/13/90	DURO,CEMENT MORTAR	DISSEMBLE,DERUST,REBOND/REMESH	01	SW
6/26/90	ETHANOL,ACETONE,GE #162	CLEAN,REBOND TILES	01	SW
6/27/90	GE 162	REBOND TILE	01	SW
7/09/90	WATER/STEEL BRUSH	CLEAN MORTAR/ORNAMENTS	01	SW
7/13/90	STEEL RING,MESH,BOLTS	REPLACE STEEL REINFORCEMENT	01	SW
7/23/90	ACETONE,GE 162	CLEAN,REBOND MORTAR FRAGMENTS	01	SW
7/23/90	ACETONE,GE 162	CLEAN/REBOND MORTAR FRAGMENTS	01	SW
7/23/90	CEMENT MORTAR,STEEL MESH	REASSEMBLE MINV ARC W/CEMENT	01	SW

DATE	MATERIALS TECHNOLOGY	TECHNIQUE	DIR SEQ NO.	VIEW ASPECT
C ELEVATION				
7/23/90	GE 162 RTV SILICONE	REBOND MORTAR FRAGMENTS	01	SW
7/24/90	ACETONE,GE 162	REBOND MORTAR,TILE,POTTERY	01	SW
7/31/90	ACETONE,GE 162	REBOND TILE/POTTERY	01	SW
7/31/90	CEMENT MORTAR W/#30 SAND	REBOND MORTAR FRAGS W/CEMENT	01	SW
7/31/90	CEMENT MORTAR/#30 SAND,ACETONE	OPEN MINV02,CLEAN REBAR,FILL	01	SW
8/01/90	CEMENT MORTAR W/#60 SAND	REBOND MORTAR/POTTERY	01	SW
8/06/90	ACETONE,GRINDER	CLEAN,RECESS REPAIR MORTAR	01	SW
8/06/90	GRINDER	CLEAN-UP REPAIRS,RECESS SURFAC	01	SW
8/07/90	GE 162, BRASSO,ETHANOL,H2O	CLEAN TILE,REBOND TO MORTAR	01	SW
8/13/90	CEMENT MORTAR 1:1,WIRE/MESH	REBOND MORTAR COVER,RE-MESH	01	SW
8/13/90	CEMENT MORTAR-#16/#60 SAND 1:1	REBOND MORTAR TO MORTAR	01	SW
8/15/90	ACETONE,CEMENT MORTAR 1:1 SND	CLEAN, REBOND MORTAR FRAGMENTS	01	SW
8/20/90	CEMENT MORTAR	ADD 1/4" CEMENT MORTAR COAT	01	SW
8/22/90	CEMENT MORTAR	ADD 1/4"CEMENT MORTAR COAT	01	SW
9/04/90	GE 162 SILICONE,ACETONE	CLEAN,REBOND TILES TO MORTAR	01	SW
6/04/90	ACETONE,DC 738	CLEAN/FILL CRACKS	04	NNN
6/11/90	ACETONE,FOAM,DC 738	CLEAN/ADD FOAM,FILL W/SILICONE	04	NNN
6/05/90	ACETONE,DC 738	CLEAN/FILL CRACKS W/SILICONE	04	NW
10/10/89	DC738 & 1/2"FOAM	REBOND/FILL CRACKS	04	SE
10/09/89	GE DF104/ACRYLOID B-72	CONSOLIDATION OF SHELLS	04	SSS
6/12/90	ACETONE,DC 738	CLEAN/FILL CRACKS	04	SSS
6/12/90	ACETONE,DC 738	CLEAN/FILL CRACKS W/SILICONE	04	SW
D ELEVATION				
2/26/90	FOAM, DC 738,ACETONE	CLEAN,ADD FOAM/FILL W/SILICONE	01	NE
8/14/90	SIKADUR 31	DETACH/REATTACH MORTAR W/EPOXY	01	NE
9/12/90	CEMENT MORTAR	REBOND MORTAR/TILES W/CEMENT	01	NE
9/17/90	ACETONE,GE 162	CLEAN,REBOND TILES	01	NE
10/11/90	CEMENT MORTAR	REATTACH MORTAR FRAGMENTS	01	NE
10/25/89	GE RTV 162 ADHESIVE	BOND TILES/SHELLS & FILL CRCKS	01	NW
8/13/90	ACETONE,SIKADUR 23,GE 162	REBOND MORTAR(SIKA23),TILE(162	01	NW
8/14/90	ACETONE, SIKADUR 23	CLEAN,REBOND MORTAR FRAGMENTS	01	NW
8/27/90	ACETONE,SIKADUR 23 LO MOD GEL	REBOND MORTAR FRAGMENTS	01	NW
8/28/90	ACETONE,SIKADUR 23 LO MOD GEL	CLEAN,REBOND MORTAR FRAGMENTS	01	NW
9/05/90	ACETONE,SIKADUR 23 LO MOD GEL	REBOND MORTAR FRAGMENTS	01	NW
9/10/90	ACETONE,SIKADUR 23	CLEAN,REBOND MORTAR FRAGMENTS	01	NW
9/10/90	CEMENT MORTAR	CLEAN,REBOND TILES	01	NW
9/11/90	ACETONE,SIKADUR 23	CLEAN,REBOND MORTAR FRAGMENTS	01	NW
9/12/90	ACETONE,SIKADUR 23	CLEAN/REBOND MORTAR FRAGMENTS	01	NW
9/17/90	ACETONE,SIKADUR 23	CLEAN/REBOND MORTAR FRAGMENTS	01	NW
9/18/90	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	NW
10/16/90	ACETONE,GE RTV 162	REBOND TILES	01	NW
10/23/90	ACETONE,GE RTV162,CEMENT MORTR	CLEAN,REATTACH TILES/REBOND	01	NW
11/05/90	GRINDER,DURO,MESH/WIRE	REMOVE MORTAR,DERUST,ADD MESH	01	NW
2/20/90	ACETONE,DC 738	CLEAN, FILL W/SILICONE	01	SE
8/14/90	ACETONE,SIKADUR 23	REBOND MORTAR FRAGMENTS	01	SE
8/15/90	ACETONE,BRASSO,ETHANOL	GRIND,CLEAN DAMAGED BAND,TILE	01	SE
10/02/90	WATER, CEMENT MORTAR 1:1 SAND	FILL GAPS/CLEAN RESIDUES	01	SE
10/11/90	CEMENT MORTAR,WIRE TIES	TIE, REATTACH MORTAR FRAGMENTS	01	SE
10/11/90	CEMENT MORTAR/WIRE TIES	REATTACH MORTAR FRAGMENTS	01	SE
8/08/90	ETHANOL,SIKADUR23,GE RTV 162	DETACH,CLEAN,REBOND MORTAR/TIL	01	SW

DATE	MATERIALS TECHNOLOGY	TECHNIQUE	DIR SEQ NO.	VIEW ASPECT
D ELEVATION				
8/29/90	ACETONE,SIKADUR 23 LO MOD GEL	REBOND MORTAR FRAGMENTS	01	SW
8/29/90	BRASSO,ACETONE,SIKADUR 23	CLEAN TILES,REBOND MORTAR	01	SW
9/12/90	ACETONE,GE 162	CLEAN/REBOND TILES	01	SW
9/24/90	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	SW
10/01/90	SIKADUR 23,CEMENT MORTAR 1:1	REAFFIX FRAGMENTS/REBOND	01	SW
10/07/90	CEMENT MORTAR	CLEAN & FINISH COAT OF MORTAR	01	SW
10/11/90	WATER	GRIND ROUGH EDGES, CLEAN W/H2O	01	SW
10/18/89	BOLOGNA COCKTAIL	CONSOLIDATE SHELLS	03	SSS
10/12/89	ACRYLOID B-72,DC 738 SILICONE	CLEAN,BOND TILE,FILL CRACK	04	SSS
10/18/89	BOLOGNA COCKTAIL	CONSOLIDATE SHELLS	04	SSS
E ELEVATION				
11/15/89	FOAM,DC739	CLEAN FILL CRACK W/FOAM/739	01	NE
3/19/90	DC 738, W/50% SAND/PGMT ACETON	CLEAN,FILL,ADD SAND	01	NE
9/18/90	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	NE
11/05/90	CEMENT MORTAR	REBOND SEA SHELLS	01	NE
5/24/90	FOAM,GE RTV 162	FILL W/FOAM/162,REBOND MORTAR	01	NW
9/24/90	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	NW
10/29/90	GRINDER.CHISEL,CUTTER	REMOVE RUSTY MORTAR,MESH,WIRE	01	NW
10/30/90	DURO,WATER,GRINDER,MESH,WIRE	DERUST,CLEAN,GRIND PIPE,REWIRE	01	NW
10/31/90	MESH,WIRE,STEEL,CEMENT MORTAR	ADD STEEL,CEMENT MORTAR,FRAGS	01	NW
11/07/90	SIKADUR23;DC3145;RTV162	BOND FRAGS;GLASS;POTTERY	01	NW
11/01/89	FOAM, DC738	CLEAN,ADD FOAM/FILL W/SILICONE	01	SE
11/02/89	DC 738, W/50% SAND/PIGMENT	CLEAN,FILL W/FOAM,SILICONE	01	SE
11/02/89	RTV 738 PURE FROM TUBE	ADHESIVE FOR POTTERY/MORTAR	01	SE
11/07/89	RTV 162 FROM TUBE	ADHESIVE TO POT/MORTAR/GLASS	01	SE
11/10/89	GE RTV 162 CRACK-FILLING	CLEAN/DEGREASE,FOAM,SILICONE	01	SE
11/15/89	DC 739 SILICONE W/SAND/PIGMENT	CLEAN,ADD FOAM,CRACK-FILLING	01	SE
3/19/90	DC 738 SILICONE W/50% SAND	CLEAN/FILL CRACKS	01	SE
10/16/90	MESH,CEMENT (OK SAND)	ADD MESH,APPLY CEMENT	01	SE
11/01/89	GE RTV 162 W/50%SAND/PIGMENT	CLEAN,ADD FOAM/FILL1" RTV COAT	01	SW
11/03/89	DC 738, W/50% SAND/PIGMENTS	REMOVE 7 GLASS,FILL,REPLACE	01	SW
11/07/89	GE RTV #162	BOND MORTAR IN PLACE	01	SW
11/10/89	GE RTV #162 1/4" COAT	FILL/SEAL CRACKS	01	SW
11/15/89	DC 738 AND DC739 ADHESIVE	FILL CRACKS,BOND GLASS/MORTAR	01	SW
11/15/89	RTV162/GLASS;RTV739/MORTAR	ADHESION FOR MORTAR/GLASS	01	SW
9/17/90	NONE	CUT/OPEN/INSPECT ARC BASE/PIPE	01	SW
9/18/90	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	SW
9/24/90	ACETONE, SIKADUR 23	CLEAN, REBOND MORTAR FRAGMENTS	01	SW
10/17/90	CEMENT MORTAR,WIRE TIES	APPLY 2 COATS CEMENT TO FRAGS	01	SW
11/07/90	DC 3145,DIST WATER	CLEAN SEA SHELLS	01	SW
11/14/90	DURO	REMOVE CRACKED MORTAR,CLEAN	01	SW
11/21/90	MESH,CEMENT MORTAR	ADD MESH, ADD COAT OF CEMENT	01	SW
F ELEVATION				
5/09/90	ACETONE/GE 162	CLEAN RE-BOND POTTERY	01	NE
5/14/90	ACETONE/DC738	CLEAN/FILL CRACKS W/SILICONE	01	NE
5/15/90	ACETONE/DC738	CLEAN/FILL CRACK W/SILICONE	01	NE
5/16/90	ACETONE,DC 738	CLEAN FILL CRACKS	01	NE
5/21/90	DC 738, ACETONE	CLEAN/FILL CRACKS	01	NE
5/08/90	ACETONE,FOAM,DC-738 W/SAND #30	CLEAN,ADD FOAM-1 CRACK,FILL	01	NW

DATE	MATERIALS TECHNOLOGY	TECHNIQUE	DIR SEQ NO.	VIEW ASPECT
F ELEVATION				
5/09/90	DC 738;XYLENE/DF104/B-72	FILL CRACK;CLEAN/CONSOLIDATE 0	01	NW
5/14/90	ACETONE,DC738	CLEAN/FILL CRACKS	01	NW
5/14/90	DC 738;DF104/B-72	FILL CRACK;CLEAN/CONSOLIDATE 0	01	NW
5/15/90	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	NW
5/16/90	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	NW
5/21/90	DC 738 SILICONE	CLEAN/FILL CRACK	01	NW
5/07/90	FOAM,DC 738/ACETONE	CLEAN,ADD FOAM,FILL W/SILICONE	01	SE
5/08/90	DC738/ACETONE	CLEAN/FILL CRACK W/SILICONE	01	SE
5/09/90	GE 162;DC 738	BOND POTTERY,CLEAN/FILL CRACKS	01	SE
5/14/90	DC 738 SILICONE,ACETONE	CLEAN/FILL CRACKS	01	SE
5/15/90	FOAM,ACETONE,DC 738	TEMP FILL,CLEAN FILL CRACKS	01	SE
5/16/90	ACETONE, DC 738	CLEAN/FILL CRACK	01	SE
5/21/90	ACETONE, DC 738	CLEAN/FILL CRACK	01	SE
11/08/90	STEEL REBAR,BOLTS,MESH,CEMENT	REATTACH TOP OF SPIRE	01	SE
5/07/90	FOAM,DC 738	CLEAN,ADD FOAM,FILL W/SILICONE	01	SW
5/08/90	DC738	CLEAN/FILL CRACK W/SILICONE	01	SW
5/09/90	DC738;DF104/B-72	FILL CRACK;CLEAN/CONSOLIDATE 0	01	SW
5/14/90	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	SW
5/15/90	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	SW
5/16/90	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	SW
5/21/90	ACETONE, DC 738	CLEAN/FILL CRACKS	01	SW
G ELEVATION				
5/09/90	ACETONE,DC738	CLEAN/FILL CRACKS W/SILICONE	01	NE
5/16/90	ACETONE, DC 738	CLEAN/FILL CRACK	01	NE
5/14/90	ACETONE,DC738	CLEAN/FILL CRACK W/SILICONE	01	SE
11/14/90	ACETONE, DC 3145	CLEAN,REBOND ORNAMENTS	01	SE