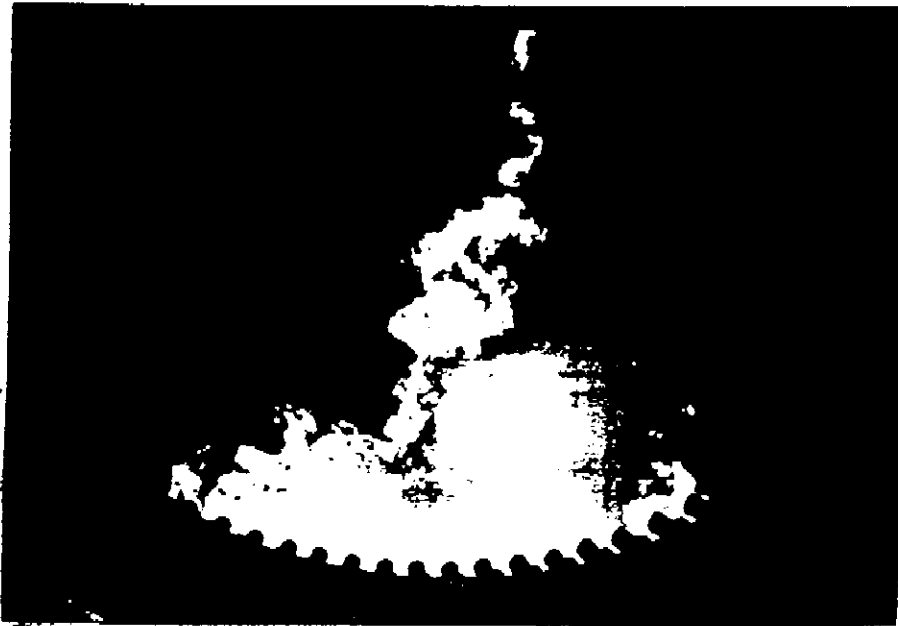


**THE STRUCTURAL STABILIZATION OF THE NEW YORK STATE PAVILION
LOCATED IN FLUSHING MEADOW CORONA PARK, BOROUGH OF QUEENS,
KNOWN AS CONTRACT NUMBERS Q099-1695 TO Q099-1995
DESIGN CONTRACT NUMBER CNYG-195**



Prepared For:

NYC DEPARTMENT OF PARKS & RECREATION

Prepared By:

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October 2, 1996

Q-RE-99-11400 ✓

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SUMMARY OF THE STRUCTURAL STABILIZATION STUDY OF THE NEW YORK STATE PAVILION WHICH IS PREPARED BY JOHN CIARDULLO ASSOCIATES

DATED
/N AS

The New York State Pavilion in Flushing Meadows Corona Park, Queens, was constructed for the 1964-1995 Worlds Fair. The pavilion consists of three parts; the Theaterama, the Tent of Tomorrow with indoor exhibition areas and the Observation Towers. John Ciardullo Associates (JCA) has completed an investigation that includes inspections of the "Tent of Tomorrow" and the "Towers".

2, 1996

The Tent of Tomorrow

The compression and tension rings are structurally sound. The concrete columns and pile caps are also structurally sound. However, the untreated wood piles have continued to deteriorate since 1992 investigation by Geiger Engineers. Due to the continued rot of the supporting wood piles immediate action must be taken to secure the Tent of Tomorrow from further deterioration and collapse. JCA recommends that in the best interest of the City, and for the safety of the general public, that an emergency contract for either stabilization or demolition of the Tent of Tomorrow be issued forthwith. The cost to stabilize the foundations of the columns by pile replacement will cost between \$2,538,496.00 and \$3,654,416.00.

The Exhibition Space

JCA documented the deficiencies present in the perimeter structure, its mechanical systems and the promenade. These components are distressed and an overall plan for rehabilitation and reuse must be addressed. However, for the purpose of this report they discuss demolition and reconstruction of the perimeter structure. Since the roof structure is supported on grade beams on pile caps with piles of the same untreated wood, and the walls are supported on spread footings, they recommend demolition of the structure and driving of new steel piles with concrete pile caps, should the need for the existing structure be warranted.

The Observation Towers

The only portion of the Observation Tower that the report investigated was the elevators. One of which appears to be in the locked position at an observation level, and the other is dismantled in its elevator pit. JCA discusses the removal of these elevators and safing off the surrounding area, and the cost is \$12,000.00. Reviewing the cost of reconstruction/stabilization and demolition, the estimates prove to be significantly more than the monies allocated for this work.

Cost Estimate

The cost to demolish the Tent of Tomorrow and the Exhibition Space is included in the report as \$3,654,416.00 which include the complete removal of the structure as well as the grading and seeding of the site. The cost of stabilization/Restoration the Tent of Tomorrow and the Exhibition Space is \$8,178,192.00.

Executive Summary

JCA has completed an investigation that includes inspections of the "Tent of Tomorrow" and the "Towers" associated with the New York State Pavilion in Flushing Meadows Corona Park, with intentions of preparing the following report. The components that make up the Tent of Tomorrow includes the tension and compression rings with cables, the concrete columns, pile caps and wood piles. The exhibition space and roof promenade are constructed of non-bearing masonry walls on spread footings enclosing the one story structure, the roof deck and steel columns supported on pile caps and wood piles. The Observation Tower investigated is limited to the two elevators that once accessed three observation platforms.

The Tent of Tomorrow

The compression and tension rings are structurally sound, requiring minor repairs and paint. The associated cables would require replacement should a roof be added. The concrete columns require minimal concrete patch, but are structurally sound. The pile caps are also structurally sound. However, the untreated wood piles have continued to deteriorate since the 1992 investigation by Geiger Engineers. The continued wood rot has reduced the solid wood diameter from 12" to 6". The reduction of the pile area due to the soft rot reduces the ability of the pile to support the existing dead load. Our calculations demonstrate that with the reduced piles' capacity, with full lateral support, it is questionable that the soft rot can laterally support the wood pile, since buckling may result in the collapse of the structure. Due to the continued rot of the supporting wood piles immediate action must be taken to secure the Tent of Tomorrow from further deterioration and collapse. Presently, the threat of collapse exists, as does damage to the Theaterama and the public. JCA recommends that in the best interest of the City, and for the safety of the general public, that an emergency contract for either stabilization or demolition of the Tent of Tomorrow be issued forthwith.

The Exhibition Space

JCA documented the deficiencies present in the perimeter structure, its mechanical systems and the promenade. These components are distressed and an overall plan for rehabilitation and reuse must be addressed. However, for the purpose of this report we discuss demolition and reconstruction of the perimeter structure. Since the roof structure is supported on grade beams on

pile caps with piles of the same untreated wood, and the walls are supported on spread footings, we recommend demolition of the structure and driving of new steel piles with concrete pile caps. should the need for the existing structure be warranted. It is cost prohibitive to try to repair the damage that already exists and obtain a Certificate of Occupancy for the Exhibition Space, and while the condition will worsen with time, the one story structure doesn't pose the same threats that the wood piles of the ten story tent structure poses. The loading here is substantially less.

The Observation Towers

The only portion of the Observation Towers that our report investigated was the elevators, one of which appears to be in the locked position at an observation level, and the other is dismantled in its elevator pit. JCA discusses the removal of these elevators and safing off the surrounding area.

Reviewing the costs of reconstruction/stabilization and demolition, the estimates prove to be significantly more than the monies allocated for this work. We await further direction prior to proceeding with scheduling the required meetings with the Community Boards and the Borough President, as outlined in our scope of work.

Estimate Data

The cost to stabilize the foundations of the columns by pile replacement as indicated in this report will cost between \$2,538,496.00 and \$3,788,800.00. Contract documents for this emergency work should be prepared and a contract issued as soon as possible.

The cost to demolish the Pavilion (with the exception of the three towers) is included in this report as \$3,654,416.00. This would include the complete removal of the structure as well as the grading and seeding of the site.

The cost for the balance of the stabilization/restoration work required at the pavilion is estimated in this report to be \$4,389,392.00

All estimates exclude costs for removal of hazardous material.

Introduction

The New York State Pavilion in Flushing Meadows Corona Park, Queens, was constructed for the 1964-1965 Worlds Fair. The Pavilion consists of three parts; the Theaterama, the Tent of Tomorrow with indoor exhibition areas and the Observation Towers. Apart from the "Theaterama," the NYS Pavilion is in a state of gross deterioration. It requires immediate stabilization to maintain its mere existence, let alone enable future use.

The scope of our contract includes investigation of the structural integrity of the Tent of Tomorrow, the Exhibition Spaces and that of the Observation Towers. We will address these components separately in terms of documentation of existing conditions. We will make recommendations for reconstruction/stabilization about an entire capital improvement project with respect to safety, the community's needs and visions for future uses.

I. Existing Documentation

The materials available to us for documenting the Tent of Tomorrow and the Observation Tower included the following:

- Partial Sets of Architectural Drawings
- Partial Sets of Mechanical Drawings
- Partial Sets of Electrical Drawings
- 1992 Structural Report prepared by Geiger Engineers.

II. Method of Investigation

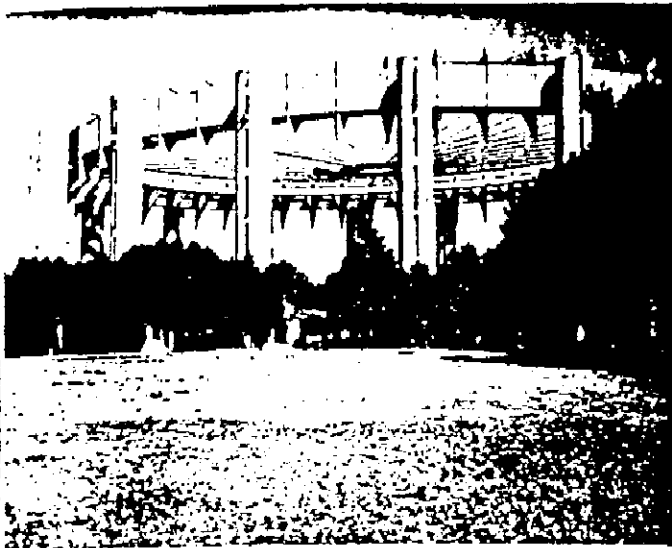
Due to the limited resources available from DPR, we sought and obtained the following:

A. Structural Drawings (obtained from Lev Zetlin Associates, the Engineer of Record)

- Pile Cap and grade beams drawings supporting the Promenade Level
- Cable Drawing for Tent
- Conversations with LZA indicated that steel piles were used to supplement the bearing capacity of the wood piles.

B. Soil boring logs were obtained from the USTA construction documentation

- Boring logs confirmed a bearing layer at 75'-80' below



grade.

- Boring logs confirmed a good bearing strata at 150' below grade.

C. Based on the above documentation, JCA conducted several on site field investigations. Two concrete columns (Column 'C' and Column 'K') were designated as representative of the structure on the site. At each column location, excavation was performed and the existing conditions were documented with respect to the condition of the surface material of the individual piles in the cluster, the pile cap and the surrounding water and soil conditions.

- Inspection pits were constructed.
- Visual inspections were substantiated with site photographs.
- Timber piles were exposed at representative locations and the piles were probed for depth of deterioration.
- Soil conditions were documented by means of visual inspection.

D. The Cables of the Compression and Tension Ring of the suspended structure were inspected in the field by JCA using a two person, 120' boom.

- All of the Tension Ring cable connections were visually inspected, and photographed.
- At the Compression Ring five cable connections were visually inspected and photographed.
- All of the typical steel sections of the Tension and Compression Rings were measured, and documented for use in calculations for actual dead loads.
- The bearing plates at two columns were inspected and documented.
- The cables were visually inspected, measured and photographed.

III. Pavilion components

A. The Tent of Tomorrow:

This is a large oval structure with an overhead cable suspension structure that supported a plexiglass roof during its use in the World's Fair. The circular space beneath the suspension structure was at one time covered with an oversized terrazzo map of New York State, which is deteriorated and beyond repair. This space was used for outdoor performances and roller skating after the World's Fair. Our report will investigate the following components of the Tent of Tomorrow:

1. Pile foundations Supporting Tent Columns
 - a) Existing Conditions of pile caps and piles
 - b) Load bearing Capacity
 - c) Longevity
 - d) Recommendations/Stabilization methods
 - e) Cost estimate to stabilize pile caps and piles
2. Roof Cables and Perimeter Ring Steel Structure
 - a) Existing Conditions
 - b) Stabilization/Reconstruction
 - c) Cost estimate to stabilize cable structure
3. Exhibition Space

The Exhibition Space consists of concrete masonry walls making up the perimeter structure wherein individual areas are sectioned off and toilet facilities exist. Above the actual structure a Roof Promenade comprises the upper level, which is accessed via stairways which are in a state of deterioration and currently pose a safety hazard.

- a) Concrete Masonry Walls (Perimeter Structure)
 - 1) Existing Conditions
 - 2) Stabilization/Reconstruction Options
- b) Roof Promenade of Perimeter Concrete Structure
 - 1) Existing Conditions
 - 2) Stabilization/Reconstruction Options

c) **Stairways to Promenade**

- 1) Existing Conditions
- 2) Removal Implications
- 3) Stabilization/Reconstruction Options

d) **Central Court Pavement**

- 1) Existing Conditions
- 2) Stabilization/Reconstruction Options

e) **Utilities/Building Systems**

- 1) Existing Conditions
- 2) Reconstruction/Upgrade Recommendations

f) **Cost of Stabilization of Exhibition Space**

B. The Observation Towers Elevators

The Towers consist of three observation platforms that were accessed by two elevators, as well as stairs and platforms. The towers and the elevators have been unused for at least 20 years. The extent of this investigation will only include the elevators, with respect to removing and/or securing them to insure the public's safety, and with consideration for future use.

1. **Towers**

- 1) Existing Conditions

2. **Elevators**

- a) Existing Conditions
- b) Recommendations
- c) Cost Estimate to Remove Elevators

IV. Cost Estimates

A. Costs of the Stabilization/Restoration of the New York State Pavilion

B. Demolition of the New York State Pavilion

A. The Tent of Tomorrow

1. Pile Foundations Supporting Tent Columns

Description

The Tent of Tomorrow is composed of 16 concrete columns arranged in an oval plan. Each column is a 12" thick cylindrical wall with an outside diameter of 12'-0", and is supported by a rectangular 4'-0" deep concrete pile cap. Each pile cap is supported by a cluster of wood piles. From the contract documents we have determined that a minimum of 26 piles make up each of the pile clusters. In addition, it was reported by Charles Thornton of the Structural Engineering firm of Lev Zetlin Associates. Thornton Tomasetti located at 641 6th Avenue, New York, New York 10011 that in addition to the 26 wood piles, up to four steel H piles were installed at each pile cap location to supplement the wood piles, some of which failed to reach the expected bearing capacity when driven to full length. Only one of these steel piles was discovered during the pile investigation and their impact on the adequacy of the existing pile cap foundations was ignored for the purpose of this study due to the fact that their exact locations are unknown and there may be pile cap pile clusters that do not contain any steel piles.

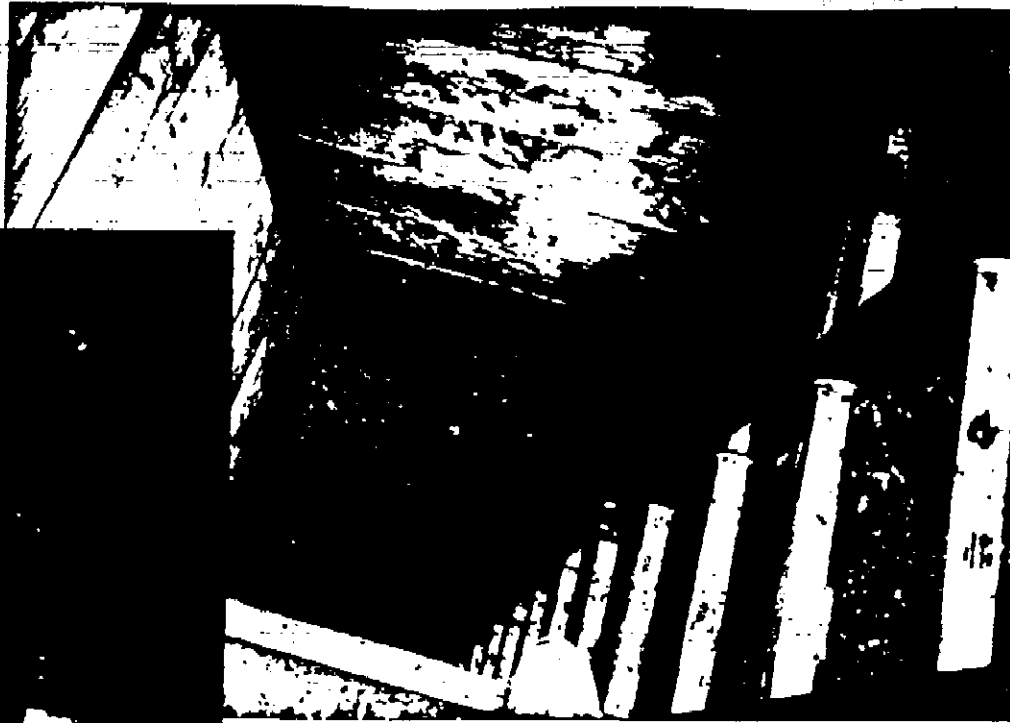
a) Existing Conditions of Pile Caps and Piles

- 1) Column C is supported by a pile cap on a pile cluster. The investigation pit excavated here exposed three untreated timber piles, A, B and C, and one "H" pile, D. At the location of our test pit, the bottom of the pile cap was 18" below grade, at the point of connection to pile cap.

- The concrete pile cap was visually inspected and showed no signs of distress.
- Piles A, B and C had a butt diameter of 13" below the pile cut off, with a 12-1/2" butt diameter at the water level. All piles were surrounded by soil containing tree roots (some of which penetrated the timber piles) and cinder materials.



1. View of test pit @ column C



2. Looking down test pit

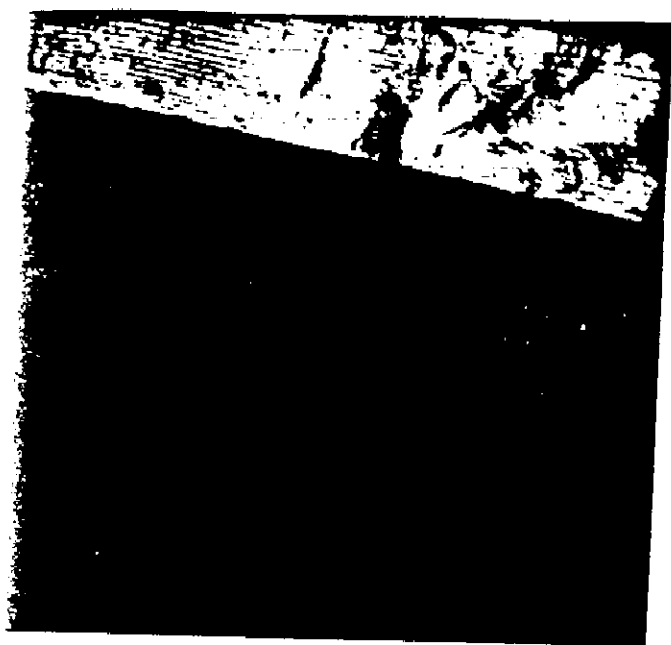


Probing @ deteriorated wood pile.

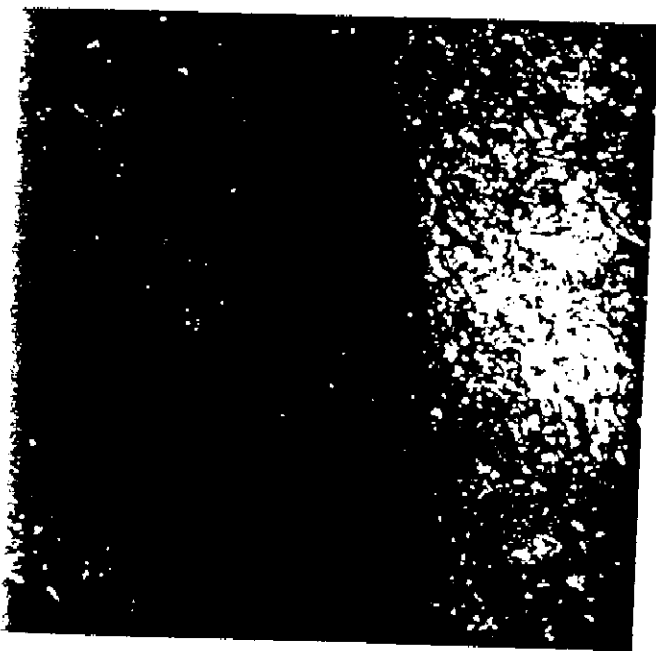


Probing @ deteriorated wood pile

- Pile A was exposed at a depth 3'-0" from the bottom of the pile cap. The pile was probed to a depth of 1-1/2" before a firm surface material was reached. The probed material was soft and rotten. This same pile was probed at a depth of 18'-0" below grade, which was 1'-6" below the water level. Here a probe pushed 1/2" into the pile, of which the probed material was continuously firm.
- Pile B was exposed 3'-0" below from the bottom of the pile cap. This pile was easily probed to a depth of 2-1/2", and with difficulty an additional 3/4" was probed. The surface material was soft and rotten.



4. Wood pile at water level



3. Steel "H" pile

- Pile C was exposed at a depth of 3'-0" from the bottom of the pile cap. The pile was easily probed to a depth of 3" before firm material was reached. The surface material was soft and rotten. At the water level, 18'-0" below grade, a probe was pushed 1/2" into firm material.
- Pile D, a steel pile, was exposed 3'-0" below the bottom of the pile cap and again at the water level, 18'-0" below grade. At both locations, the steel pile exhibits surface rust but is not deteriorated. Pile D is an uncoated A36 steel HP14 x 73 in soil that contains tree roots and cinder materials.

2) Column K is supported by a pile cap on a cluster of piles. The investigation pit excavated here exposed seven untreated timber piles. The pile cap had two horizontal cracks across the full face of the pit (4'-0" wide); these cracks were not recent and showed no sign of slippage or distress.

- Piles E, F, G, H, J, L all had a butt diameter of 12" at both the pile cut-off and at the water level. All piles were exposed at a depth of 3'-0" below the bottom of the pile cap and probed easily to a depth between 2-1/2" - 3-1/4" before firm surface was reached. The surface material is soft and rotten. At the water level, 8'-6" below the pile cap, the piles were probed to a depth of 1/2". The material is firm throughout. The soil material at this column had an odor of acetone. The soil contains roots and cinder material.

→ b) Load Bearing Capacity

1) Piles

- Background

It is assumed that the Theater and the Tent of Tomorrow, which were constructed at the same time are supported by the same type of wood piles. Based on the information available from the Construction Documents for the Queens Theater, the allowable wood pile capacity was 20 tons. During a previous examination, the deterioration of the piles was discussed in reports of an investigation of the Theater performed in 1989, and the 1992 investigation of the Tent of Tomorrow contained an Engineering Report prepared by Geiger Engineers.

- Field Investigation

Our field findings are consistent with the assumptions of Geiger Engineers that predict further deterioration of the wood piles. The

the ground water level. At the water level, however, the wood piles were found to be more stable, and showed a consistent $\frac{1}{2}$ " surface deterioration at the water level. This deterioration at the water level and below has not increased in 4 years, and is compatible with the normal conditions of wood piles intact and under water. The basic friction capacity of the submerged section of pile is stable. However, the area of concern occurs at the pile section between the pile cap and water level. Here a loss of 3" of bearing surface around the wood piles was indicated. This 3" circumferential rot reduces the 12" diameter (113 SF) of the deteriorated pile bearing area to 6" diameter (28 SF) capacity. Thus the 12" diameter wood pile is reduced to a 6" diameter wood pile, with a 76% decrease in bearing capacity.

• **Calculations**

Using the allowable compression stress parallel to the grain of 1200psi (average for western and southern pine), we determined the reduced capacity of each wood pile to be:

$$\frac{1.2 \times 3.14 \times 6 \times 6}{4} = 33.9 \text{ kips/pile}$$
$$= 16.96 \text{ tons/pile.}$$

The capacity is based on lateral bracing from the soil to prevent lateral buckling under the axial load. The length of the wood pile that has rotted is approximately 12'-6", the entire length being surrounded by soft rot and cinder contaminated soil. The total area of the wood pile does give some lateral support, however, it is highly questionable that a wood pile with 3" circumferential rot, with only 6" diameter of solid wood, could develop the capacity of 16.96 tons. Our field investigation also found some steel piles in what appears to be random locations beneath the pile caps. In conversations with the design engineers, they stated that at 70 feet there was soil with sufficient capacity to develop 20 ton wood piles. They also stated that some steel piles were also driven. The reason for this was that some wood piles did not fetch up (developing 20 ton capacity) at the maximum length of the wood piles (90 feet). Since the steel piles are longer they were used to replace the wood piles. The steel piles are structurally sound. However, since an exact number of these piles is unknown, and their bearing capacity and locations beneath the pile cap can not be determined for each column, they cannot be included in this report.



2) Pile Caps

Background

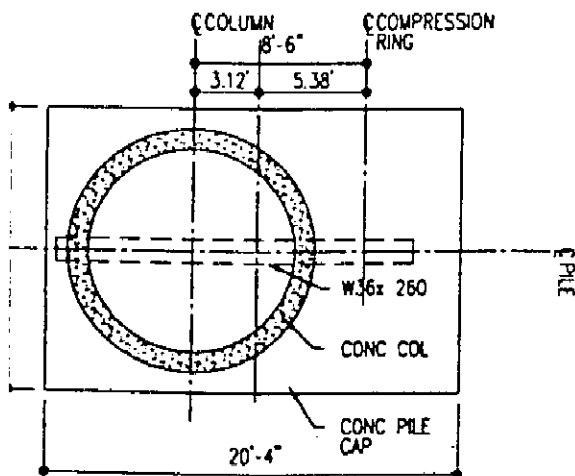
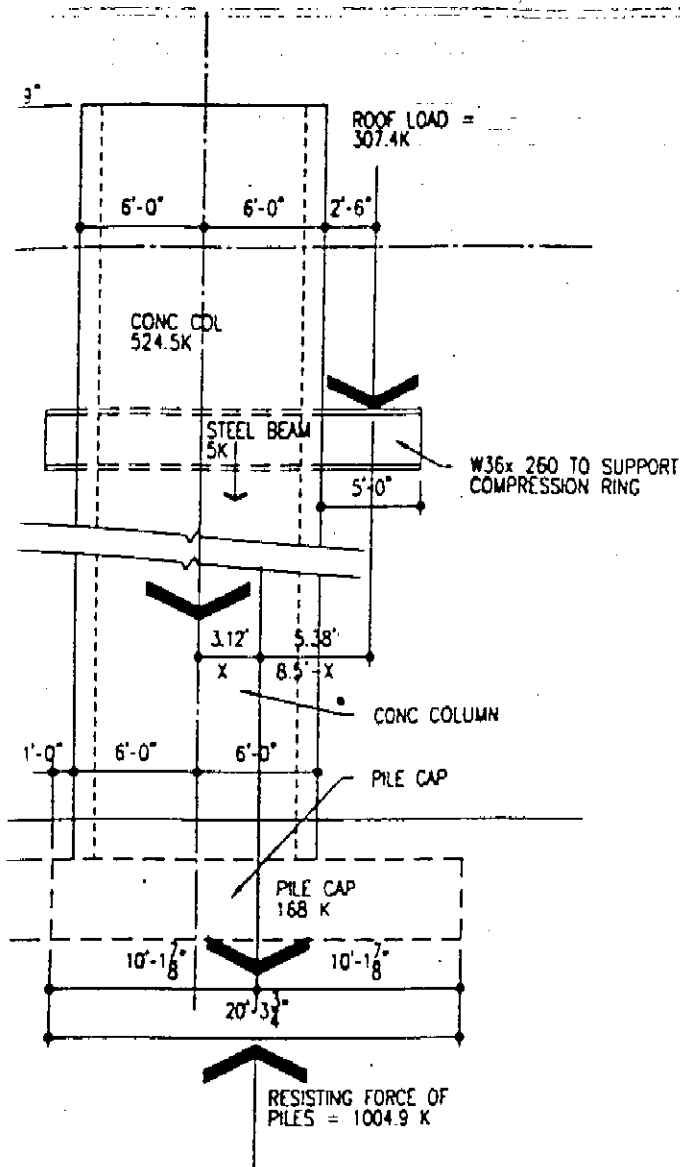
There were no structural drawings for us to research the configuration of the pile cap, or to determine the size and spacing of the piles.

- Working from the roof level down, based upon field measurements for the roof structural members and sizes and the weight of steel, the roof dead loads were calculated. The roof live loads were calculated based upon the building code and snow loading for the area. These were combined and total of the roof dead loads and the live loads were calculated. The total roof load was then distributed to the 16 columns for transfer to the pile caps. The weight of the concrete columns was calculated from the volume of concrete each column contains. The pile caps were likewise measured and calculated and their weight added to the roof and column loads.
- Assuming the minimum number of piles, each acting to resist their design loading, the number of wood piles necessary to support the combined loading was calculated.
- Based upon the calculated load from the roof, the weight of the column and the distance measured between them, the centroid of the pile cap was calculated.

- The actual bearing capacity of the wood piles in their noted condition was calculated based upon the deterioration noted during the field investigation.
- Wood pile capacities are based upon the assumption that they are continuously braced along their length by the soil around them. The existing piles no longer qualify for this assumption since the outer 3 inches of the piles have become spongy and this layer is easily compressed. With a slenderness ratio for a 6" column and an unbraced height of 12'-6", it can no longer be assumed that the piles will continue to support the imposed loading without buckling.
- By this method it was determined that replacement of the existing wood piles with steel piles is necessary to sustain the original design load.

Investigations

- The roof structure, which includes the compression and tension rings and cable structures, was measured and drawn to scale.
- The steel support beams and wide flange members were measured and their locations were documented as forces applied relative to the concrete column.
- Excavation was performed at the pile cap on three of its four sides, and at a portion of some of the existing piles. Using this information we determined the size and weight of the concrete pile cap.



Calculations

In order to determine the number of piles required to support the original design load, the first step was to determine the total dead and live loads.

Loading

Dead loads

1) Roof weight

Tension Ring 120.26kips

Compression Ring:

Outer 1,163.12kips

Inner 730.61kips

Web capes

Misc plates 72.20kips

Total compression ring 2,247.6 kips

Cables & Anchors 129.92kips

Plexiglass roof (5psf @ 53,784) 268.92kips
2,766.7kips

Total= $\frac{2,766.6\text{kips}}{16\text{ columns}} = 172.9\text{kips/col}$

2) Column weight

Area of concrete column=

$$\frac{3.14(12 \times 12) - (10 \times 10)}{4} =$$

$$\frac{3.14(44)}{4} = 34.54\text{sf}$$

Volume of concrete column=

$$34.54 \times 101.25 = 3,497.2\text{cf}$$

Weight of column . $3,497.2 \times 150 = 524.5\text{ kips/col}$

3) Weight of roof support beam

(W36x260)= 5.0kips/col

Weight of pile cap

$14' \times 20' \times 4' \times 150$ 168kips/col

Total dead load/column=

870.4kips/col

Live loads

53.784sf x snow load @ 40psf=

$$\frac{2151.36 \text{ kips}}{16 \text{ columns}} = 134.5 \text{ kips/col}$$

Total load on pile cluster

Live load(870.4)+dead load(134.5)=

1004.9kips/col

$$1004.9 \text{ kips/col} = 502.45 \text{ tons/col}$$

Determining the centroid of the pile cluster, relative to the column since the roof load is applied eccentrically to the column (2'-6" from the face of the concrete column)

Resisting force of pile cluster=

$$1004.9 \text{ kips/col} = 502 \text{ tons/col}$$

We calculated the location of centroid of the pile cluster from the centerline of the concrete column. Taking the moments about the centroid of the pile cluster, which is x feet from the centerline of the concrete column, we can calculate its location.

$$\text{Moments @ centroid} = 0 = 307.4(8.5-x) - (524.5+5)x$$

$$0 = 2612.9 - 307.4x - 529.5x$$

$$x = \frac{2612.9}{836.9} = 3.12 \text{ feet}$$

Required Number of Piles

We calculated the number of 20 ton wood piles required to support the original design load.

$$\text{Number of wood piles} = \frac{502.45 \text{ tons}}{20 \text{ tons/pile}} = 25.12 \text{ piles}$$

26 piles are required.

Capacity of Deteriorated Piles to Support Existing Structure.

We calculated the required capacity of the 26 existing deteriorated wood piles to support the dead load of the structure, excluding the plexiglass roof.

Total dead load-plexiglass roof

$$\frac{870.4 - 268.92}{16 \text{ col}} = 853.6 \text{ kips/col} = 426.8 \text{ tons/column}$$

The capacity of the existing piles with full lateral support;

$$26 \times 16.96 \text{ tons} = 440.96 \text{ tons/col} > 426.8 \text{ tons/col}$$

Therefore, the reduced wood pile, laterally supported, will presently support the structure. However, the lateral support or +/- 3" soft rotted wood is highly questionable when the length of the pile which is rotted is 12'-6". These factors put the pile in danger of buckling.

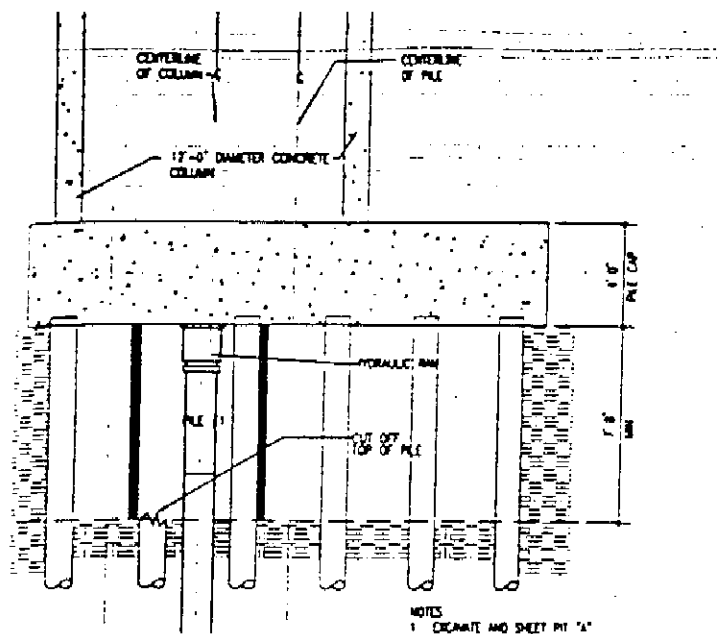
c) Longevity

Based upon our investigations, we propose a stabilization procedure that will result in the maximum long term use and stability, without repeated yearly investigations and monitoring for further deterioration or decay. In other words, we are proposing a permanent solution to revitalize the salvageable components of a once temporary, now historic structure. In order to do this, our calculations are based on the following derived evidence;

- 1) Documented continued deterioration of the piles' bearing capacity.
- 2) The unknown number of the actual piles.
- 3) Our calculations that the existing pile cluster can barely withstand the dead load of the structure.

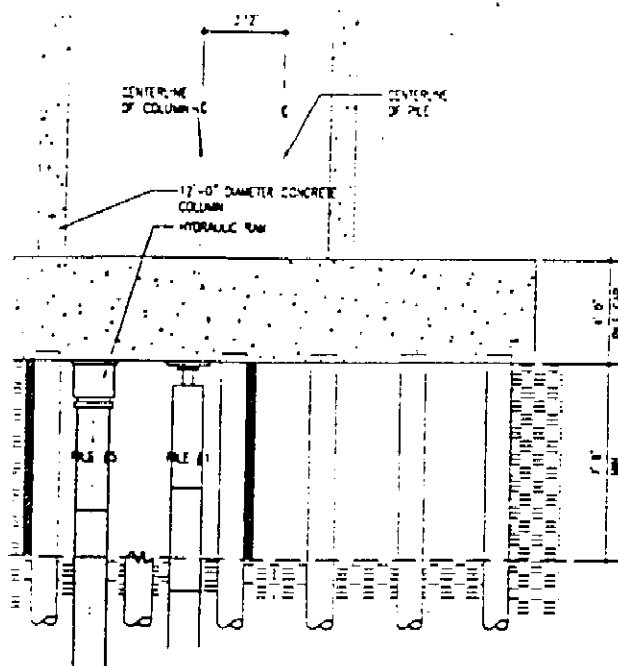
d) Recommendations/Stabilization Methods

We propose the use of steel piles to be installed by hydraulic jacking methods that use the pile caps, columns and steel roof support system as reactions. Replacement steel piles @65 tons jacking in 6' to 8' lengths from bottom of pile cap. We calculated the number of steel piles required to replace the wood piles, and to support the original design load



SECTION THROUGH PILE CAP
FIRST PILE IN QUADRANT
"A" PIT

- NOTES
1. EXCAVATE AND SHEET PIT "A"
 2. JACK PILE TO BEARING STRATUM
CLEAN/PULL PILE
 3. JACK AND TEST TO 150% DESIGN LOAD
HOLD 1 HOUR
 4. TREMIE POUR, BUILD UP PILE TO
WITHIN 8" TO 12" OF UNDERSIDE
OF JACK PLATE
 5. INSERT 10.75" (Ø) x 0.365" (WALL THICKNESS)
CONCRETE FIELDED PIPE POST AND "WEDGE OUT"
TO JACK PLATE (SHIM WEDGES-NO LOAD TRANSFER)
 6. PROCEED TO JACK PILE #2, THEN #3, #4 & #5
AS PER NOTES #1, #2, #3, #4 & #5
 7. EXCAVATE AND SHEET PIT "B"
 8. JACK PILE #6, THEN #7, #8, #9, #10, #11, #12, #13, #14, #15, #16, #17, AND #18



SECTION THROUGH PILE CAP
SECOND PILE IN QUADRANT
"B" PIT

on the column.

Number of piles = $\frac{502.45 \text{ tons/col}}{65 \text{ tons}} = 7.3$ steel piles

We use (8) 65 ton steel piles/column.

Eight new piles, each having a capacity of 65 tons, are to be installed under each of the 16 pile caps. We do not currently have specific soils data for the site and have based our design on information furnished to us that indicates there is a lens of generally granular soil at a depth of about 80 feet below the existing pile caps. This would produce suitable bearing for a closed-end steel pipe pile having an outside diameter of no more than 16 inches. Unless the original borings made for this structure are obtained, it will be necessary to have new borings (one boring at alternate columns, 8 in total) made to clearly identify the soil conditions at the site.

The sketches detail the sequence of operations. Due to the conditions of the existing wood piles, we recommend that only one pile be installed at a time, and that the work progresses from quadrant to quadrant as detailed in design sketches. This procedure will limit, to the maximum extent possible under the circumstances, the exposure to over stressing the remaining wood piles in the cluster. Control measures will be necessary to monitor column settlement during all of this work. To expedite progress we would conduct operations under eight columns concurrently. The time required for the installation would be approximately eight months.

• Alternate Solution Investigated

JCA has investigated several alternate schemes to resolve the instability of the piles. In addition to the underpinning/pile jacking solution previously presented, There is another option that is typically used in similar circumstances which could not be safely employed on this project. This solution involves exposing the existing wood piles.

number of piles are exposed at any time for a total unbraced length of approximately 8'-0". The load bearing capacity of the disturbed wood piles is rapidly replaced with new, tested and certified concrete filled steel piles.

of the Stabilization project may be reduced to approximately 67% of the above cost.

$$\$3,788,800.00 \times 67\% = \$2,538,496.00$$

Cost Estimate to Stabilize Pile Caps and Piles

It has been assumed for this report that the pile caps are supported by untreated wood piles only.

It has been reported by Lev Zetlin's successor, Charles Thornton and confirmed by examination that a number of steel H piles have also been installed at undetermined locations throughout the structure and that from our investigation that the condition of these steel piles is much better than that of the wood piles.

If we ignore the presence of these piles and the bearing capacity they represent, then we must assume that 8 new steel tube "jack" piles are required at each pile cap.

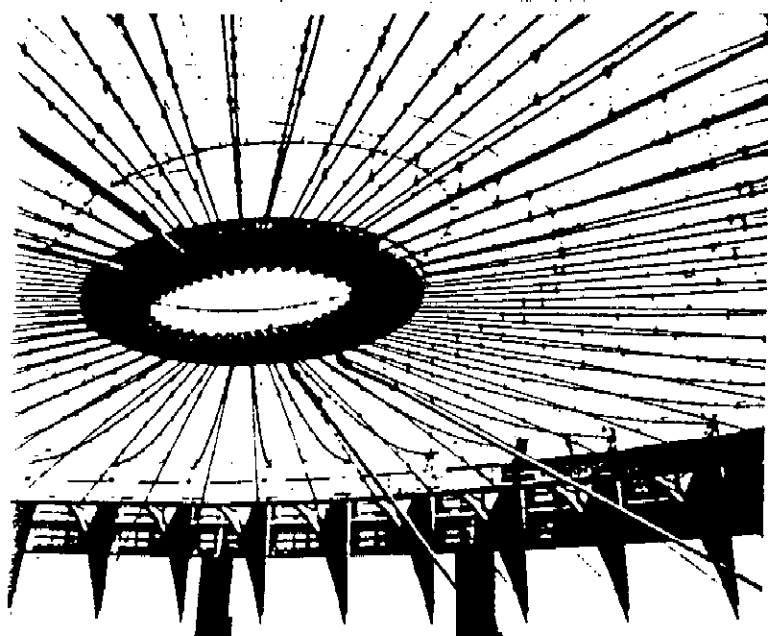
70/ft of pile jacked, excavated, backfilled and stored

$$\text{cols} \times 8 \text{ piles} \times 80 \text{ ft. deep} @ \$370/\text{ft} = \$3,788,800$$

In the event that additional steel H piles are discovered during the jack pile installation process, then the number of "jack" piles required may be reduced at these locations reducing the overall cost of the project significantly.

The actual capacity of these steel H piles when found must be determined by testing.

To accurately assess the impact of these steel piles on the stabilization project cost without documentation is impossible without excavating every pile cap. However, if we assume that 4 H piles are found at each pile cap and if we assume that the bearing capacity of these piles is equal to or greater than one steel "jack" pile, then the cost



2. Roof Cables and Perimeter Ring Steel Structure

Description

The roof structure for the pavilion is an elliptical dampened catenary suspension roof system composed of a central tension ring, and an external trussed, compression ring with double catenary cables spanning the distance between them. This entire structure is supported on 16 cylindrical concrete columns surrounding the pavilion. The original design included a plexiglass roof of which only fragments remain attached to the roof drain gutter located in the tension ring.

- The upper cables that support all of the gravity loading on the roof structure are 2 1/4" diameter. The lower cables stabilize the upper cables and act to resist wind uplift forces on the roof and dampen wind induced resonance roof oscillations .
- The tension ring is suspended above the pavilion floor somewhat below the central axis of the cable structure. Threaded tensioning anchors project on the inside of the elliptical ring.
- The Compression ring around the perimeter of the roof is elaborated and serves an aesthetic purpose beyond the basic structural functional requirements. In essence the compression ring is fabricated like an elliptical truss with an outer 14' high outer chord and a much smaller inner chord member. The interior web members of this truss consist of stiffened sculptural steel plates.
- All of the vertical roof loads and horizontal cable tension forces are resolved in this roof structure. Live and dead loads are transferred to the outer compression ring member for transfer to the columns. The oval cable structure is similar in some ways to a spoked bicycle tire rim, where the rim holding the tire is in compression and the hub around the axle is in constant



tension. All the roof live and dead loads are transferred horizontally through the roof system to the outer chord of the compression ring. From this ring, these loads are transferred vertically to the 16 concrete columns that surround the structure. The roof loads are applied eccentrically to the columns and as a result of this eccentric loading, the pile caps are also eccentric to the concrete columns and transfer their own weight plus that of the superimposed column and roof loading to the pile foundations.

a) Existing Conditions

Upon close inspection of the various parts of the structure from a boom lift, it appears that the overall condition of the steel work is fair. Much of the steel is still protected to some degree by paint. There are also many exposed and rusted areas that can be found on the steel where the paint has failed. For the most part this rusting can be clearly seen to be superficial due to the thickness of the existing steel plates, however, there are also several key areas which are now hidden and must be re-evaluated after the rust, scale and bird debris is completely removed from the inside and tops of many of the horizontal steel work. The following conditions were noted in connection with the structural steel plates and shapes used in the roof construction:

- 1) The bearing pads between the column structure and the compression ring appear to be intact. No further investigation was required based upon the noted conditions visible from the boom at 2 locations plus visual inspection of the balance of the pads with binoculars from the ground.
- 2) The outer compression ring has the most significant deposits of bird debris. This debris has been noted to be up to 5 inches deep in some areas. Due to the quantity of this material it was impossible to ascertain the amount of damage caused by this material on the steel surfaces below it. This material is evident on almost all horizontal plates and may exhibit the worst corrosion found on the roof structure itself. The inner chord member of the compression ring is box shaped and provides a good nesting site for birds due to the





fact that the inside of the box is protected on three sides from the weather has also allowed the collection of bird debris there. Part of the fluted steel plates that compose the diagonal members of the compression ring are approximately 1/4" thick. These plates appear to be severely rusted at the bottom intersection of these plates and the thicker 1/2" plates that compose the outer 36" of these fluted plates. The bottom corners of these plates appear to be separating from the stiffening beams behind them due to oxidization pressure between the steel beams and steel plates.

- 3) The tension ring steel and cable anchors appear in good condition due to the fact that there is less room for birds to land and roost in the cables and steel structure, and it is less protected from the rain and wind. There are remnants of the steel rain gutter still attached to this ring on the top and outside edge. This gutter is completely rusted away for the most part and the steel clips that hold it in place have also been rusted completely through. The roof drain pipes are still in place and appear to be in fair condition.



- 4) The upper cables and their anchor points are in fair condition. however, it was noted that the entire length of the bottom of this cable is red with rust colored stains. This indicates that this cable as well as the lower cables have lost their galvanized coating in some places and have been subject to corrosion for some time. This indication of interior rust casts some doubt on the cable's ultimate capacity. It would be prudent to assume that these cables have a diminished capacity at this point and to replace these cables if a roof structure will be attached to it. Unlike the lower cable connections, no broken strands were noted at the two top cable connections inspected with the boom crane or at those inspected from the ground with binoculars. This could be due to the fact that precipitation flows down the cables away from the exterior anchor points as well as from the connections to the central tension ring.



5) The worst visible damage that has occurred to the cable roof structure is that damage found at the compression ring lower cable attachment points. The action of weather and bird debris at these points may be magnified due to the fact that any precipitation landing on the lower cable runs off at these points. The damage noted at these locations is more severe corrosion than can be found anywhere else on the cables and it has progressed to the point where one or more of the exterior cable strands in each cable bundle have completely failed at approximately 27 of the total 48 of these connections. At the two locations where a close inspection was made, approximately 9 to 12 of these strands had completely failed. This may represent an approximately 6% to 10% of the total cable thickness. Although these lower cables do not directly support the roof structure, they are necessary for the stability of the structure and are necessary to maintain the current shape and the equilibrium of all forces in the tensile structure. In this capacity, these cables are maintained under a considerable amount of tension at all times.



6) The tie cables which connect the upper and lower cables and stabilize the structure are in very poor condition. These cables were small in diameter to begin with and cannot continue to function with a diminution of cross sectional area. At least one of these cables has completely snapped and failed.

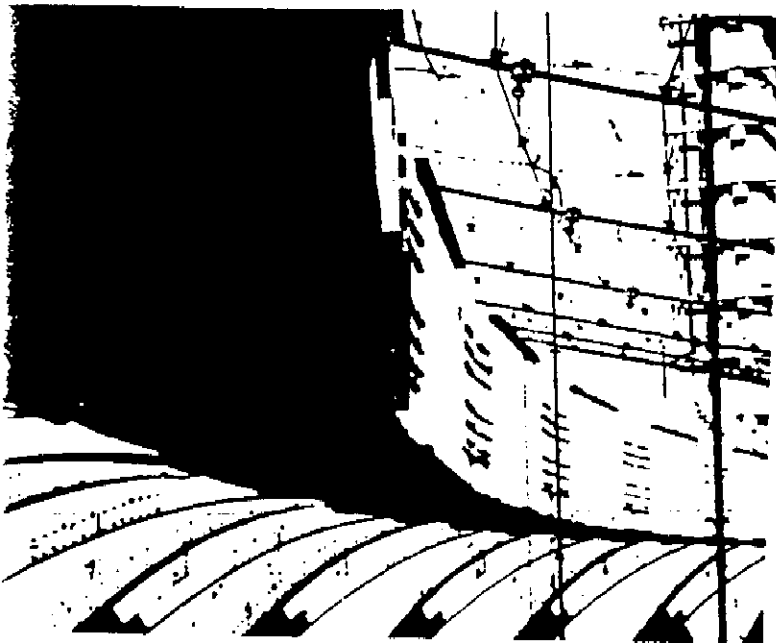
- 7) There is another level of small diameter steel cables strung off the center ring and the upper cables. This network of cables apparently served two purposes.
- Electrical lighting supports above the now missing plexiglass roof. Remnants of electric lighting conduit can still be seen attached to this web.
 - The lightning protection system appears to use this network of cables to intercept lightning strikes inside the roof perimeter. There are wires attached to this web that appear to be

connected to the lightning arresting masts that are attached to many of the fluted cable connection points. Several of these copper lighting masts are bent or missing.

b) Stabilization/Reconstruction

- Reconstruction

- 1) The first step to the reconstruction of the roof structure is the complete cleaning of the structure including the cables. This includes the removal of bird debris and loose scale and paint. Without this cleaning, there will be no way to completely assess the damage to the surfaces below these deposits. The most cost effective means of cleaning this steel would be by high pressure abrasive water washing. Cleaning will also slow the accelerated rate of corrosion that these accumulations promote.
- 2) The second step to the stabilization process is the repainting of the steel structures including the cables. This would require the scraping and wire brushing of all loose paint from the steel plates and bolts and removing all rust coatings from all surfaces in preparation for painting. The surfaces and cables should be completely primed with a durable coating system composed of a commercial quality high concentration zinc based paint, epoxy paint, or aliphatic urethane for maximum coating durability and life.
- 3) After application of the primer system, repairs to the steel work should be performed. These repairs may consist of bolt replacements, addition of supplemental steel plates in the worst areas of damage and filling low or dented areas in the steel plates to remain.
- 4) Repair to cables will be the most significant cost in the stabilization/reconstruction project for the superstructure of the pavilion. The process for cable removal and replacement will require careful consideration. Sequencing the cable removal and replacement for the removal of opposing cables simultaneously in order to maintain equilibrium in



the structure once cable replacement begins. Failure to consider this in cable replacement will result in deformation of roof structure and changes in the shape of the compression ring. As a part of this process, all of the auxiliary and tie cables will be removed and replaced and both the upper and lower cables removed and replaced. Alternatives to total cable replacement may be considered if future plans for the pavilion do not include installation of a complete roof. Partial replacement of the most damaged lower cables and redesign of cable anchors to re-attach the sound ends of the existing cables to the fluted ends of the compression ring may be possible however, these alternative solutions would require careful design and could theoretically provide the least expensive method of reconstruction. However, any of these options would require careful study and procedural innovation to keep reconstruction costs down.

After priming and completion of repairs, two finish coatings should be applied to the steel work including the cables consisting of a product compatible with and complementary to the prime paint system selected for each part of the structure.

Demolition of the Cable Structure

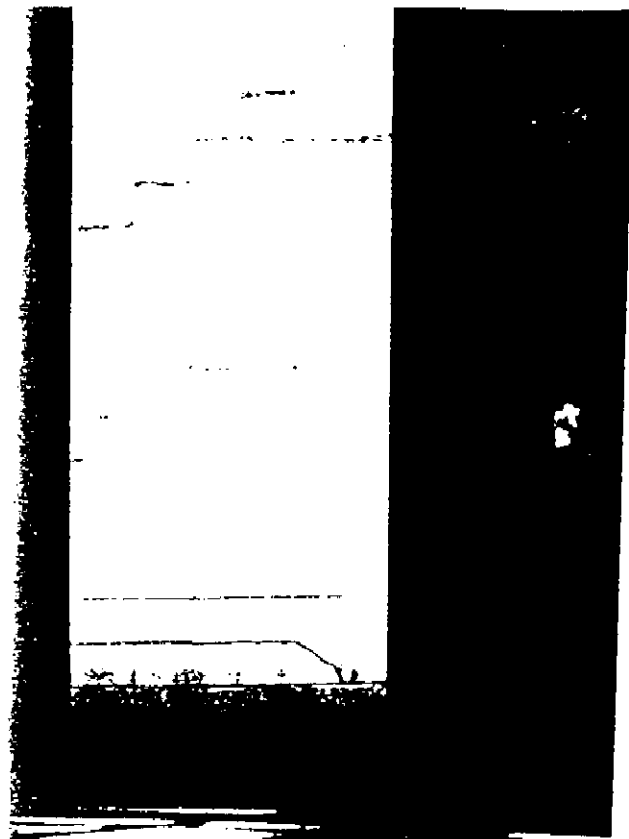
In order to demolish the cable structure if it is determined that the Pavillion should be removed, it is necessary to provide a staging platform which would include temporary shoring for the compression ring and scaffolding to enable the steel work to be removed.

If the cables are removed, the stability of the compression ring is substantially reduced. As indicated in the previous section, the compression ring loading is eccentric to the 16 concrete columns. Once the compression ring is compromised, the ring will tend to rotate and fall off the supporting steel girders projecting from the concrete columns. In order to prevent this collapse which would endanger the Exhibition spaces below as well as possible damage to the heatrama) the compression ring would require

temporary support including shoring and scaffolding. This is a formidable expense for work on a 1300 ton roof structure which is suspended over 100 feet in the air without the benefit of a lower floor to stand on.

c) Cost Estimate to Stabilize Cable Structure

Description	Units	Qty	Unit Cost	Total
Removals				\$0.00
Removal of Cables	LS	96	\$1,000.00	\$96,000.00
Materials				
Cable - 1 3/4"	LF	6000	\$24.00	\$144,000.00
Cable - 2 1/2"	LF	6000	\$51.00	\$306,000.00
Cable Fittings - 1 3/4"	EA	96	\$240.00	\$23,040.00
Cable Fittings - 2 1/2"	EA	96	\$480.00	\$46,080.00
Cable Splices - 1 3/4"	EA	96	\$240.00	\$23,040.00
Cable Splices - 2 1/2"	EA	96	\$480.00	<u>\$46,080.00</u>
				\$588,240.00
Labor & Equipment				
2 - 8 man Steel Crews	Days	60	\$12,000.00	<u>\$720,000.00</u>
				\$1,404,240.00



Cracked mortar joints @ interior perimeter walls



Masonry walls with settled and dislocated concrete blocks

3. Exhibition Space and Promenade

Description

The one story structure that surrounds the central space in the Tent of Tomorrow was used for exhibits and toilet facilities. This report discusses the concrete masonry walls that make up the perimeter structure, the exterior stairs that connect the central paved area to the roof promenade and the roof promenade, which covers the entire perimeter structure. The reference drawings indicate that the walls are supported by spread footings. To confirm this, excavation and probing was performed below the masonry wall for an 8'-0" span with no evidence of existing piles. Grade level is a concrete slab on grade. The following existing conditions confirm the this with respect to settlement.

a) Concrete Masonry Walls (Perimeter Structure)

1) Existing Conditions

- Masonry blocks comprise the perimeter and interior non-bearing walls of these spaces. These walls sit on spread footings, but the columns are supported on untreated wood pile foundations. This was done due to the original intent of building a temporary structure for short term use. Since the soil is not suitable for spread footings, the amount of differential settlement between the walls and the columns has caused significant damage to the structure.
- The interior and exterior perimeter walls show numerous cracked mortar joints in patterns which can be directly attributed to the settlement of the spread footings. At some locations the masonry block faces are vertically out of plumb, indicating rotation of the footings. This damage is all a result of settling, and the absence of an adequate pile foundation.
- At some locations, masonry openings have been blocked up.
- Paint at the masonry walls is peeling and in poor condition.



3. Peeling membrane with weed infiltration



c) Stairways to Promenade

- The roof promenade structure is a concrete slab on a steel deck. The top of the slab has been coated with an asphaltic wearing surface. This asphaltic surface has alligatored, peeled up, chipped off and has generally worn out at many locations.
- Inspection of a section of lifted asphalt shows that at one time it was directly adhered to the concrete deck. There is no indication that there was any insulation or other waterproofing compounds used on this level.
- The asphalt surface at the roof promenade has settled and large depressions have formed that now retain water. The existing drainage structures are clogged and not maintained, if they are still intact, and do not adequately serve the roof. In some locations, water has penetrated the promenade and completely rotted out the steel deck.

2) Stabilization/Reconstruction Options

- Replace existing wood piles with steel piles.
- Completely remove existing asphalt roof to concrete deck.
- Cut out and replace damaged areas where metal deck has corroded or failed.
- Install roof insulation, roofing membrane, flashing and ballast in either an IRMA or standard built up roof configurations. The choice of roof system depends upon whether access to the roof is anticipated or required.
- Remove entire building, columns, walls floors and pile caps to 36" below grade.



6. Underside of stair platform deteriorated.
Cracks at adjacent wall



another stair. These stairs and the escalator are unsafe and accordingly have been fenced off.

1) Existing Conditions

- The two interior open stairs are continuous in one direction with an intermediate platform. The stair stringers are made of curved steel channels, with concrete filled metal pan treads and platforms. The railings are of painted steel.
- The metal pan tread and risers of the stairways are grossly deteriorated. In many locations light can be seen through sections of the riser and tread joints.
- The undersides of the stair platforms are decayed and have rusted through in many places.
- The fencing is adequate for the prevention of access to the promenade but their condition is generally poor.

2) Removal Implications

- If the Promenade is not to be accessed in the future the stairs should be removed completely and not replaced.
- Removal of the stairs would, from a safety point of view, be beneficial to the community and the city. It would prevent the possibility of unwanted accidents.
- Removal of the stairs to the roof would result in the creation of an inaccessible area.
- Removal of the stairs would also require construction of barriers or a continuation of the existing railing at the connection where the stairs meet the promenade level.

e) Utilities/Building Systems

Description

The existing drawings we received were issued for the 1967 rehabilitation and new usage addition of the structure. These drawings were vague, indicating "replacement" and "connection to existing", therefore, leaving the original installations unknown.

1) Existing Conditions

Water

- An 8" water line feeds the site at the NNE corner of the site, between the Pavilion and the Theaterama. The service is split so that one four inch line feeds the Theaterama, and another four inch line feeds the Pavilion. There is no back flow preventor at either of the service locations.
- The existing, vitreous china fixtures are in poor conditions; some are cracked, missing pieces and nonfunctional. The remainder can not be salvaged for reuse for several reasons;
- The fixtures and flush valves do not comply with the State Water Savings Regulations.
- The existing bathrooms do not meet the requirements set forth by the ADA, and will have to be redesigned/reconstructed for conformance.
- We exposed the hot and cold water piping, which indicated that the existing service is operating. However, the pipe insulation was not tested for asbestos containing materials. This is necessary, since the existing insulation is in poor conditions and friable in some sections. There exists some extra piping that is connected to abandoned kitchen equipment that should be removed from the site.

Fire Suppression System

- The 4" water line serving the Pavilion feeds the fire suppression system that runs in a loop at the same elevation of the Pavilion Promenade Floor. This is a dry system.
- The fire stand pipe is in working condition. However, all of the valves must be replaced if the structure is to remain.

Gas

- Existing construction drawings indicate that the gas service fed both the Theaterama and the Pavilion from an 8" gas main located on the Avenue of the States, at the southwest corner of the Pavilion. A 2" medium pressure service is provided. Our site investigation showed that a new gas meter installed at the Theaterama. A new gas service was probably installed at the time of the reconstruction of the Theaterama, and the existing 2" gas service was disconnected.
- The existing gas hot water boilers and pumps appear to be in poor condition. The shell of the gas hot water boilers is also in poor condition. Electrical wiring connections have been removed.

Gas, hot water boilers, pumps, piping, HVAC units, and some hot water unit heaters, make up.

- The HVAC units are completely rusted and without panels. The interior control wiring has been removed.
- The interior cooling towers are also rusted and without panels and controls. The wiring and other mechanical components have been removed.
- The hot water supply and return piping is good condition. However, all valves and controllers

must be replaced. All electric connections have been stripped and must be replaced.

- Pipe insulation is missing at over 50% of the locations, and must be replaced. Furthermore, the existing pipe insulation must be tested for asbestos contaminating materials. Should the results be positive it will be required that all insulation be abated and replaced prior to any work being performed at these locations.



4. Electric panel

Electric

All electrical power enters the basement of the Theaterama, from where it is distributed to the Pavilion and Theaterama. From the Theaterama two sets of feeds leave the main switchboard at each end, and loop around the exterior of the Pavilion. Two feeders are connected to electrical panels installed at every other pavilion column.

The remnants of what was once an operating electrical system has been reduced to exterior rusted panels that were installed at the exterior columns and broken light fixtures, none of which are salvageable.

- The interior electrical panels have been modified several times over the years. Circuit breakers have been removed, and reused at other locations.
- At walls that were altered for space modifications, the branch circuits to the outlets in these walls were cut at the source and now hang from the ceiling.
- The receptacles have been pulled from the wall.
- There are no lighting fixtures that can be reused or salvaged.
- None of the Emergency Lights and Exit Signs are operational. This entire system must be

replaced.

- Fire alarm and intrusion alarm systems should be installed if the structure is to be restored/rebuilt.

b) Reconstruction/ Upgrade Recommendations

In view of the gross deterioration of all of the mechanical systems within the Pavilion, total gut and rehabilitation are recommended if the facility is to be brought up to code and in proper operating condition.

Electrical

- Any application planned for the Pavilion shall start at the service box which feeds the panels located within the exterior columns. From this new service box, the feeder should be extended to an electrical rooms where the new panels will be installed.

HVAC

- The condition of the existing units, heaters, pumps and boilers warrant total replacement. All valves and controllers must be replaced. With the new use of the facility unknown at this time, redesign of the entire HVAC system and its routing is probable and therefore, we recommend complete demolition and removal of all mechanical systems and associated piping. Retrofitting and repairing existing, semi-salvageable components is an unwise and costly option, that would not result in the most economical and efficient solution for the City.

- Plumbing

As with the HVAC system, the most economical and practical solution for the plumbing systems at the Pavilion, especially with the new use currently unknown, would be to disconnect and remove all existing fixtures and piping to the point at the incoming service.

- Fire Suppression System

Until a use for the facility and its continued existence has been determined, we can only recommend that should the perimeter structure be demolished, the existing standpipe should be removed.

- Sanitary and Storm Drainage
We recommend video camera investigation of the existing sanitary and storm drainage lines that might be considered for reuse.

Costs of Stabilization of the Exhibition Space

Description	Unit	Quantity	Unit Cost	Totals
Demolition				
Masonry Walls	SF	19,166	\$2.00	\$38,332.00
Spread Footings	CF	2,736	\$2.00	\$5,472.00
Removal of Steel Stairs & Escalators	LS	1	\$28,000.00	\$28,000.00
Removal of Central Court Pavement	CY	1053	\$40.00	\$42,120.00
Removal of Promenade Roofing	SF	24,770	\$2.50	\$61,925.00
Remove, Cut and Cap Utilities at Source	LS	1	\$25,000.00	\$25,000.00
				\$200,849.00
Reconstruction				
Piles to Support Masonry, Non-bearing Walls	EA	200	\$6,400.00	\$1,280,000.00
Piles to Support Promenade Roof	EA	120	\$6,400.00	\$768,000.00
Pile Caps to support non bearing walls	CY	338	\$400.00	\$135,200.00
New 8" Concrete Block Walls	SF	19,152	\$14.00	\$268,128.00
New Roof Membrane w/ 3" Rigid Insulation	SF	24,770	\$12.00	\$297,240.00
Total				\$2,949,417.00

a construction fence with appropriate signage.

- As with the terrazzo paved map sections, the locked elevator cab may want to be salvaged for possible restoration for exhibit or historical reference.

c) Costs to Remove Elevators

Cost for lowering the secured elevator and removing it, with its associated cables and counterweights, and removing the existing released elevator with its associated cables and counterweights, and including provisions for temporarily securing the area are estimated at a lump sum cost of \$12,000.

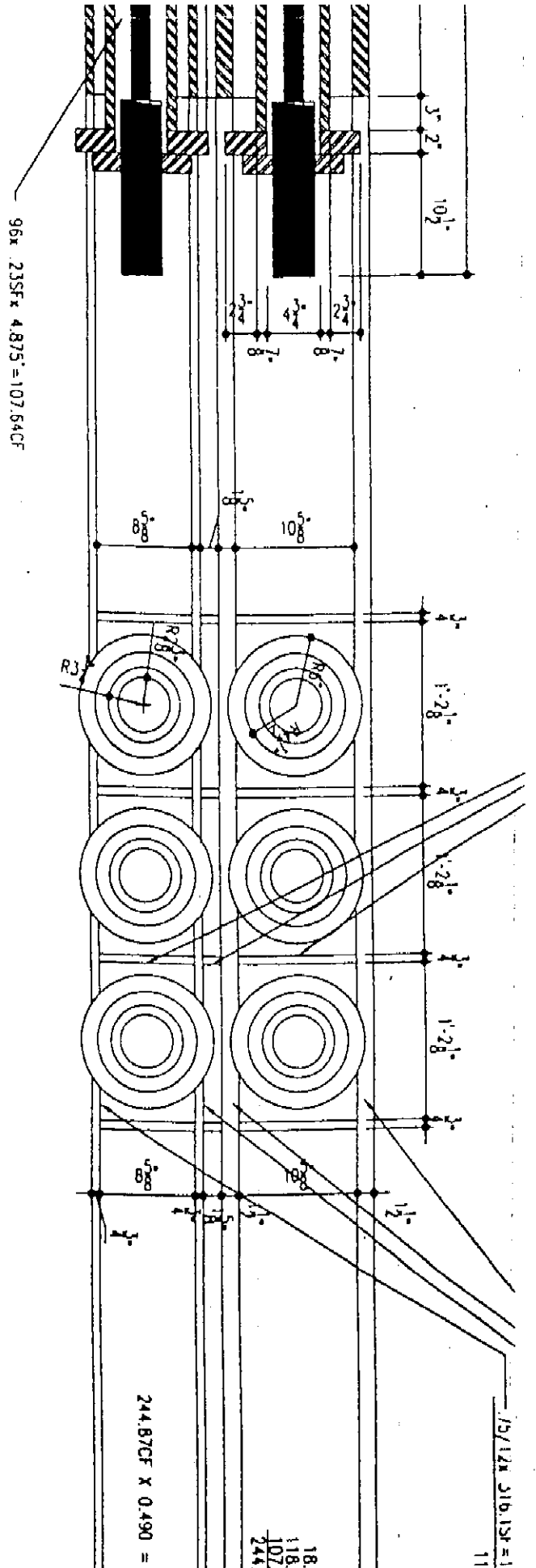
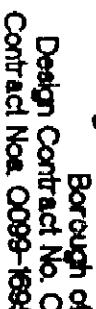
IV. Cost Estimate

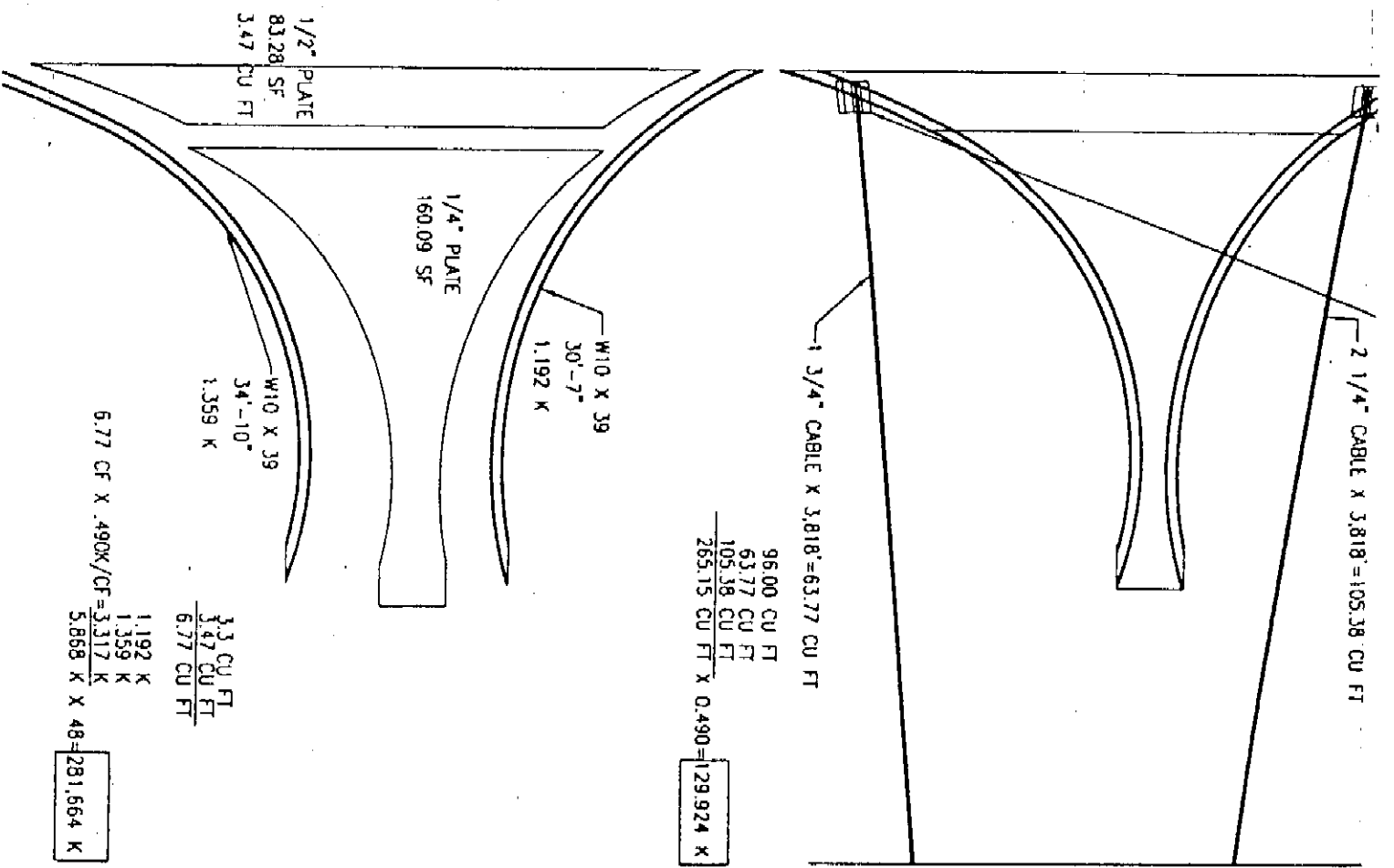
A. Costs of the Stabilization/Restoration New York State Pavilion

Description	Unit	Quantity	Unit Cost	Totals
Stabilization of Tent Supporting Columns	LF	10,240	\$370.00	\$3,788,800.00
Demolition				
Masonry walls	SF	19,166	\$2.00	\$38,332.00
Spread Footings	CF	2,736	\$2.00	\$5,472.00
Removal of Steel Stairs & Escalators	LS	1	\$28,000.00	\$28,000.00
Removal of Central Court Pavement	CY	1053	\$40.00	\$42,120.00
Remove, Cut and Cap Utilities at Source	LS	1	\$25,000.00	\$25,000.00
Pile caps	CY	338	\$400.00	\$135,200.00
Reconstruction of Cable Structure	LS	1	\$1,404,240.00	\$1,404,240.00
Reconstruction				
Piles to Support Masonry, Non-bearing Walls	EA	200	\$6,400.00	\$1,280,000.00
Piles to Support Promenade Roof	EA	120	\$6,400.00	\$768,000.00
Pile Caps	CY	338	\$400.00	\$135,200.00
New 8" Concrete Block Walls	SF	19,152	\$14.00	\$268,128.00
New Roof Membrane w/ 3" Rigid Insulation	SF	24,770	\$10.00	\$247,700.00
Elevators	LS	1	\$12,000.00	\$12,000.00
Total				\$8,178,192.00

B. Demolition New York State Pavilion

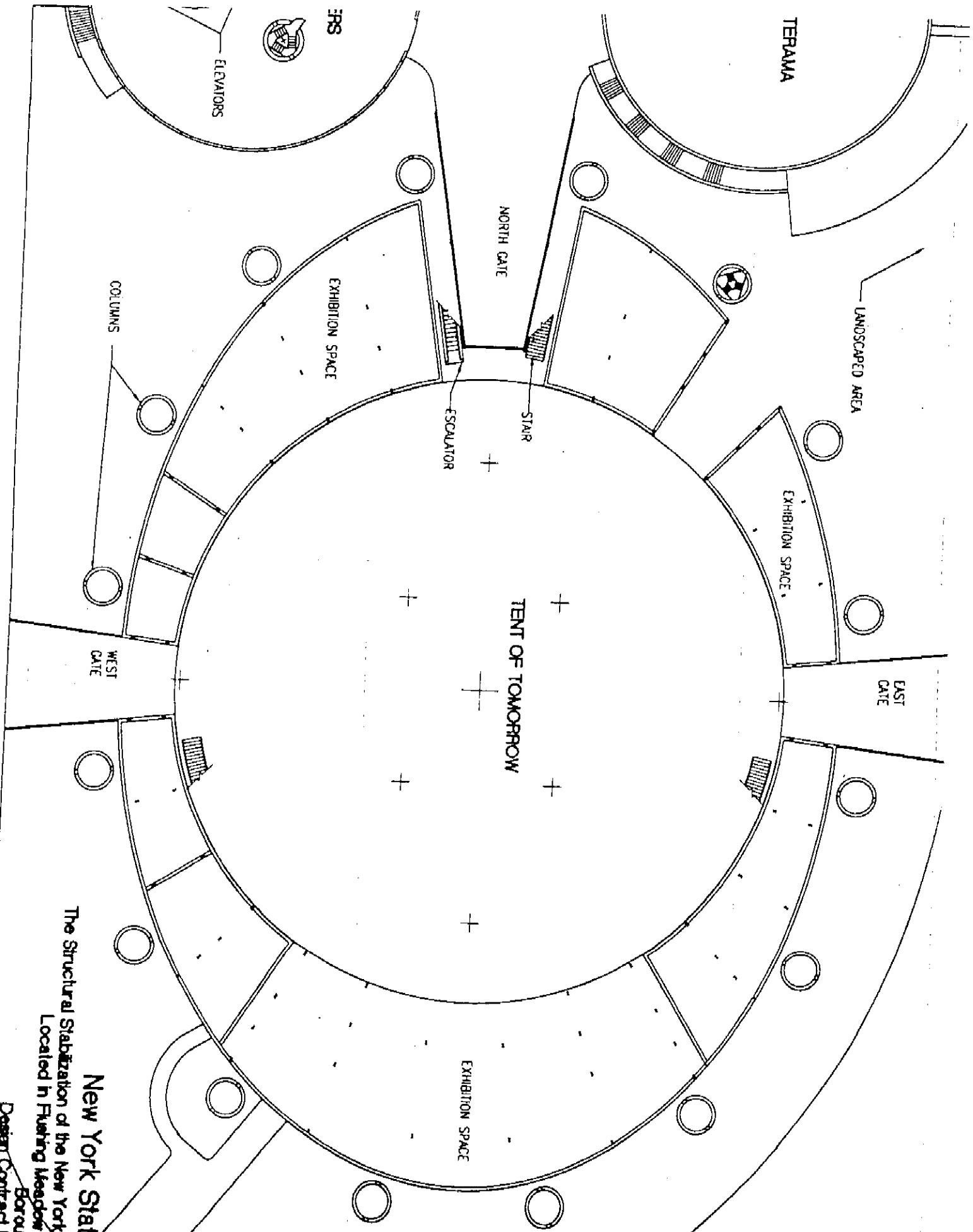
Description	Unit	Quantity	Unit Cost	Totals
Mobilization	LS	1	\$95,535.00	\$95,535.00
Construction Sign	EA	1	\$1,000.00	\$1,000.00
Construction Fence	LF	1184	\$28.00	\$33,152.00
Demolition Exhibition Space & Promenade				
Masonry walls	SF	19,166	\$2.00	\$38,332.00
Spread Footings	CF	2,736	\$2.00	\$5,472.00
Removal of Steel Stairs & Escalators	LS	1	\$28,000.00	\$28,000.00
Removal of Central Court Pavement	CY	1053	\$40.00	\$42,120.00
Remove Pile Caps	CY	113	\$400.00	\$45,200.00
Remove Grade Bms	CY	23	\$400.00	\$9,200.00
Remove Promenade Roofing	EA	24770	\$2.50	\$61,925.00
Remove, cut and cap Utilities	LS	1	\$25,000.00	\$25,000.00
Demolition of Cable Structure including Shoring and Scaffolding				
Demolition of Cables & Tension Ring	LS	1	\$95,000.00	\$95,000.00
Demolition of Compression Ring	LS	1	\$700,000.00	\$700,000.00
Demolition of Pile Caps	CY	663.7	\$400.00	\$265,480.00
Demolition of Columns	CY	2073	\$1,000.00	\$2,073,000.00
Regrade Site & Seed	SF	68000	\$2.00	\$136,000.00
Total				\$3,654,416.00



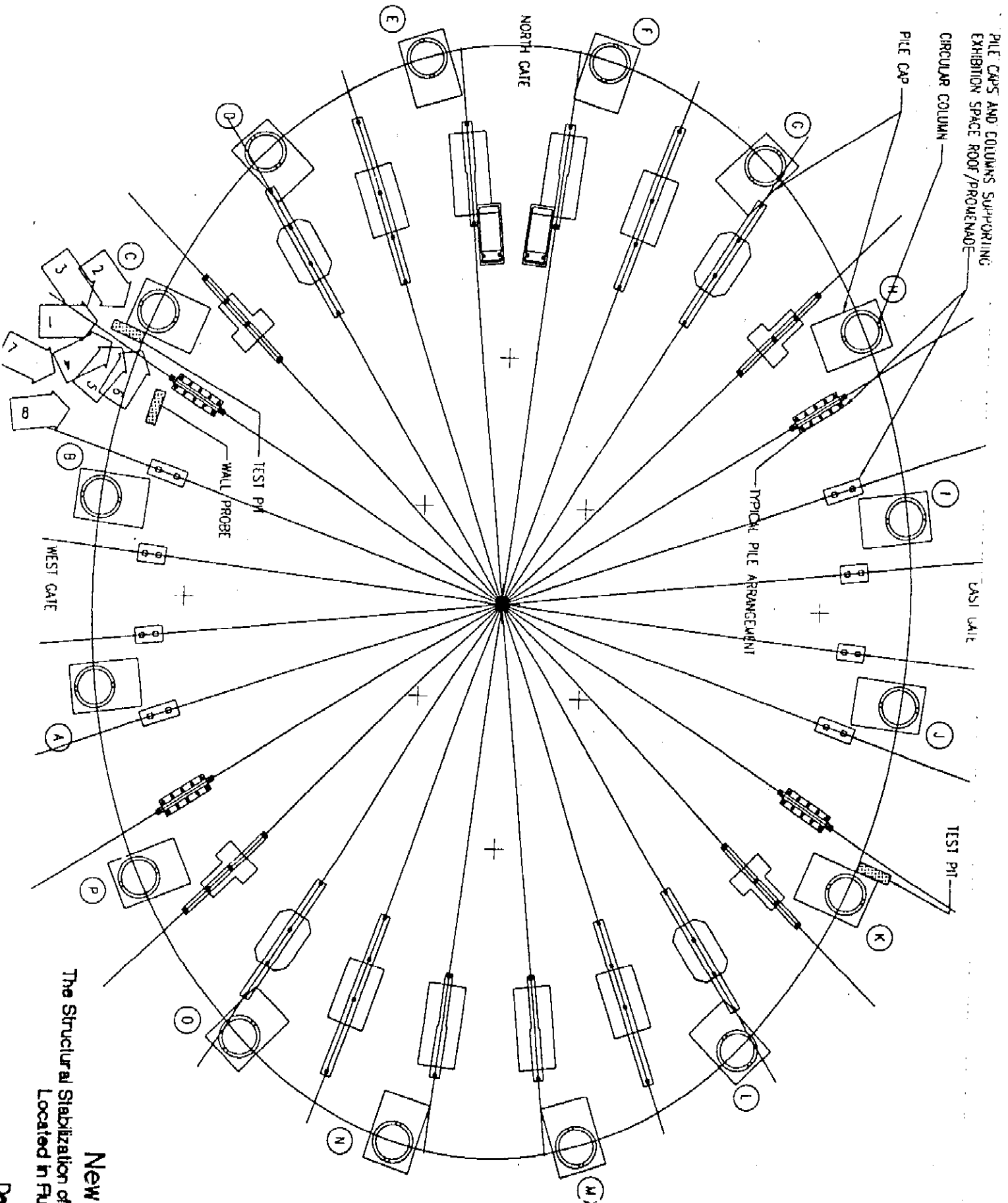


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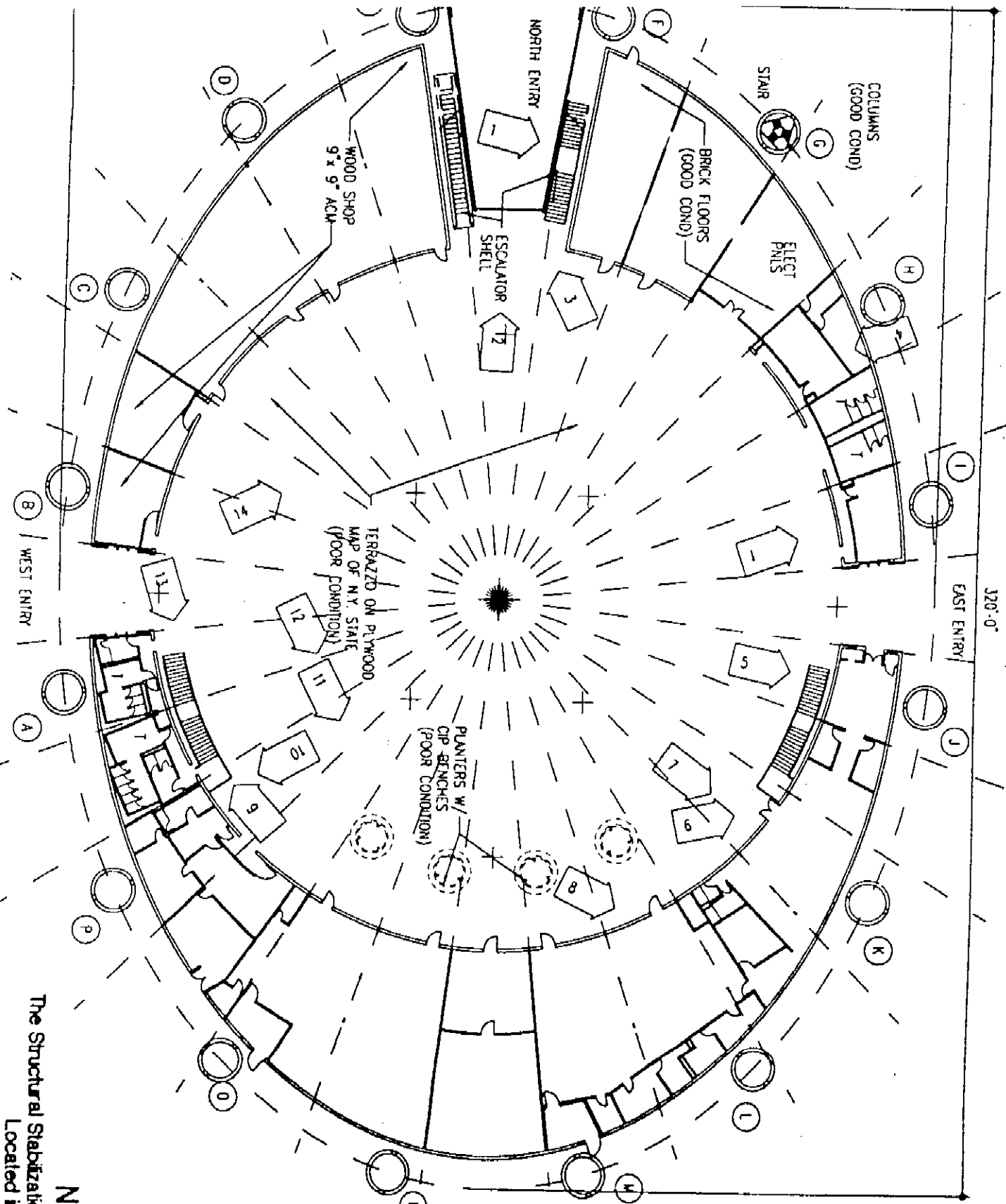
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The Structural Stabilization of the New York
Located in Flushing Meadows
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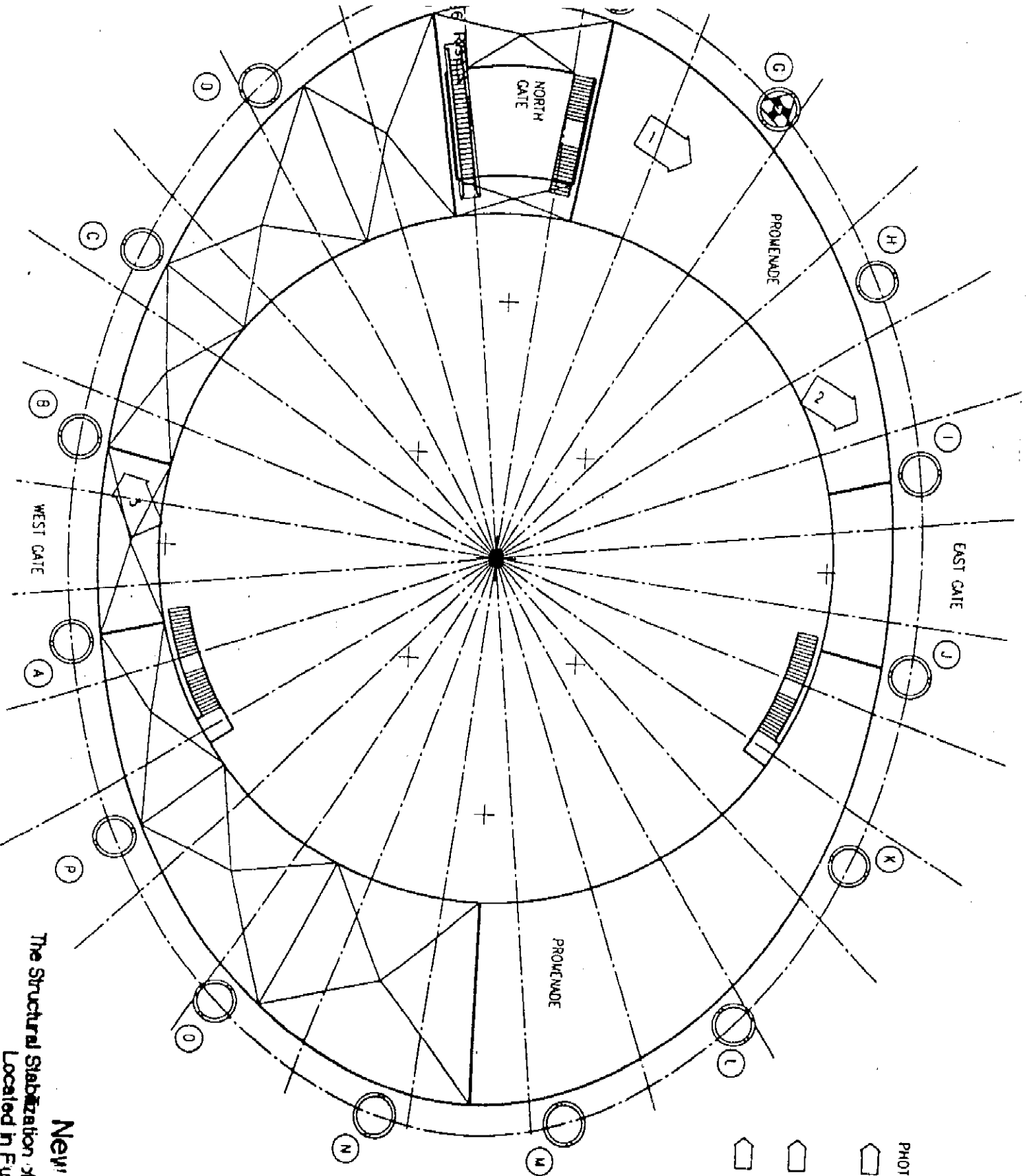


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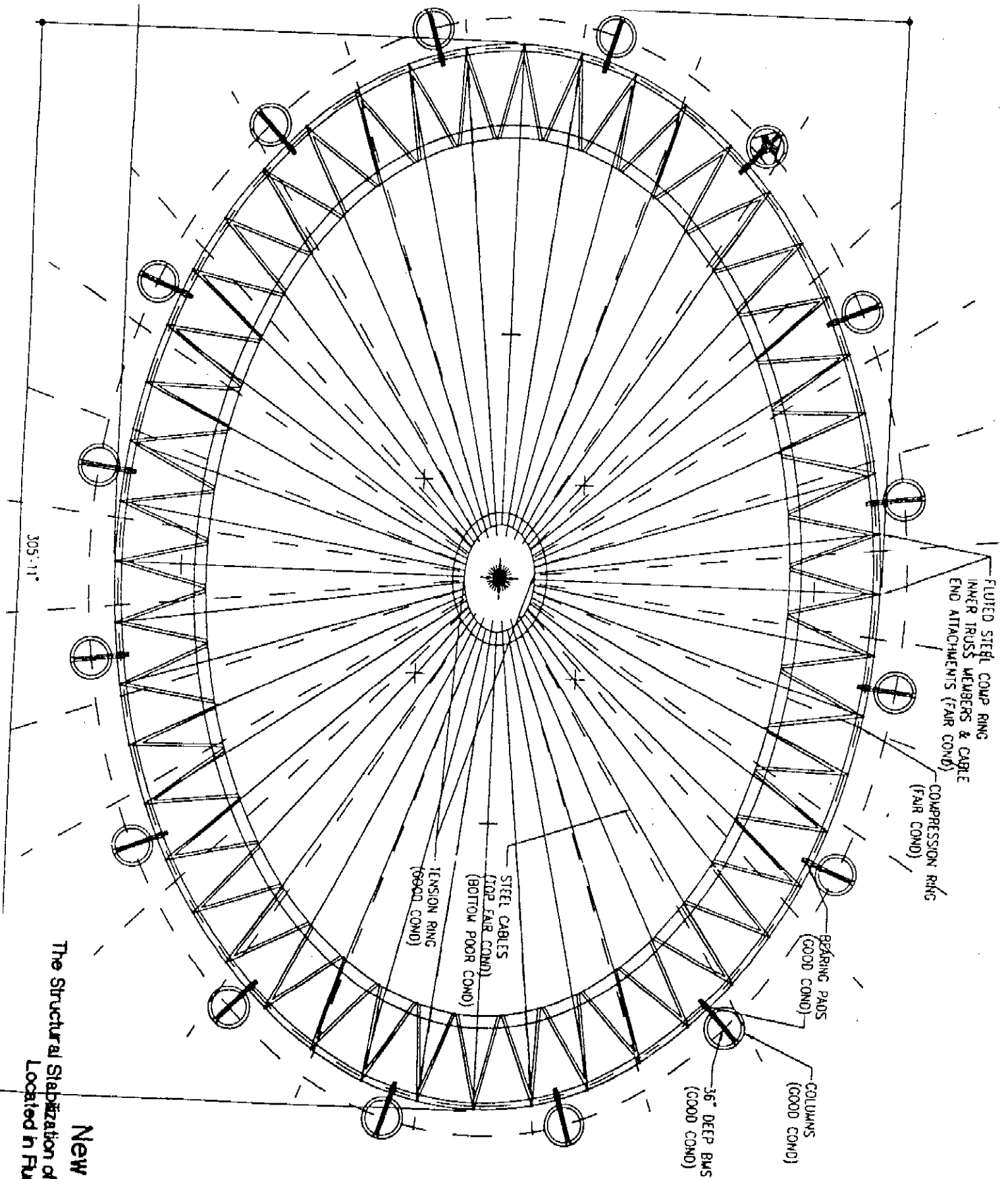
- PHOTO NO. DESCRPTION
- 1- ROTTED STAIR
 - 2- VIEW UP STAIR
 - 3- RUSTED S
 - 4- ELEC PANEL
 - 5- SIDE STAIR
 - 6- UNDERSID PLATFORM IN ADJAC
 - 7- CRACKED INTERIOR
 - 8- MASONRY & DISLOC
 - 9- UNDERSID PLATFORM
 - 10- DAYLIGHT
 - 11- CLOSE UP PLYWOOD TERRAZZO
 - 12- MAP OF 1 CRACKED WEEDS
 - 13- VIEW UP STAIR

New York State
 The Structural Stabilization of the New York
 Located in Flushing Meadow
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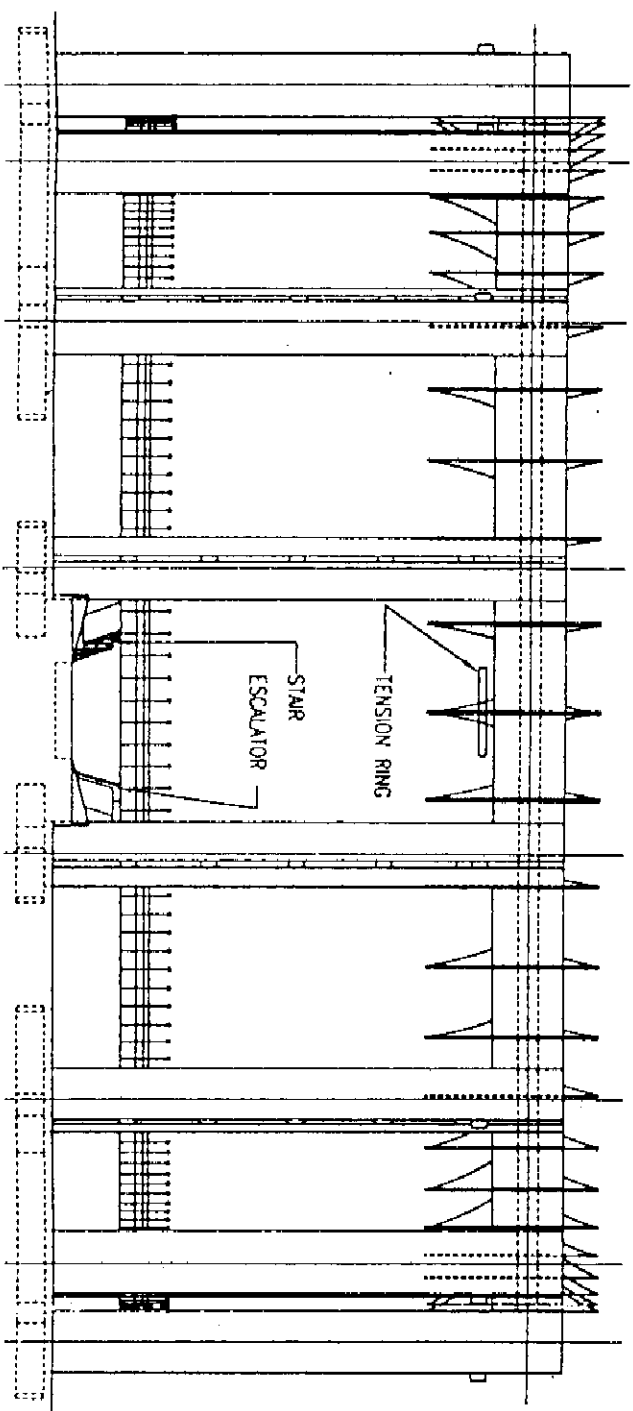
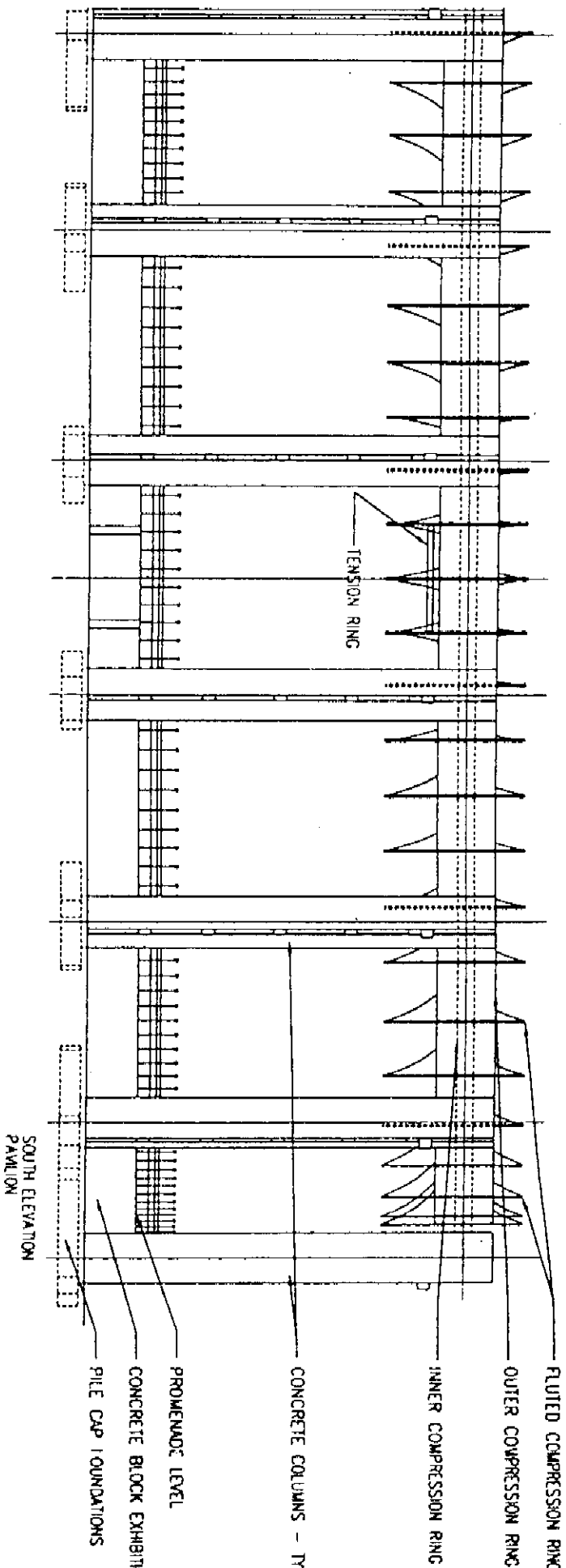


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AREAS OF PO
 - 2- ASPHALT ROO
CONC DECK
 - 3- PEELING WEVB
INFILTRATION

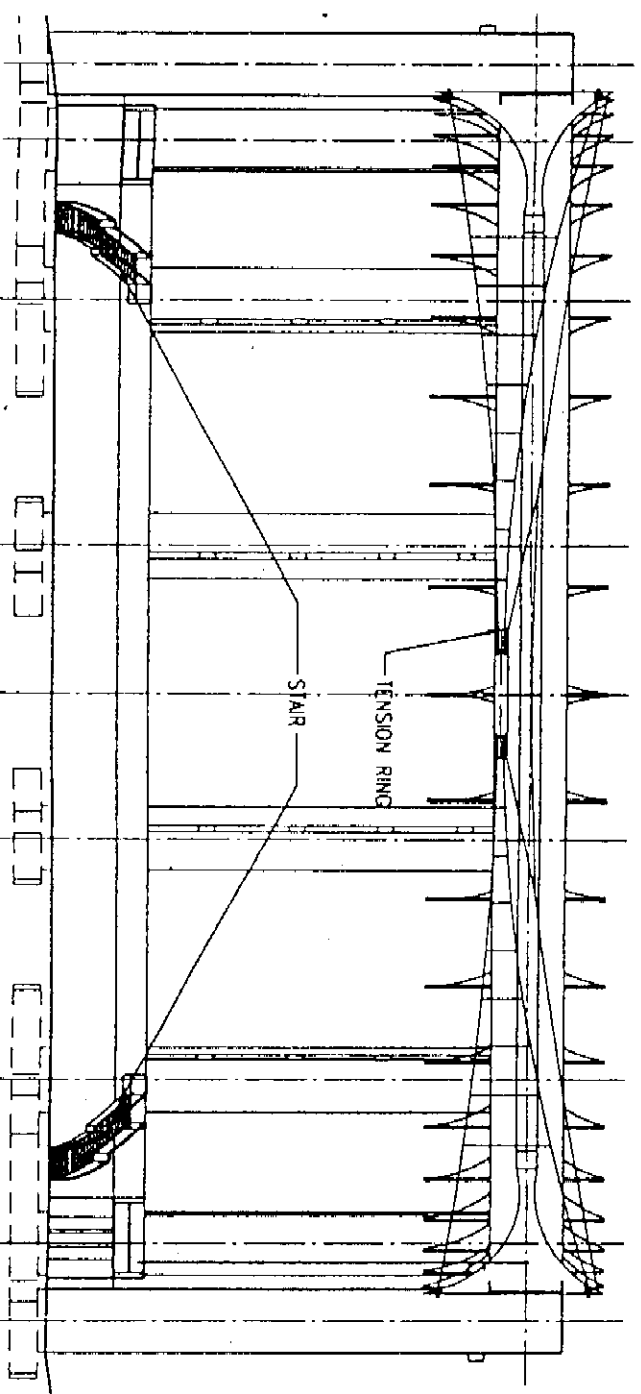
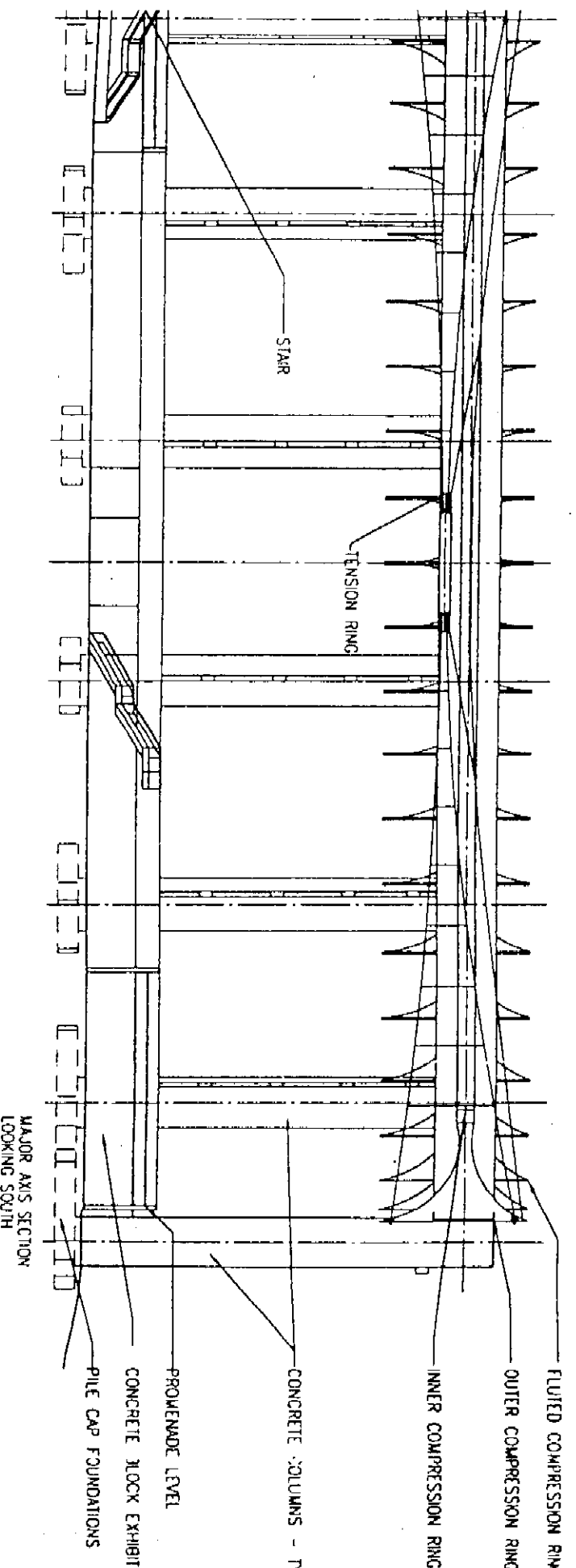
New York State Fairgrounds
 The Structural Stabilization of the New York State Fairgrounds
 Located in Flushing Meadow Corc



New York State
The Structural Stabilization of the New York State Thruway Bridge
 Located in Flushing Meadows
 Borough of Queens



New York State
The Structural Stabilization of the New York State
Located in Flushing Meadows



New York State Thruway Authority Building
 The Structural Stabilization of the New York State Thruway Authority Building
 Located in Rushing Meadows, New York
 By [illegible]