

BATTERY PARK CITY
COMMERCIAL CENTER

FOUNDATION SPECIFICATIONS FOR
CONTRACTS OF CONSTRUCTION FOR
WORLD TRADE CENTER RIVER WATER INTAKE SYSTEM RELOCATIONS
AT
BATTERY PARK CITY COMMERCIAL CENTER

Owner:

Battery Park City Authority, acting through
BPC Development Corporation, a subsidiary of
the New York State Urban Development
Corporation

Developer:

Olympia & York Battery Park City

Design Consultants:

Design Architect: Cesar Pelli & Associates
Architects: Haines Lundberg Waehler;

Mechanical & Electrical Engineers: Norman D.
Kurtz Consulting Engineers/member of the
F+K Group

Soils & Foundation Engineer:
Mueser, Rutledge, Johnston & DeSimone

Contractor:

Olympia & York Battery Park Company

INDEXDIVISIONS 02000 & 03000WORLD TRADE CENTER RIVER WATER INTAKE SYSTEM. RELOCATIONSFOUNDATIONS

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WORLD TRADE CENTER RIVER WATER INTAKE SYSTEM
RELOCATIONS

SECTION 02110

DEMOLITION

I. GENERAL

A. DESCRIPTION

1. The Work covered in this division of the Specifications includes the construction described in this Paragraph A, including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.

2. Demolish existing 1941 Bulkhead wall as shown.

B. RELATED WORK NOT INCLUDED IN THIS SECTION
BUT SPECIFIED ELSEWHERE

1. The following related items are specified in other Sections of the Specifications:

- | | | |
|--|---|---------------|
| a. Earthwork | - | Section 02200 |
| b. Concrete Filled Steel
Pipe Piles | - | Section 02363 |
| c. Foundation Concrete | - | Section 03315 |

C. GENERAL REQUIREMENTS

1. All utility lines and existing structures shown or not shown on the Drawings, shall be protected from damage during construction/demolition. The Subcontractor shall be solely responsible for conducting his operations without causing injury, damage or interruption of utility services. Any damage caused by the Subcontractor's operations shall be repaired by the Subcontractor at his expense.

2. The Subcontractor shall carry out his operations in a manner that will protect and cause a minimum of interference to adjoining occupants and vehicular parking facilities and to pedestrian and vehicular traffic in adjacent areas. The Subcontractor shall provide and maintain

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temporary fences, barricades, signs, warning lights and the like required by local ordinance, or as ordered by the Contractor for the protection of pedestrians and vehicular traffic. All work shall meet the requirements of agencies or authorities having jurisdiction.

II. PRODUCTS

A. MATERIALS

1. All demolition debris, removed stones from the existing bulkhead and concrete pieces shall become the property of the Subcontractor and be removed and disposed of by him at his expense off the site.

III. EXECUTION

A. WORKMANSHIP

1. All demolition work shall be done in a careful and workmanship like manner. No unnecessary damage shall be allowed to the old 1941 Bulkhead Line below Elevation -7.0 feet. The Subcontractor shall be solely responsible for the removal, handling, transportation and disposal of all materials of all kinds demolished under the terms of this Section of the Specifications, and for all arrangements, permits, costs or charges incident thereto.

2. Concrete shall be carefully chipped to a reasonable plane and the rebars burned off flush with the surface of the concrete.

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EARTHWORK

SECTION 02200

I. GENERAL

A. DESCRIPTION

1. The Work covered in this division of the Specifications includes the construction described in this Paragraph A, including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.

- a. Excavate and rough grade surface to the elevations noted on drawings for each portion of the utility relocation platform and trenches.
- b. Provide temporary sheeting and support as required for excavation.
- c. Transport and dispose of all materials as further specified in this Section. Backfill as required.
- d. Dewater and drain as required.

B. RELATED WORK NOT INCLUDED IN THIS SECTION BUT SPECIFIED ELSEWHERE

1. The following related items are specified in other Sections of the Specifications.

- a. Concrete filled steel pipe- Section 02363
piles
- b. Foundation Concrete - Section 02315
- c. Demolition - Section 02110

II. PRODUCTS

A. All material of whatever nature including recent sand fill, underlying clayey silt, organics, timber, boulders, debris, or rock encountered within the boundaries of the Work and the excavation subgrades indicated on the drawings

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shall be unclassified excavation and shall be removed, transported and disposed of as specified in this Section.

B. MATERIAL CLASSIFICATION

1. For purposes of disposal only, excavated material shall be classified as follows:

a. Recent fill - Recent fill is primarily a fine relatively uniform sized sand hydraulically placed for the construction of the Battery Park City landfill. Slight mixing or interbedding of the sand and the underlying organics at their interface, provided that the silt is not more than 10 percent of the volume will be classified as recent fill with the approval of the Contractor

b. Organic silt - Organic silt is primarily river deposits of organic clayey silt left in place during the construction of the Battery Park City landfill.

c. Miscellaneous unsuitable - Miscellaneous unsuitable shall be wood, timbers or steel exceeding one cubic foot in volume, and pieces of rock or concrete exceeding two feet in maximum dimension or four square feet in area.

III. A. EXCAVATION - SOIL

1. All material within the boundaries of the work shall be removed to the excavation subgrades indicated on the Drawings.

2. Backfill, grade and compact all areas and volumes excavated beyond the limits shown on the drawings with recent fill.

B. TEMPORARY SHEETING

1. The sides of pits and changes in subgrade levels shall be supported by suitable sheet piling or sheeting held in place by soldier beams, braces, shores or wales. Timber and steel used for the sheeting system may be either new or used, but must, in all cases, be sound, free from defects and suitable for its intended use.

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2. Temporary sheeting shall be maintained by the Sub-contractor until acceptance of the work by the Contractors Representative.

C. DEWATERING

1. It shall be the responsibility of this Subcontractor to control and maintain water levels in the excavations so that all excavation will be done in the dry. The water level in the excavation shall at all times be a minimum of 2 feet below the deepest excavation. Softening of the bottom will not be allowed. Subcontractor shall maintain and operate the dewatering system until acceptance of the work by the Contractor.

D. BACKFILL

1. Trenches shall be backfilled with recent fill or similar clean sand compacted to 95% of standard Proctor density within 5 feet of finished grade and 90% otherwise.

2. Maximum compacted lift thickness shall not exceed 1'-6 inches in structural areas, such as footings, roads, sidewalks. Maximum compacted lift thickness shall not exceed 24 inches in non-structural areas. No compaction is allowed on frozen ground.

3. Filter stone at demolished bulkhead.

E. DISPOSAL

The Subcontractor shall dispose of excavated material in accordance with MRJD Drawing No. SP-1, dated 1-15-82. With respect to offsite disposal of material, Subcontractor shall comply with requirements of General Conditions, Paragraph 2.16.07.

1. Recent fill (F-2) - Recent fill as defined in Paragraph II.B.1.a of this section shall be stockpiled on the Battery Park City site in areas designated by the Contractor.

2. Organic silt (A-2) & Miscellaneous unsuitable (F-2)
a. Organic silt and Miscellaneous unsuitable shall be defined in Paragraph II.B.1 b&c of this section shall be disposed of off-site at locations selected by the Subcontractor. All costs of transporting, permits and disposal sites shall be borne by the Subcontractor.

3. Alternate - The Contractor shall have the option of having Subcontractor dispose of portions of these materials which cannot be properly disposed of on the Battery Park City site, as fill conveyed to New York Department of Sanitation. Contact Mr. Walter C. Zwartacky at (212) 566-8870. In such event Subcontractor shall be responsible for all costs attendant to such disposal and contract price shall reflect any credits realized by Subcontractor, See Bid Form Alternate C.1.

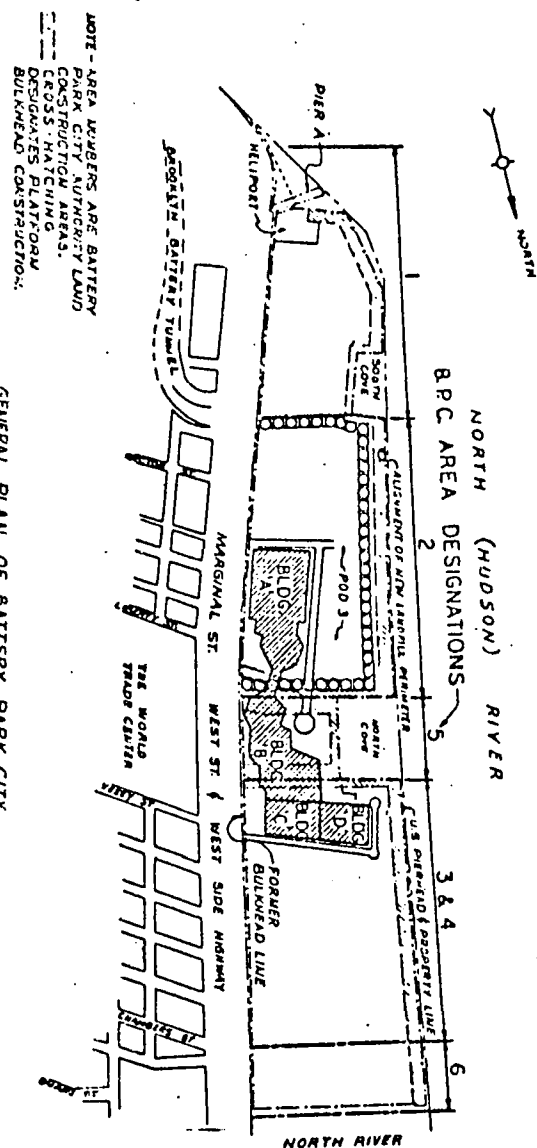
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F. MISCELLANEOUS DEMOLITION & BACKFILL

Abandoned existing concrete pipe shall be broken at sufficiently close intervals and completely filled with recent fill saved from trench excavations.

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GENERAL PLAN OF BATTERY PARK CITY

SUMMARY OF MATERIAL USE

MATERIAL TYPE	DERIVED FROM STRATUM	BUILDING AREAS WHERE SOIL IS FOUND	MATERIAL LIMITS OR TREATMENT	TYPE OF USE	LOCATION OF USE
I	^{F2} (IMMEDIATE SAND FILL)	B, C & D	< 105 TIMES PASS- ING NO. 200 SIEVE DEPTH IN 1 FOOT STANDARD PROCTOR DENSITY	CONTROLLED FILL SUGGESTED FOR PARKING USE	SITES A, B, C & D AREAS 1, 3, 4 & 6
II	^{F2} (ORGANIC SILT CLAY) AS MIXED WITH F1 OR F2 POSSIBLE OR AS WINNERS F1 OR F2	A & D SMALL AREAS IN B & C	> 205 TIMES PASS- ING NO. 400 SIEVE	ROCK	DISPOSAL C/F SITE
III	^{F1} (MISCELLANEOUS FILL)	A SMALL AREAS IN B, C & D	< 205 TIMES PASS- ING NO. 200 SIEVE ACTIVE OR INACTIVE OR > 15% SALT CONTENTION	TEMPORARY ROAD- WAYS SUBJECTIVE EVALUATED OVER MATERIAL STOCKPILE	IMPROVED AREA SITES 1, 3, 4 & 6

NOTE: REFER TO ANALYTICAL SOILS REPORTS AND CONTRACT DRAWINGS FOR MORE DETAILED INFORMATION ON THE SOILS CONSTITUTING THE MATERIAL TYPES.

NOTE.
REFER TO AVAILABLE SITES REPORTS AND CONTRACT DRAWINGS FOR MORE DETAILED INFORMATION ON THE SITES
CONSTITUTING THE MATERIAL TYPES.

OLYMPIA 3 YORK		NY	
245 PARK AVENUE			
NEW YORK			
COMMERCIAL CENTER			
BATTERY PARK CITY			
BUESER-BUTLER & JOHNSTON ASSOCIATES CONSULTING ENGINEERS 708 THIRD AVENUE, NEW YORK, NY 10017			
DATE	NUMBER	DATE	NUMBER
06/01/87	00000001	06/10/87	00000002
06/01/87	00000001	06/10/87	00000002
RECOMMENDED FILL AND STOCKPILE OF EXCAVATED MATERIAL		SP-1	
5336-PUB			

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WORLD TRADE CENTER RIVER WATER INTAKE SYSTEM
RELOCATIONS
STEEL PILING

SECTION 02310

I. GENERAL

A. DESCRIPTION

The Work covered by this division of the Specifications includes the construction described in this Paragraph A, including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.

1. Furnish, install and load test as required .130 ton capacity HP 14 x 73 steel piles for support of concrete deck relieving platform within existing cellular cofferdam.
2. Furnish all surveys, layouts, and record keeping incident to pile driving and as specified in the Contract Documents.

B. RELATED WORK NOT INCLUDED IN THIS SECTION
BUT SPECIFIED ELSEWHERE

1. The following related items are specified in other Sections of the Specifications.

- a. Earthwork - Section 02200
- b. Foundation Concrete - Section 03315
- c. Concrete Filled Pipe Piles - Section 02363

C. REFERENCES

1. Perform all Work in accordance with the latest editions and revisions of applicable standards and/or specifications of:

- a. American Institute of Steel Construction (AISC)
- b. American Society for Testing & Materials (ASTM)

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- c. American Welding Society (AWS)
- d. American Concrete Institute (ACI)
- e. New York City Building Code

D. SUBMITTALS

1. Before beginning pile driving the Subcontractor shall submit:

- a. Description of equipment proposed for pile driving including hammer, leads and cap block cushioning.
- b. Pile numbering plan.
- c. Description of proposed pile driving sequence and procedure.
- d. Details of any required splices.

2. The Subcontractor shall employ a surveyor licensed in the State of New York who shall determine and certify the actual location of each pile as installed, and shall submit certified lists and drawings of the pile designation number, cutoff elevation as installed, or deviation from plumb.

3. The Subcontractor shall keep a record of each pile driven, and shall furnish signed, typewritten copies daily. The records shall include the pile length as driven, date and time of driving, time delays during driving, splice locations, tip and cut-off elevations, deviations from plan location and from plumb, hammer data, driving resistance, and any other applicable data.

II. MATERIALS

A. PILES

1. Steel piles for utility supports and platforms shall be HP 14 x 73 rolled shapes conforming to the requirements of ASTM A-36, Current Edition.

a. The Subcontractor shall furnish mill certificates to the Contractors Representative certifying that the piles conform to the requirements of ASTM A-36, Current Edition.

3. The Subcontractor shall splice sections of pile with an approved full penetration butt weld made by a New York City certified and AWS qualified welder, and conforming to the Specifications of the American Welding Society Structural Welding Code, AWS D1.1, Current Edition. There shall be no splicing allowed from the tip of the pile to a point 40 feet above it. There shall be no more than two splices per pile.

III. EXECUTION

A. GENERAL

1. The Subcontractor shall be solely responsible for the manufacture, handling, transporting and driving of the piles under the terms of this Section, and for all permits, arrangements, costs and charges incident thereto.

B. EQUIPMENT

1. All piles shall be driven using a single acting steam or air hammer developing not less than 26,000 ft. pounds. The source of steam or air shall be sufficient to operate the hammer at its rated speed.

2. The Subcontractor's attention is drawn to the fact that all piles in the test pile program were driven by use of single acting hammers. If the Subcontractor proposes to use double acting hammers of equivalent energy, it shall be its responsibility and at its cost to develop and demonstrate a revised pile driving criteria by first driving to a proposed minimum resistance using the double-acting hammer and then testing their resistance by driving the same piles to the specified minimum resistance, with the specified single acting hammer. A minimum of three test drives for each pile size is required and additional test drives may be required, until criteria are developed which meet all requirements and approvals of the New York City Building Department and Foundation Engineer.

3. The hammer shall be in good operating condition at all times during driving.

4. Piles shall be driven using fixed leads and hammer carriages constructed in such a manner as to allow freedom of movement to the hammer, and such that the pile is held firmly in correct position and alignment as well as in axial alignment with the hammer.

5. A suitable anvil shall be used to prevent damage to the pile tops. Suitable cushioning shall be used in the cap block to prevent damage to the pile top.

C. PILE DRIVING CRITERIA

1. Piles shall be driven to sound bedrock and then to specified penetration resistance. Pile driving shall be continuous until the pile has developed its required bearing capacity.

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2. Piles shall be driven to a minimum penetration resistance of five (5) blows per one quarter inch or smaller penetration for the last 40 blows and in addition shall be installed in accordance with the New York City Building Code.

3. Piles whose tops have been crimped or damaged during driving shall be trimmed square below the damaged portion and redriven to the specified minimum penetration resistance.

D. PILE LENGTHS

1. The Subcontractor shall be solely responsible for selecting the lengths of piles to be driven.

2. The approximate elevations of the bedrock surfaces have been estimated at test borings and approximate contours are shown on the Information Drawings. These elevations are shown for information only, and actual bedrock elevations at pile locations may differ from the contoured elevations.

E. PILE DRIVING

1. All piles shall be driven in the presence of a Professional Engineer who will keep a detailed record of each pile driven. The Professional Engineer will be engaged by the Contractor.

2. All piles shall be driven in conformity with the pile driving criteria specified in this Section.

3. Spudding of piles to clear obstructions will be permitted.

4. Jetting of piles will not be permitted.

5. Piles shall be driven at subgrade elevation and the use of followers will not be permitted, except as may be specifically approved by the Foundation Engineer.

6. No pile driving will be permitted within 50 feet of any concreting operation or within 50 feet of any concrete less than 48 hours old.

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F. OBSTRUCTIONS

1. When a pile meets an obstruction which will damage the pile tip or cause the pile to drift off location, the obstruction shall be removed by spudding, augering, drilling or other approved methods, and the pile redriven.
2. If in the opinion of the Contractor a pile has been damaged by obstructions during driving, or otherwise does not meet specification requirements, it will be abandoned and a replacement pile or piles shall be driven at no additional cost to the Contractor.

G. TOLERANCE

1. Piles shall be accurately located and their locations at cut-off elevation shall not vary more than 3 inches from the plan locations shown on the Contract Drawings.
2. No pile required to be driven plumb shall be out of plumb more than 2 percent.

H. CUT OFF

1. The tops of all piles shall be cut off at elevations indicated on the Drawings or as specified by the Foundation Engineers. The cut shall be clean and to a true plane.

I. ABANDONED PILES

1. Abandoned piles shall be pulled or shall be cut off two feet below specified elevation.

J. ANALYSES AND CORRECTIVE MEASURES

1. The analysis and redesign work called for herein shall be performed for the Contractor by the Foundation Engineer. Cost for this Work shall be at the Subcontractor's expense.
2. The Foundation Engineer shall analyse the piles, as driven, to determine whether corrective measures are required. If corrective measures are not required, approval will be given to proceed with the concrete work and there will be no cost for corrective work to the Subcontractor.

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3. The Foundation Engineer shall determine the corrective measures required to keep pile loads within the allowable limits for those piles driven more than 3 inches from plan location, more than 2 percent out of plumb, or rejected for whatever reason. All costs shall be at the Subcontractor's expense.

4. If corrective measures involve the abandonment of piles, the installation of additional piles, the modification of pile caps and the corrective work, the drawings will be prepared by the Foundation Engineer at the Subcontractor's expense and the cost of performing the corrective work shall be at the Subcontractor's expense, including furnishing and driving piles and all other related materials and work.

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WORLD TRADE CENTER RIVER WATER INTAKE SYSTEM
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CONCRETE FILLED STEEL PIPE PILES

SECTION 02363

I. GENERAL

A. DESCRIPTION

1. The Work covered in this division of the Specifications includes the construction described in this Paragraph A, including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.

a. Install closed-end pipe piles with conical tips, bearing on bedrock with a design capacity of 130 tons.

b. Install open-end pipe piles bearing on bedrock with a design capacity of 130 tons.

c. Furnish all surveys, layout, and record keeping incident to pile driving and as specified in the Contract Documents.

B. RELATED WORK NOT INCLUDED IN THIS SECTION
BUT SPECIFIED ELSEWHERE

1. The following related items are specified in other Section of the Specifications:

- a. Earthwork - Section 02200
- b. Foundation Concrete - Section 03315
- c. Demolition - Section 02110
- d. Steel Piling - Section 02310

C. REFERENCES

1. Perform all work in accordance with the latest editions and revisions of applicable standards and/or specifications of:

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- a. American Institute of Steel Construction (AISC)
- b. American Society for Testing and Materials (ASTM)
- c. American Welding Society (AWS)
- d. American Concrete Institute (ACI)
- e. New York City Building Code

D. SUBMITTALS

1. Before beginning pile driving the Subcontractor shall submit:
 - a. Description of equipment proposed for pile driving including hammer, leads and cap block cushioning.
 - b. Pile numbering plan.
 - c. Description of proposed pile driving sequence and procedure.
2. The Subcontractor shall determine and certify the actual location of each pile as installed, and shall submit certified lists and drawings of the pile designation number, cutoff elevation as installed, deviation from plumb to Contractor's representative.
3. The Subcontractor shall keep a record of each pile driven, and shall furnish signed, typewritten copies daily. The records shall include the pile length as driven, ~~date and time of driving~~, time delays during driving, splice locations, tip and cut-off elevations, deviations from plan location and from plumb or required batter, hammer data, driving resistance, and any other applicable data.

II. MATERIALS

A. PILES

1. Steel pipe piles shall have an outside diameter of 12-3/4 inches and a minimum wall thickness of 0.500 inches and shall conform to the requirements for Grade

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CONCRETE FILLED STEEL
PIPE PILES -
WTC RELOCATION

2 pipe pile of the Standard Specification for Welded and Seamless Steel Pipe Pile of the American Society for Testing and Materials (ASTM Designation: A242).

2. The Subcontractor shall splice sections of pipe pile with an approved water-tight butt weld that shall develop the full strength of the pipe section. There shall be no splicing allowed from the tip of the pile to a point 40 feet above it. There shall be no more than two splices per pipe.

3. Welding shall conform to the requirements of the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society. Welding shall be performed by welders who have been qualified by tests as prescribed in Standard Qualification Procedure of the American Welding Society.

4. PILE TIPS

a. The bottom of closed-end pipe piles shall be fitted with a "Pl3006 Inside Flange Extra Strong Ribbed 60° Point", as manufactured by Associated Pile Fitting Corp. of Clifton, New Jersey, or shall be closed with a 1-1/4" steel plate welded completely around the pipe or an approved equal.

b. Pile tips of open-end pipe piles shall be reinforced, as necessary, to assure that the tips are not damaged or distorted during driving and seating operations.

B. CONCRETE

1. Concrete fill in the pile shafts shall have a 3 to 5 inch slump and shall attain a minimum compressive strength at 28 days of 5,000 psi.

C. REINFORCING

1. Except as specified below all reinforcing steel shall be new billet steel, deformed bars conforming to ASTM Specification A-615, Grade 60.

2. Specified clearances from the steel pipe pile shall be maintained throughout the length of the element. All spacers shall be non-conductors of electricity and shall have a compressive strength equal to or greater than the compressive strength of the concrete.

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PIPE PILES - WORLD

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III. EXECUTION

A. GENERAL

1. The Subcontractor shall be solely responsible for manufacture, handling, transporting, and driving of the pile under the terms of this Section, and for all permits, arrangement, costs and charges incident thereto.

B. EQUIPMENT

1. All piles shall be driven using a single acting steam or air hammer developing not less than 32,000 ft. pounds of energy. The source of steam or air shall be sufficient to operate the hammer at its rated speed.

2. Piles shall be driven using fixed leads and hammer carriages constructed in such a manner as to allow freedom of movement to the hammer, and such that the pile is held firmly in correct position and alignment, as well as in axial alignment with the hammer.

3. A suitable anvil shall be used to prevent damage to the pile tops. Suitable cushioning shall be used in the cap block to prevent damage to the pile top.

C. PILE DRIVING CRITERIA

1. Piles shall be driven to sound bedrock and then to specified penetration resistance. Pile driving shall be continuous until the pile has developed its required bearing capacity.

2. Piles shall be driven to sound bedrock and then to resistance of five (5) blows per one quarter inch or smaller penetration for the last 40 blows.

3. Piles whose tops have been crimped or damaged during driving shall be trimmed square below the damaged portion and redriven to the specified minimum penetration resistance.

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CONCRETE FILLED STEEL
PIPE PILES

D. PILE LENGTHS

1. The Subcontractor shall be solely responsible for selecting the lengths of piles to be driven.
2. The approximate elevations of the bedrock surfaces have been estimated at test borings and approximate contours are shown on the Information Drawings. These elevations are shown for information only, and actual bedrock elevations at pile locations may differ from the contoured elevations.

E. PILE DRIVING

1. All piles shall be driven in the presence of a Professional Engineer who will keep a detailed record of each pile driven. The Professional Engineer will be engaged by the Contractor.
2. All piles shall be driven in conformity with the pile driving criteria specified in this Section.
3. Spudding of piles to clear obstructions and jetting to aid pile penetration through overburden will be permitted. Care shall be taken so as not to eliminate lateral support of individual piles, adjacent structures, or loss of ground during jetting operations.
4. Piles shall be driven at subgrade elevation and the use of followers will not be permitted.
5. No pile driving will be permitted within 50 feet of any concreting operation or within 50 feet of any concrete less than 48 hours old.
6. The Subcontractor shall determine the elevation of each pile after driving. At the completion of driving of all piles within a group the Subcontractor shall determine the elevation of all piles within the group. If any pile within the group has heaved the Subcontractor shall redrive all piles within the group to their original elevation and to a resistance of 40 blows per inch.

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CONCRETE FILLED STEEL
PIPE PILES -
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F. OBSTRUCTIONS

1. When a pile meets an obstruction which will damage the pile tip or cause the pile to drift off location, the obstruction shall be removed by spudding, augering, or drilling, and the pipe redriven.

2. If in the opinion of the Foundation Engineer, a pile has been damaged by obstructions during driving, or otherwise does not meet Specification requirements, it will be abandoned and a replacement pile driven at the Subcontractor's expense.

G. TOLERANCES

1. Piles shall be accurately located and their locations at cut-off elevation shall not vary more than 3 inches from the plan locations shown on the Contract Drawings.

2. No pile required to be driven plumb shall be out of plumb more than 2%. Piles required to be driven on a batter shall not vary from the indicated batter by more than 2%.

H. CUT-OFF

1. The tops of all piles shall be cut off at elevations indicated on the Drawings or as specified by the Contractor. The cut shall be clean and to a true plane.

I. ABANDONED PILES

1. Abandoned piles shall be pulled or shall be cut off two feet below specified elevation and filled solidly with sand.

J. CONCRETING

1. No concrete shall be placed in any pile until it has been inspected and found free of water, debris or other foreign materials, and the pile shell has been confirmed to be undamaged by Foundation Engineer.

2. All piles for each pile cluster shall be driven prior to placement of concrete within any pile in a cluster.

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CONCRETE FILLED STEEL
PIPE PILES -
WORLD TRADE CENTER
LOCATION

3. Concrete shall be placed through funnel hopper and inserted into pipe pile and permitted to drop through funnel. The first material placed shall be one cubic foot of 1:2 cement-sand mortar followed by specified concrete.

K. ANALYSES AND CORRECTIVE MEASURES

1. The analysis and redesign work called for herein shall be performed for the Contractor by the Foundation Engineer. Cost for this work shall be at the Subcontractor's expense.

2. The Foundation Engineer shall analyze the piles, as driven, to determine whether corrective measures are required. If corrective measures are not required, approval will be given for preceeding with the concrete work and there will be no cost for corrective work to the Subcontractor.

3. The Foundation Engineer shall determine the corrective measures required to keep pile loads within allowable limits for those piles driven more than 3 inches from plan location, more than 2% out of plumb, or rejected for whatever reason. All costs shall be at the Subcontractor's expense.

4. If corrective measures involve the abandonment of piles, the installation of additional piles, the modification of pile caps and slabs, the supplemental drawings will be prepared by the Foundation Engineer at the Subcontractor's expense and the cost of performing the corrective work shall be at the Subcontractor's expense, including furnishing and driving piles, furnishing and placing concrete and all other related materials and work.

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CONCRETE FILLED STEEL
PIPE PILES - WORLD TRADE
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WORLD TRADE CENTER RIVER WATER INTAKE SYSTEM
RELOCATIONS

SECTION 03315

FOUNDATION CONCRETE
AND REINFORCEMENT

I. GENERAL

A. DESCRIPTION

1. The work covered by this division of the Specifications includes the construction described in this Paragraph A, including all labor necessary to perform and complete such construction, materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.
2. Place concrete and rebar in accordance with items II and III below.
- B. RELATED WORK NOT INCLUDED IN THIS SECTION BUT SPECIFIED ELSEWHERE

1. The following related items are specified in other sections of the Specifications:

- | | |
|--|-----------------|
| a. Earthwork | - Section 02200 |
| b. Concrete Filled Steel
Pipe Piles | - Section 02363 |
| c. Demolition | - Section 02110 |

C. SUBMITTALS

1. Submit shop and placing drawings of reinforcing steel.
2. Submit design mix for 4,000 psi concrete structural elements.

II. PRODUCTS

A. CONCRETE

1. Concrete for structural elements shall have a minimum 28 day strength of 4,000 psi and a maximum 4" slump.

B. Concrete Aggregates

1. Fine aggregate for concrete shall comply with the requirements of ASTM Specification C-33, Current Edition. It shall consist of clean, hard, strong, durable uncoated particles of mineral origin, free from salt, loam, shale, clay and other deleterious matter and shall be well graded from coarse to fine.
2. Coarse aggregate shall comply with the requirements of ASTM Specification C-33, Current Edition. It shall consist of crushed sound stone, composed of hard, strong, durable uncoated pieces free from soft, friable, thin, elongated or laminated fragments or a screened and washed bank run gravel.

C. Cement

1. Cement for all concrete shall be Portland Cement, Type II, of United States manufacture and of an approved brand complying with the requirements of ASTM Specification C-150, Current Edition.

D. Water

1. Water used in concrete shall be potable water.

E. Admixtures

1. Water reducing and retarding admixtures shall be approved by the Contractor and shall meet the requirements of ASTM Specification C-494

F. Reinforcement

1. Bar reinforcement shall be new deformed billet steel bars, Grade 60 of United States manufacture conforming to the requirements of ASTM Specification A615, Current Edition.

G. Concrete Design

1. Concrete shall be composed of materials meeting the requirements of this Section, proportioned so as to provide the minimum specified compressive strength for that portion of the Work.

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WORLD TRADE CENTER RELOCATION

2. The working consistency of the concrete shall be slump test described in ASTM Specification C-143, Current Edition.
3. Each of the constituent materials of the concrete shall be accurately measured by weight, unless otherwise specified or approved by the Contractor, and the method of measurement shall be such as to secure the specified proportions in each batch.
4. Coarse aggregate shall have a maximum size of 3/4 inch unless the size is otherwise limited by the spacing of the reinforcing in the concrete.
5. The Subcontractor shall employ and pay for, as part of his contract price, an approved Testing Laboratory to design a series of concrete mixes using the materials and sources which he proposes to employ during the Construction of the Work. Concrete design mixes shall produce an average strength 15% higher than the minimum 28 day strength specified.

III. EXECUTION

A. BATCHING OF MATERIAL

1. The materials shall be measured in conformance with the requirements of the ASTM Specification C94. Weight-batch apparatus for conventional type mixers shall also meet the same requirements.
2. Bulk cement shall be weighed on scales having a degree of control and accuracy such that the delivered weight shall be correct within one percent. The scale and weight hopper shall be separate and distinct from those used for other materials. Cement may be batched on a bag basis; the weight of a bag of Portland Cement (U.S.) shall be taken as 94 pounds and only whole units are to be used with this method.
3. Aggregates shall be weighed on scales having a degree of control of accuracy such that the delivered weights are correct within two percent. Moisture, both free and absorbed, shall be corrected for and the free moisture shall be taken into account when dispensing the mixing water.
4. Water shall be measured by volume or weight with an accuracy and control within a one percent tolerance.
5. When the outdoor temperature is below 40°F or is likely to fall below 40°F during the 24-hour period after placing, adequate equipment shall be provided for heating

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the concrete material and protecting the concrete against freezing, but no frozen materials or materials containing ice shall be used. Temperatures of the separate materials, including the mixing water, when placed in the mixer, shall not exceed 140°F. When placed in forms, the concrete shall have a temperature between 50°F and 70°F.

B. MIXING CONCRETE

1. Unless otherwise authorized, the mixing of concrete shall be done in a batch mixer of approved AGC type or in transit-mix equipment conforming to ASTM Specification C-94, using Alternate No. 2 method to determine quality. The volume of the mixed material for each batch shall not exceed the manufacturer's rated capacity of the mixer. If transit-mixed, the materials shall be brought to the site dry and the period of time from batching to the addition of water at the site of the pour shall not exceed thirty minutes.
2. Site mixed concrete shall be mixed in an approved batch mixer and the batching and mixing shall be of sufficient capacity and power to carry out each prearranged concrete operation without danger of delay or interruption until the unit or concrete pour is completed. The mixer drum shall be rotated at the speed recommended by the manufacturer and mixing of the concrete ingredients shall continue for not less than 1-1/2 minutes from the time all of the materials, including the water, are in the mixer drum. Mixing shall continue until all the ingredients are uniformly distributed throughout the batch and the mass of the concrete is homogeneous and uniform in color. Discharge of concrete shall be completed within a maximum period of 30 minutes. No new materials shall be permitted to enter the mixer until all of the preceeding batch has been discharged. Mixing and handling equipment shall be cleaned at frequent intervals while in use.
3. All concrete shall be used while fresh and before there is any evidence of initial set. Any concrete which has achieved its initial set shall be rejected and not used in the Work. No retempering of concrete will be permitted.

C. CONCRETE TESTING

1. Tests of the concrete will be made by an approved independent testing and inspection laboratory hired by the Contractor. The Subcontractor shall provide casual labor and assistance to the testing laboratory personnel for required testing.

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WORLD TRADE CENTER RELOCATION

D. CONCRETE HANDLING & PLACING

1. Foundations - Concrete for pile caps, slab, beams, retaining walls and miscellaneous members shall be placed in the dry. Before placing any concrete all equipment for mixing and transporting the concrete shall be clean, all debris and ice shall be removed from the spaces to be occupied by the concrete and the reinforcement thoroughly cleaned of ice or other deleterious coatings. All accumulated water shall be removed from the place of deposit before concrete is placed. Dropping of concrete through water will not be permitted.

E. REINFORCEMENT

1. The Subcontractor shall prepare and submit shop drawings of bar reinforcement for the Contractor's approval in accordance with the requirements of the General Conditions. Such drawings shall show: the element identification, bending diagrams, cutting, lists, inserts, spacers, etc. and shall completely demonstrate the location, size, spacing, length and bending of the bar reinforcement. Shop drawings for concrete reinforcement shall be prepared in accordance with the American Concrete Institute "Manual of Standard Practice for Detailing Reinforced Concrete Structures", ACI-315.

2. Reinforcing cages for each elements shall be completely assembled and securely tied and braced so as to maintain dimensional rigidity during placing of concrete.

3. Slab reinforcing shall not be in contact with neither the pile casing, nor the pile reinforcing.

F. FORMS

Forms shall conform to the shape, lines and dimensions of the elements shown on the Contract Drawings and shall be substantially free from surface defects and sufficiently tight to prevent leakage of mortar. They shall be properly braced so as to maintain position and shape during the placing of concrete. Forms shall meet the requirements of ACI-341-68, "Recommended Practice for Concrete Formwork", and ACI-SP No. 4, "Formwork for Concrete".

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FOUNDATION CONCRETE
WORLD TRADE CENTER RELOCATION

FOUNDATION SPECIFICATIONS

FOR

CONTRACTS OF CONSTRUCTION

FOR

CUL-DE-SAC

AT

BATTERY PARK CITY COMMERCIAL CENTER

OWNER:

Battery Park City Authority, acting through BPC
Development Corporation, a subsidiary of the
New York State Urban Development Corporation

DEVELOPER:

Olympia & York Battery Park City

DESIGN CONSULTANTS:

Design Architects: Cesar Pelli & Associates
Architects: Haines, Lundberg & Waehler
Mechanical & Electrical Engineer: Norman D.
Kurtz Consulting Engineers/member of the F&K
Group
Foundation & Soils Engineer: Mueser, Rutledge,
Johnston & DeSimone

CONTRACTOR:

Olympia & York Battery Park Company

APRIL 7, 1982

INDEXDIVISIONS 02000 & 03000FOUNDATIONSCUL-DE-SAC

<u>SECTION</u>	<u>TITLE</u>	<u>DATE</u>
02110	ALTERATION	April 7, 1982
02200	EARTHWORK	April 7, 1982
02310	STEEL PILING	April 7, 1982
03315	FOUNDATION CONCRETE	April 7, 1982

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SECTION 02110

ALTERATION

I. GENERALA. DESCRIPTION

1. The Work covered in this division of the Specifications includes the construction described in this Paragraph A, including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.

a. Remove top 2 feet of 2 "pedestrian" piers as shown on Dwg. No. CD.S-1.

B. RELATED WORK NOT INCLUDED IN THIS SECTION, BUT SPECIFIED ELSEWHERE

1. The following related items are specified in other Sections of the Specifications:

- a. Earthwork - Section 02200
- b. Steel Piling - Section 02310
- c. Foundation Concrete - Section 03315

C. GENERAL REQUIREMENTS

1. The Subcontractor shall carry out his operations in a manner that will protect and cause a minimum of interference to adjacent work which will be underway at the time this work is to be performed.

II. PRODUCTSA. MATERIALS

1. All alterations debris, rebar and concrete pieces, shall become the property of the Subcontractor and be removed and disposed of by him at his expense off the site.

III. EXECUTIONA. WORKMANSHIP

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ALTERATION

1. All alteration work shall be done in a careful and professional manner. No unnecessary damage shall be allowed to the "pedestrian" piers below Elev. +5 or to the relieving composite deck. The Subcontractor shall be solely responsible for the removal, handling, transportation and disposal of all materials of all kinds demolished under the terms of this Section of the Specifications, and for all arrangements, permits, costs or charges incident thereto.

2. Concrete shall be chipped or sawed to a rough horizontal plane at Elev. +5 and the rebars burned off flush with the surface of the concrete at the limits shown on the Drawings.

3. The 550 psf loading limit for existing relieving platforms will not allow the placement on the platform of heavy equipment such as Dynahoe or compressor unless timbers distribute the loadings satisfactorily. Prior approval of the Foundation Engineer is required for any procedure involving placement of heavy equipment on the platform.

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EARTHWORK

SECTION 02200

I. GENERALA. DESCRIPTION

1. The Work covered in this division of the Specifications includes the construction described in this Paragraph A, including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.

a. Excavate and rough grade surface to the elevations noted on drawings for each portion of the Work.

b. Provide temporary sheeting and support as required for excavation.

c. Transport and dispose of all materials as further specified in this Section.

d. Dewater and drain as required. The Subcontractor's attention is drawn to the expected difficulty involved in transporting materials across the aforementioned utility lines by truck unless a temporary bridge is installed.

B. RELATED WORK NOT INCLUDED IN THIS SECTION BUT SPECIFIED ELSEWHERE

1. The following related items are specified in other Sections of the Specifications.

- | | |
|------------------------|-----------------|
| a. Alteration | - Section 02110 |
| b. Steel Piling | - Section 02310 |
| c. Foundation Concrete | - Section 03315 |

II. PRODUCTS

A. All materials of whatever nature including recent sand, metal, fill, timber boulders, debris, or rock encountered within the boundaries of the Work and the Excavation subgrades indicated on the drawings shall be unclassified excavation and shall be removed, transported and disposed of as specified in this Section.

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EARTHWORK

B. MATERIAL CLASSIFICATION

1. For purposes of disposal only, excavated material shall be classified as follows:

a. Recent fill (F-2) - Recent fill is primarily a fine relatively uniform sized sand hydraulically placed for the construction of the Battery Park City landfill. Slight mixing or interbedding of the sand and the underlying organics at their interface, provided that the silt is not more than 10 percent of the volume will be classified as recent fill with the approval of the Foundation Engineer.

b. Miscellaneous unsuitable (F-1) - Miscellaneous unsuitable shall be wood, all metal or timbers exceeding one cubic foot in volume, and pieces of rock or concrete exceeding two feet in maximum dimension or four square feet in area. Plastic and metal debris and soil with more than 10% fines shall also be miscellaneous unsuitable.

III. A. EXCAVATION - SOIL

1. All materials within the boundaries of the Work shall be removed to the excavation subgrades indicated on the drawings.

2. Backfill, grade and compact all areas and volumes excavated beyond the limits shown on the drawings with recent fill.

B. TEMPORARY SHEETING

1. The changes in subgrade levels shall be supported by suitable sheet piling or sheeting held in place by soldier beams, braces, shores or wales.

2. Timber and steel used for the sheeting system may be either new or used, but must, in all cases, be sound, free from defects and suitable for its intended use.

3. Temporary sheeting shall be maintained by the Subcontractor until acceptance of the Work by the Contractors Representative.

C. DEWATERING

1. It shall be the responsibility of this Subcontractor to control and maintain water levels in the excavations so that all excavation will be done in the dry. The water level in the excavation shall at all times be a minimum of 2 feet below the deepest excavation. Softening of the bottom will not be allowed. Subcontractor shall maintain and operate the dewater system until acceptance of the Work by the Contractor.

D. BACKFILL

1. Backfill, except for space between relieving platforms, shall be recent fill or similar clean sand compacted to 95% or ultimate standard Proctor density.

2. Backfill for space between relieving platforms shall be uncompacted lightweight fill composed of cinders (at least 3 years old and well-leached out) or expanded shale with a maximum particle size of 3 inches.

3. Maximum compacted lift thickness shall not exceed 1'0" in structural areas, such as footings, roads, sidewalks. Maximum compacted lift thickness shall not exceed 24 inches in non-structural areas.

E. DISPOSAL

The Subcontractor shall dispose of excavated material in accordance with MRJD Drawing No. Sp-1, dated 1/15/82. With respect to offsite disposal of material, Subcontractor shall comply with requirements of General Conditions, Paragraph 2.16.07.

1. Recent Fill (F-2) - Recent fill as defined in Paragraph II.B.1.a of this Section shall be stockpiled on the Battery Park City site in areas designated by the Contractor.

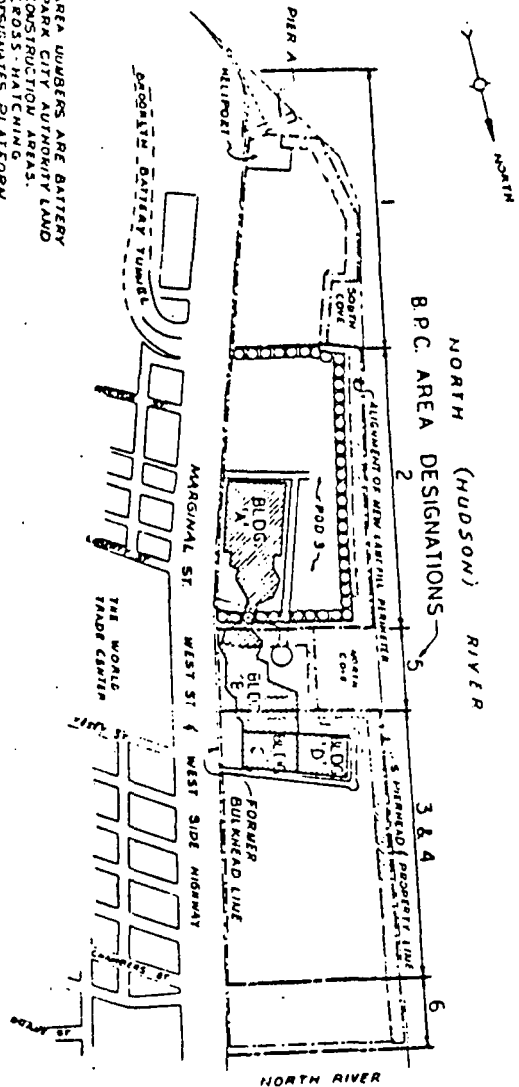
2. Miscellaneous Unsuitable (F-1) - Miscellaneous unsuitable as defined in Paragraph II.B.1.b of this Section shall be disposed of off-site at locations selected by the Subcontractor. All costs of transporting, permits and disposal sites shall be borne by the Subcontractor.

3. Alternate - The Contractor shall have the operation of having Subcontractor dispose of portions of these materials which cannot be properly disposed of on the Battery Park City site, as fill conveyed to New York Department of Sanitation. Contact Mr. Walter C. Zwartacky at (212) 566-8870. In such event Subcontractor shall be responsible for all costs attendant to such disposal and contract price shall reflect any credits realized by Subcontractor, See Bid Form Alternate C.1.

NOTE - AREA NUMBERS ARE BATTERY
PARK CITY AUTHORITY LAND
CONSTRUCTION AREAS.
--- CROSS-HATCHING
DESIGNATES PLATFORM
BULKHEAD CONSTRUCTION.

GENERAL PLAN OF BATTERY PARK CITY

0 500' 1000'



SUMMARY OF MATERIAL USE

MATERIAL TYPE	DERIVED FROM STRATUM	BUILDING AREAS WHERE SOIL IS FOUND	MATERIAL LIMITS OR TREATMENT	TYPE OF USE	LOCATION OF USE
I	(ARTIFICIAL SAND FILL)	B, C & D	< 101 FINE PASS- ING NO. 200 SIEVE. COMPACT IN 1 FOOT LIFTS TO 95% STANDARD PROCTOR DENSITY	COMPACTED FILL STOCKPILE FOR FUTURE USE	SITES A, B, C & D LOTS 1, 2, 4 & 6
II	(ORGANIC SILTY CLAY) AS MIXED WITH 15% PORTLAND CEMENT 11 OR 12	A, B & D SMALL MOUNTAINS IN SITE	> 201 FINE PASS- ING NO. 200 SIEVE REWORK DEBRIS > 2" OR 2" IN DIA.	ROAD TEMPORARY ROAD- WAY STOCKPILE MATERIAL	DISPOSAL SITE 3, 5, 4 & 6
III	(MISCELLANEOUS FILL)	A SMALL MOUNTAINS IN SITE	< 201 FINE PASS- ING NO. 200 SIEVE REWORK DEBRIS > 2" OR 2" IN DIA.	TEMPORARY ROAD- WAY STOCKPILE MATERIAL	DISPOSAL SITE 3, 5, 4 & 6

NOTE
REFER TO AVAILABLE SOIL REPORTS AND CONTACT SPEAKING FOR MORE DETAILED INFORMATION ON THE SOILS
CONSTITUTING THE MATERIAL TYPES.

OLYMPIA & YORK 245 PARK AVENUE NEW YORK NY	COMMERCIAL CENTER BATTERY PARK CITY	FEJESER-RUTLEDGE-JONES & O'SHEA CONSULTING ENGINEERS 700 THIRD AVENUE NEW YORK, NY 10017	RECOMMENDED FILL AND STOCKPILING OF EXCAVATED MATERIAL	SP-1
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BATTERY PARK CITY
COMMERCIAL CENTER

CUL-DE-SAC

STEEL PILING

SECTION 02310

I. GENERAL

A. DESCRIPTION

The Work covered by this division of the Specifications includes the construction described in this Paragraph A, including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.

1. Furnish, install as required 100 ton design capacity HP 10 x 57 steel piles for support of concrete deck relieving platform south of the WTC utility lines in the vicinity of the cul-de-sac.

2. Furnish all surveys, layouts, inspection and record keeping incident to pile driving and as specified in the Contract Documents.

B. RELATED WORK NOT INCLUDED IN THIS SECTION
BUT SPECIFIED ELSEWHERE

1. The following related items are specified in other Sections of the Specifications.

- a. Alteration - Section 02110
- b. Earthwork - Section 02200
- c. Foundation Concrete - Section 03315

C. REFERENCES

1. Perform all Work in accordance with the latest editions and revisions of applicable standards and/or specifications of:

- a. American Institute of Steel Construction (AISC)
- b. American Society for Testing & Materials (ASTM)

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- c. American Welding Society (AWS)
- d. American Concrete Institute (ACI)
- e. New York City Building Code

D. SUBMITTALS

1. Before beginning pile driving the Subcontractor shall submit:

- a. Description of equipment proposed for pile driving including hammer, leads and cap block cushioning.
- b. Pile numbering plan.
- c. Description of proposed pile driving sequence and procedure.
- d. Details of any required splices.

2. The Subcontractor shall employ a surveyor licensed in the State of New York who shall determine and certify the actual location of each pile as installed, and shall submit certified lists and drawings of the pile designation number, cutoff elevation as installed, or deviation from plumb.

II. MATERIALS

A. PILES

1. Steel piles for utility supports and platforms shall be HP 10 x 57 rolled shapes conforming to the requirements of ASTM A-36, Current Edition.

a. The Subcontractor shall furnish mill certificates to the Contractor's representative certifying that the piles conform to the requirements of ASTM A-36, Current Edition.

3. The Subcontractor shall splice sections of pile with an approved full penetration butt weld made by a New York City certified and AWS qualified welder, and conforming to the Specifications of the American Welding Society Structural Welding Code, AWS D1.1, Current Edition. There shall be no splicing allowed from the tip of the pile to a point 40 feet above it. There shall be no more than two splices per pile.

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STEEL PILING
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III. EXECUTION

A. GENERAL

1. The Subcontractor shall be solely responsible for the manufacture, handling, transporting and driving of the piles under the terms of this Section, and for all permits, arrangements, costs and charges incident thereto.

B. EQUIPMENT

1. All piles shall be driven using a single acting steam or air hammer developing not less than 26,000 ft. pounds. The source of steam or air shall be sufficient to operate the hammer at its rated speed.

2. The Subcontractor's attention is drawn to the fact that all piles in the test pile program are driven by use of single acting hammers. If the Subcontractor proposes to use double acting hammers of equivalent energy, it shall be its responsibility and at its cost to develop and demonstrate a revised pile driving criteria by first driving to a proposed minimum resistance using the double-acting hammer and then testing their resistance by driving the same piles to the specified minimum resistance, with the specified single acting hammer. A minimum of three test drives for each pile size is required and additional test drives may be required, until criteria are developed which meet all requirements and approvals of the New York City Building Department and Foundation Engineer.

3. The hammer shall be in good operating condition at all times during driving.

4. Piles shall be driven using fixed leads and hammer carriages constructed in such a manner as to allow freedom of movement to the hammer, and such that the pile is held firmly in correct position and alignment as well as in axial alignment with the hammer.

5. A suitable anvil shall be used to prevent damage to the pile tops. Suitable cushioning shall be used in the cap block to prevent damage to the pile top.

C. PILE DRIVING CRITERIA

1. Piles shall be driven to sound bedrock and then to specified penetration resistance. Pile driving shall be continuous until the pile has developed its required bearing capacity.

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2. Piles shall be driven to a minimum penetration resistance of five (5) blows per one quarter inch or smaller penetration for the last 40 blows and in addition shall be installed in accordance with the New York City Building Code.

3. Piles whose tops have been crimped or damaged during driving shall be trimmed square below the damaged portion and redriven to the specified minimum penetration resistance.

D. PILE LENGTHS

1. The Subcontractor shall be solely responsible for selecting the lengths of piles to be driven.

2. The approximate elevations of the bedrock surfaces have been estimated at test borings and approximate contours are shown on the Information Drawings. These elevations are shown for information only, and actual bedrock elevations at pile locations may differ from the contoured elevations.

E. PILE DRIVING

1. All piles shall be driven in the presence of a Professional Engineer who will keep a detailed record of each pile driven. The Professional Engineer will be engaged by the Contractor.

2. All piles shall be driven in conformity with the pile driving criteria specified in this Section.

3. Spudding of piles to clear obstructions will be permitted.

4. Jetting of piles will not be permitted.

5. Piles shall be driven at subgrade elevation and the use of followers will not be permitted, except as may be specifically approved by the Foundation Engineer.

6. No pile driving will be permitted within 50 feet of any concreting operation or within 50 feet of any concrete less than 48 hours old.

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STEEL PILING
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F. OBSTRUCTIONS

1. When a pile meets an obstruction which will damage the pile tip or cause the pile to drift off location, the obstruction shall be removed by spudding, augering, drilling or other approved methods, and the pile redriven.
2. If in the opinion of the Contractor's representative a pile has been damaged by obstructions during driving, or otherwise does not meet specification requirements, it will be abandoned and a replacement pile or piles shall be driven at no additional cost of the Contractor.

G. TOLERANCE

1. Piles shall be accurately located and their locations at cut-off elevation shall not vary more than 3 inches from the plan locations shown on the Contract Drawings.
2. No pile required to be driven plumb shall be out of plumb more than 2 percent.

H. CUT OFF

1. The tops of all piles shall be cut off at elevations indicated on the Drawings or as specified by the Contractor. The cut shall be clean and to a true plane.

I. ABANDONED PILES

1. Abandoned piles shall be pulled or shall be cut off two feet below specified elevation.

J. ANALYSES AND CORRECTIVE MEASURES

1. The analysis and redesign work called for herein shall be performed for the Contractor by the Foundation Engineer. Cost for this Work shall be at the Subcontractor's expense.
2. The Foundation Engineer shall analyse the piles, as driven, to determine whether corrective measures are required. If corrective measures are not required, approval will be given for proceeding with the concrete work and there will be no cost for corrective work to the Subcontractor.

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3. The Foundation Engineer shall determine the corrective measures required to keep pile loads within the allowable limits for those piles driven more than 3 inches from plan location, more than 2 percent out of plumb, or rejected for whatever reason. All costs shall be at the Subcontractor's expense.

4. If corrective measures involve the abandonment of piles, the installation of additional piles, the modification of pile caps and the corrective work, the drawings will be prepared by the Foundation Engineer at the Subcontractor's expense and the cost of performing the corrective work shall be at the Subcontractor's expense, including furnishing and driving piles and all other related materials and work.

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COMMERCIAL CENTER

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SECTION 03315

FOUNDATION CONCRETE

I. GENERAL

A. DESCRIPTION

1. The work covered by this division of the Specifications includes the construction described in this Paragraph A, including all labor necessary to perform and complete such construction, materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.
2. Place concrete in accordance with items II and III below.
- B. RELATED WORK NOT INCLUDED IN THIS SECTION
BUT SPECIFIED ELSEWHERE

1. The following related items are specified in other sections of the Specifications:

- a. Alteration - Section 02110
- b. Earthwork - Section 02200
- c. Steel Piling - Section 02310

C. SUBMITTALS

1. Submit shop and placing drawings of reinforcing steel.
2. Submit design mix for 4,000 psi concrete structural elements.

II. PRODUCTS

A. CONCRETE

1. Concrete for structural elements shall have a minimum 28 day strength of 4,000 psi and a maximum 4" slump.

B. Concrete Aggregates

1. Fine aggregate for concrete shall comply with the requirements of ASTM Specification C-33, Current Edition. It shall consist of clean, hard, strong, durable uncoated particles of mineral origin, free from salt, loam, shale, clay and other deleterious matter and shall be well graded from coarse to fine.
2. Coarse aggregate shall comply with the requirements of ASTM Specification C-33, Current Edition. It shall consist of crushed sound stone, composed of hard, strong, durable uncoated pieces free from soft, friable, thin, elongated or laminated fragments or a screened and washed bank run gravel.

C. Cement

1. Cement for all concrete shall be Portland Cement, Type II, of United States manufacture and of an approved brand complying with the requirements of ASTM Specification C-150, Current Edition.

D. Water

1. Water used in concrete shall be potable water.

E. Admixtures

1. Water reducing and retarding admixtures shall be approved by the Contractor and shall meet the requirements of ASTM Specification C-494

F. Reinforcement

1. Bar reinforcement shall be new deformed billet steel bars, Grade 60 for bars of United States manufacture conforming to the requirements of ASTM Specification A615, Current Edition.

G. Concrete Design

1. Concrete shall be composed of materials meeting the requirements of this Section, proportioned so as to provide the minimum specified compressive strength for that portion of the Work.

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2. The working consistency of the concrete shall be slump test described in ASTM Specification C-143, Current Edition.
3. Each of the constituent materials of the concrete shall be accurately measured by weight, unless otherwise specified or approved by the Contractor, and the method of measurement shall be such as to secure the specified proportions in each batch.
4. Coarse aggregate shall have a maximum size of 3/4 inch unless the size is otherwise limited by the spacing of the reinforcing in the concrete.
5. The Subcontractor shall employ and pay for, as part of his contract price, an approved Testing Laboratory to design a series of concrete mixes using the materials and sources which he proposes to employ during the Construction of the Work. Concrete design mixes shall produce an average strength 15% higher than the minimum 28 day strength specified.

III. EXECUTION

A. BATCHING OF MATERIAL

1. The materials shall be measured in conformance with the requirements of the ASTM Specification C94. Weight-batch apparatus for conventional type mixers shall also meet the same requirements.
2. Bulk cement shall be weighed on scales having a degree of control and accuracy such that the delivered weight shall be correct within one percent. The scale and weight hopper shall be separate and distinct from those used for other materials. Cement may be batched on a bag basis; the weight of a bag of Portland Cement (U.S.) shall be taken as 94 pounds and only whole units are to be used with this method.
3. Aggregates shall be weighed on scales having a degree of control of accuracy such that the delivered weights are correct within two percent. Moisture, both free and absorbed, shall be corrected for and the free moisture shall be taken into account when dispensing the mixing water.
4. Water shall be measured by volume or weight with an accuracy and control within a one percent tolerance.
5. When the outdoor temperature is below 40°F or is likely to fall below 40°F during the 24-hour period after placing, adequate equipment shall be provided for heating

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D. CONCRETE HANDLING & PLACING

1. Foundations - Concrete for pile caps, scabs, beams, girders retaining walls and miscellaneous members shall be placed in the dry. Before placing any concrete all equipment for mixing and transporting the concrete shall be clean, all debris and ice shall be removed from the spaces to be occupied by the concrete and the reinforcement thoroughly cleaned of ice or other deleterious coatings. All accumulated water shall be removed from the place of deposit before concrete is placed. Dropping of concrete through water will not be permitted.

2. The Subcontractor's attention is drawn to the expected difficulty involved in transporting materials across the aforementioned utility lines by truck unless a temporary bridge is installed.

E. REINFORCEMENT

1. The Subcontractor shall prepare and submit shop drawings of bar reinforcement for the Contractor's approval in accordance with the requirements of the General Conditions. Such drawings shall show: the element identification, bending diagrams, cutting, lists, inserts, spacers etc. and shall completely demonstrate the location, size, spacing, length and bending of the bar reinforcement. Shop drawings for concrete reinforcement shall be prepared in accordance with the American Concrete Institute "Manual of Standard Practice for Detailing Reinforced Concrete Structures", ACI-315.

2. Reinforcing cages for each element shall be completely assembled and securely tied and braced so as to maintain dimensional rigidity during placing of concrete.

F. FORMS

Forms shall conform to the shape, lines and dimensions of the elements shown on the Contract Drawings and shall be substantially free from surface defects and sufficiently tight to prevent leakage of mortar. They shall be properly braced so as to maintain position and shape during the placing of concrete. Forms shall meet the requirements of ACI-341-68, "Recommended Practice for Concrete work", and ACI-SP No. 4, "Formwork for Concrete".

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the concrete material and protecting the concrete against freezing, but no frozen materials or materials containing ice shall be used. Temperatures of the separate materials, including the mixing water, when placed in the mixer, shall not exceed 140°F. When placed in forms, the concrete shall have a temperature between 50°F and 70°F.

B. MIXING CONCRETE

1. Unless otherwise authorized, the mixing of concrete shall be done in a batch mixer of approved AGC type or in transit-mix equipment conforming to ASTM Specification C-94, using Alternate No. 2 method to determine quality. The volume of the mixed material for each batch shall not exceed the manufacturer's rated capacity of the mixer. If transit-mixed, the materials shall be brought to the site dry and the period of time from batching to the addition of water at the site of the pour shall not exceed thirty minutes.

2. Site mixed concrete shall be mixed in an approved batch mixer and the batching and mixing shall be of sufficient capacity and power to carry out each prearranged concrete operation without danger of delay or interruption until the unit or concrete pour is completed. The mixer drum shall be rotated at the speed recommended by the manufacturer and mixing of the concrete ingredients shall continue for not less than 1-1/2 minutes from the time all of the materials, including the water, are in the mixer drum. Mixing shall continue until all the ingredients are uniformly distributed throughout the batch and the mass of the concrete is homogeneous and uniform in color. Discharge of concrete shall be completed within a maximum period of 30 minutes. No new materials shall be permitted to enter the mixer until all of the preceeding batch has been discharged. Mixing and handling equipment shall be cleaned at frequent intervals while in use.

3. All concrete shall be used while fresh and before there is any evidence of initial set. Any concrete which has achieved its initial set shall be rejected and not used in the Work. No retempering of concrete will be permitted.

C. CONCRETE TESTING

1. Tests of the concrete will be made by an approved independent testing and inspection laboratory hired by the Contractor. The Subcontractor shall provide casual labor and assistance to the testing laboratory personnel for required testing.

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G. SEALS & PROTECTIVE COVERS

Copper band seals (Celotex seals or equal) shall be installed in the deck as shown on Drawing CDS-2. Bentonite board shall be installed as shown to act as a protective cover.

H. BLOCK WALL

Provide block wall to retain light weight fill if Chamber C is not installed before backfill.

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MECHANICAL SPECIFICATIONS
FOR
CONTRACTS OF CONSTRUCTION
FOR
BUILDING 'B'
WORLD TRADE CENTER RIVER WATER INTAKE
SYSTEM RELOCATIONS

AT
BATTERY PARK CITY COMMERCIAL CENTER

OWNER:

Battery Park City Authority, acting through BPC
Development Corporation, a subsidiary of the
New York State Urban Development Corporation

DEVELOPER:

Olympia & York Battery Park Company

DESIGN CONSULTANTS:

Design Architect: Cesar Pelli & Associates
Architects: Haines Lundberg Waehler
Mechanical & Electrical Engineer: Norman D.
Kurtz Consulting Engineers/member of The F+K
Group
Foundations & Soils Engineer: Mueser-Rutledge-
Johnston & DeSimone

CONTRACTOR:

Olympia & York Battery Park Company

April 7, 1982

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DIVISION 15000

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<u>SECTION</u>	<u>TITLE</u>
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15020	REINFORCED CONCRETE PIPE
15030	PRESTRESSED CONCRETE CYLINDER PIPE
15040	PIPE TESTING, EXAMINATIONS & INSPECTIONS
15050	CONCRETE FOR MECHANICAL WORK

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SECTION 15010
MECHANICAL
SPECIAL CONDITIONS

PART I - GENERAL

1.01 DESCRIPTION

A. General

1. The General Conditions for Contracts of Construction, referred to in the Contract Documents as the General Conditions, together with the following articles of the Mechanical Special Conditions, which amend, modify and supplement various articles and provisions of the General Conditions are made part of the Contract and shall apply to all work under the Contract.
2. All articles or parts of articles of the General Conditions not so amended, modified or supplemented by these Supplementary Conditions, shall remain in full force and effect. Should any discrepancy become apparent between the General Conditions and these Special Conditions, the Subcontractor shall notify the Contractor, in writing, and the Contractor shall interpret and decide such matters in accordance with the provisions of the General Conditions.

B. Work Included

The work covered by this subcontract includes the construction described in the Contract Documents including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction, and all services, facilities, tools and equipment necessary or used to perform and complete such construction. The work includes, but is not limited to, the following:

1. Enlargement of existing 60"Ø reinforced concrete WTC river water pumped discharged pipe line to 66"Ø and construction of new 66"Ø line around Building 'B' Gatehouse.

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2. Enlargement of existing 20"Ø prestressed concrete WTC river water pumped discharge pipe line to 66"Ø reinforced concrete pipe and construction of new 66"Ø line around Building 'B' Gatehouse.
3. Connection of new 66"Ø lines to existing 60"Ø line and existing 20"Ø line.
4. Pipe access manholes including frames, covers and ladders.
5. Pipe anchors, supports, thrust blocks, cradles, and connections to pipe support foundations.
6. Air venting.
7. Pipe cleaning and testing.
8. Permits and fees.
9. Field fabricated reinforced concrete pipe - 66"Ø.
10. Factory fabricated prestressed concrete pipe - 20"Ø.
11. Steel pipe liner.
12. Corrosion protective coatings.
13. Coordination of system shut-downs.
14. Removal of existing abandoned lines where interference occurs with installation of new work.
15. Staging of work to insure uninterrupted river water service to the existing World Trade Center refrigeration plant.
16. Sacrificial anode cathodic protection of steel lining of concrete pipes.
17. Furnishing and placing reinforced concrete and forms as required for piping.
18. Coordination with adjacent utilities.
19. Draining and refilling of existing and relocated piping systems. Coordinate scheduling of shut-down and start-up of existing plant.

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20. Alternate M-1: Provide continuous steel lined reinforced concrete pipe as detailed and specified.

C. Related Work Not Included In This Division But Specified Elsewhere

1. Finish grading.
2. Pipe foundation supports including piles, pile bents, concrete platforms.
3. Filling of abandoned river water intake lines.
4. Excavation and backfill.
5. Sheeting and dewatering.
6. Cutting and patching of existing foundation structures.

1.02 DRAWINGS AND RECORDS

A. Information Drawings

1. The following drawings will be available at the Contractor's offices to bidders for their convenience. These drawings and data are for information only and are not Contract Drawings. The data shown is not represented to be correct or up-to-date and should be evaluated on the basis of inspection of the premises and the bidder's interpretation of subsurface conditions.
 - a. Drawings CI-B-1 through CI-B-18 are boring data. The logs of borings from which these data were drafted are available at the Contractor's office.

<u>General</u>	<u>Title</u>
CI-B-1	Commercial Center - Boring Location Plan
CI-B-2	Commercial Center - Contours of Bottom of Fill
CI-B-3	Commercial Center - Contours of Tops of Rocks

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<u>General</u>	<u>Title</u>
CI-B-4	Commercial Center - Existing and Previous Structures
CI-B-5	Boring Location Plan - Bldg. A & Adjacent Streets
CI-B-6	Contours of Bottom of Fill - Bldg. A & Adjacent Streets
CI-B-7	Contours of Top of Rock - Bldg. A & Adjacent Streets
CI-B-*	Existing & Previous Structures - Bldg. A & Adjacent Streets
CI-B-10	Geologic Sections A4, A5 & A6
CI-B-11	Geologic Sections B1, B2 & B3
CI-B-12	Geologic Sections B4, B5 & B6
CI-B-13	Geologic Sections B7, B8 & B9
CI-B-14	Geologic Sections C1 & C2
CI-B-15	Geologic Sections C3, C4 & C5
CI-B-16	Geologic Sections D1, D2 & D3
CI-B-17	Geologic Sections D4 & D5
CI-B-18	Geologic Sections VI

b. The following drawings pertaining to Battery Park City construction previous to the Work in this Contract will be available to the bidders at the office of the Contractor, as Information Drawings and are not Contract Drawings:

- (1) Contract Set BPCA 75-95A - Roadway & Utilities "As-Built" Dwg. Nos. II 6 - GEN. 1-3, II 6-R-1 to 8, II 6-ST- 1 to 14, II 6-EN 1 to 5 and II 6-E-1 to 19.
- (2) Contract Set BPCA 73-21 - Land Construction Areas.
- (3) Contract WTC 130.27-Pump Station, River Water Line and Pump Station Utilities; Contract WTC 541.00-Auxiliary Water Line and Electrical Ducts.

c. Boring Logs, Soil Samples and Rock Cores

Boring logs, soil samples and rock cores showing information obtained from test borings are available for inspection, for information purposes only, through the

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in a manner approved by the Contractor. All changes required in the work of the Subcontractor, caused by his neglect to do so, to be made by him at his own expense.

- G. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale similar to that of the design drawings, prepared on tracing medium of the same size as contract drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the drawings as to the area to which it applies. Do not submit these drawings to the Contractor for approval. At completion, however, include a set of such drawings with each set of as-built drawings. When directed by the Contractor, submit drawings for approval, clearly showing the mechanical work and its relation to the work of other trades before commencing shop fabrication or erection in the field.
- H. Before commencing work, examine all adjoining work on which this work is in any way dependent for perfect workmanship and report any conditions which prevent performance of first class work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

1.04 USE OF SITE AND LOAD LIMITATIONS

- A. The Subcontractor shall review all available data on the location and types of pipe lines and other facilities connecting the WTC pump station with the WTC, together with cooling water discharge lines and other existing underground utilities. The Subcontractor shall not operate equipment over the facilities and shall take care not to damage them or otherwise impair their use. The Subcontractor shall make investigation to verify the location of these facilities before proceeding with construction and/or operations in their vicinity.
- B. Subcontractor shall note that the "Port Authority of New York and New Jersey" (PANYNJ) must review and approve the proposed construction operations within sixty (60) feet of their facilities before work is started. No equipment or materials shall be set, placed, stored, erected, or crossed on or over the

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office of Battery Park City Authority, 40
Rector Street, New York, New York 10006.

B. Additional Information

Additional drawings may be available for inspection purposes only, at the office of the City of New York, Department of Ports and Terminals at South Street, New York, and at other government agencies.

1.03 COORDINATION OF WORK

- A. The mechanical drawings show the arrangement of piping and appurtenances. Follow these drawings as closely as the actual construction and the work of other trades will permit. Conform the mechanical work to the requirements shown on the drawings. Provide off-sets, fittings, and accessories which may be required but not shown on the drawings. Coordinate the site, structural and finish ground conditions affecting the work.
- B. Carefully check space requirements with other trades to insure that all material can be installed in the spaces allotted thereto.
- C. The Subcontractor shall transmit to other trades, all information required for work to be provided under their respective Sections, in ample time for installation.
- D. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment.
- E. Provide required supports for, piping and equipment, so that loading will not exceed allowable loadings of structures.
- F. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades, and report any discrepancies between them to the Contractor and obtain from him written instructions for necessary changes. Coordinate the work of other trades with the mechanical work. Before installation, take proper provisions to avoid interferences

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facilities of the "Port Authority of New York and New Jersey" without written authorization from the Contractor. The "Port Authority of New York and New Jersey" facilities are defined as all areas within the easements provided to "PANYNJ" for the "PATH-Tubes", river water intake lines, river water pump room, and river water outfall lines.

1.05 SUBCONTRACTOR'S RESPONSIBILITY FOR EVALUATION

- A. The Contractor, Developer and Engineer make no representations, regarding the character or extent of the subsoils, water levels, existing structural, mechanical and electrical installations, above or below ground or other subsurface conditions which may be encountered during the Work. The Subcontractor must make his own evaluation of existing conditions which may affect methods or cost of performing the Work, based on his own examination of the facility or other information. Failure to examine the drawings or other information shall not relieve the Subcontractor of his responsibility for satisfactory accomplishment of the Work.

1.06 SHUT-DOWNS

A. Shut-Down of Existing Facilities

1. Subcontractor shall include in his progress schedule dates for shut-down of existing systems and connection to existing systems.
2. All shut-downs, draining and refilling of the existing lines shall be arranged by the Subcontractor through the Contractor under the supervision of the "PANYNJ". All related costs shall be the responsibility of the Subcontractor.
3. The Subcontractor shall advise the Contractor a minimum of fourteen (14) days in advance of the dates the Subcontractor will be prepared to tie into or work on the existing lines, requiring system shut-down.
4. The operation of the main (60" dia.) and auxiliary (20" dia.) intake lines must be maintained in continuous operation in accordance with the following (World Trade Center) schedule:

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60" dia. line - March 15 thru Nov. 15

20" dia. line - Nov. 15 thru March 15

1.07 EXISTING STRUCTURES AND UTILITIES

- A. The Subcontractor shall use utmost caution and proper care in the prosecution of the Work to assure the stability of the existing bulkhead walls, Marginal St., Sewer Outfalls, World Trade Center cooling water facilities, PATH Tubes and other structures, utilities, installations and services. In the event that the Contractor determines that any such structure or installations have been damaged as a result of the Subcontractor's operations, repairs or replacement shall be performed to the satisfaction of the Contractor and the Owners of the property, all at the sole cost and expense of the Subcontractor.

1.08 RULES FOR WELDING AND BURNING

- A. The Subcontractor shall secure a copy of the "Rules for Welding and Burning" for the Department of Ports and Terminals. These rules cover requirements for safety in connection with Work on waterfront structures. The Subcontractor shall comply with these rules at all times and keep a copy available at the site for use of his employees and others.

1.09 FIRE ACCESS TO FIRE APPARATUS

- A. The Subcontractor shall not interfere with access to hydrants and fire alarm boxes. In no case shall the Subcontractor's material or equipment be within twenty (20) feet of a hydrant or fire alarm box.

1.10 EQUIPMENT AND MATERIALS

- A. If products and materials are specified or indicated on the drawings for a specific item or system, the Subcontractor shall use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of shop drawings.
- B. All products and materials shall be new, clean, free of defects and free of damage and corrosion.

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- C. Ship and store all products and materials in a manner which will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair.
- D. Make certain that all materials selected directly or by suppliers conform to the requirements of the contract drawings and specifications. Transmittal of such specifications and drawings information to persons manufacturing and supplying materials to the project, and rigid adherence thereto, is the Subcontractor's responsibility. Approval of a manufacturer's name by the Contractor does not release the Subcontractor of the responsibility for providing materials which comply in all respects with the requirements in the Contract Documents.
- E. Applicable equipment and materials to be listed by Underwriters' Laboratories and Manufactured in accordance with ASME, AWWA, or ANSI standards, and as approved by local authorities having jurisdiction.

1.11 CODES AND FEES

A. Codes

- 1. Comply with all current codes, ordinances and regulations, as well as with requirements of NFPA, UL and all other applicable codes.
- 2. Comply with the requirements of the New York City Building Code, Port Authority of New York and New Jersey Construction Guidelines, and the Construction Guidelines of Battery Park City Authority, and other agencies or authorities having jurisdiction over any part of the Work and secure all necessary permits.
- 3. Where codes or standards are listed herein, the applicable portions apply.
- 4. Plans, specifications, codes and standards are all minimum requirements. Where requirements differ, apply the more stringent.
- 5. Should any change in plans or specifications be required to comply with Governmental regulations, the Subcontractor to notify the Contractor at the time of submitting his bid.

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6. The codes and standards listed in the Specifications can be obtained from the organizations listed as follows:

Abbreviations

ANSI	American National Standard Institute, Inc.
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
PANYNJ	Port Authority of New York and New Jersey

B. Fees

1. Pay all required fees.
2. Pay royalties or fees required in connection with the use of patented devices and systems.

1.12 SHOP DRAWINGS

- A. Prepare and submit detailed shop drawings for piping work and other distribution services, including locations and sizes of all supports.
- B. The work described in any shop drawing submission to be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with all trades on the job. Each submitted shop drawing to include a certification that all related job conditions have been checked and that no conflict exists.
- C. All drawings to be submitted sufficiently in advance of field requirements to allow ample time for checking. All submittals to be complete and contain all required and detailed information. Shop drawings with multiple parts to be submitted as a package.
- D. If submittals differ from the Contract Document requirements, make specific mention of such difference in a letter of transmittal, with request for substitution, together with reasons for same.

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- E. Approval of any submitted data or shop drawings for material, equipment apparatus, devices, arrangement and layout shall not relieve Subcontractor from responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, quality and installation details to efficiently perform the requirements and intent of the Contract. Such approval shall not relieve the Subcontractor from responsibility for errors, omissions or inadequacies of any sort on submitted data or shop drawings.
- F. Each shop drawing to contain job title and reference to the applicable drawing and specification article.
- G. Within fifteen (15) days after award of Contract, submit for approval, a list of all material and equipment manufacturers whose products are proposed, as well as names of all Subcontractors whom this Trade proposes to employ.
- H. Within three (3) weeks after award of Contract, submit a list of all shop drawings which will be submitted in the course of the project. List to show disposition of each item, including date of submission, approval, and the like. List to be kept up-to-date throughout entire construction period.
- I. Submit shop drawings and manufacturer's data for the following items in accordance with the Contract Documents:
 - 1. Coordinated, detailed shop layout drawings of all services and distribution systems, including plans, profiles and sections.
 - 2. Location and size of related piles, concrete platforms, manholes, and other foundations and supports.
 - 3. Schedule of pipe and fittings, materials and application.
 - 4. Details of piping supports, elbows, manholes connections to existing piping, anchors, thrust blocks, and miscellaneous appurtenances.
 - 5. Sacrificial anodes and cathodic protection.

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6. Corrosion protective coatings.

7. Other shop drawings and submittals as requested within the specifications.

1.13 CONNECTIONS WITH EXISTING SITE SYSTEMS

- A. Make any connections of the proposed systems to existing systems with a minimum amount of disturbance to the existing lines.
- B. Make connections to existing systems watertight and without interrupting flow unless permission is obtained from the Owner and the interruption is made at the Owner's schedule.
- C. Make all connections to existing lines in accordance with the requirements of the Port Authority of New York and New Jersey.
- D. Replace or reconstruct at no additional cost to the Owner any existing pipe line or structure which is damaged while making connections to it.

1.14 GUARANTEE

- A. The General Conditions are amended to include the following:
 - 1. The Subcontractor shall submit a single guarantee stating that all portions of the work are in accordance with contract requirements. Guarantee all work against faulty and improper material and workmanship for a period of five (5) years from date of final acceptance by the Contractor, except that where guarantees or warranties for longer terms are specified herein, such longer term to apply. Within 24 hours after notification, correct any deficiencies which occur during the guarantee period at no additional cost to Contractor, all to the satisfaction of the Contractor.
 - 2. Be responsible for all leaks in all pipes for a period of five (5) years from date of acceptance of work under this Contract. Repair at no cost to Contractor all such leaks which occur within

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24 hours notice thereof by the Contractor. Repair leaks which occur prior to the completion of this Contract at once. Be responsible for any damage caused by such leaks and repair thereof and reimburse Contractor for all expense incurred thereby. This Subcontractor indemnifies the Contractor against loss, liability, damage or expense, including reasonable attorneys' fees, in connection with any claim resulting from such leaks.

1.15 UNIT PRICES

- A. State and hold firm for the duration of the construction contract, unit prices for the following items. Reflect in the unit price costs for the addition as well as the deletion of each item including profit, overhead, and insurance of each trade involved. Specifically reflect in the unit price the final price of the installed and operating item to the Owner, in full accordance with plans, specifications and Contract Documents. Prices shall include all labor, materials, miscellaneous appurtenances, etc. for the complete installation.
- B. Unit Price No. 1: 66" Ø reinforced concrete pipe, straight run, including pipe supports, per linear foot.
- C. Unit Price No. 2: 66" Ø steel lined reinforced concrete pipe at bends and transitions including all pipe supports, per centerline linear foot.
- D. Unit Price No. 3: 66" Ø pipe access manhole complete with cover plate, frame, access ladder as detailed, each.
- E. Unit Price No. 4: 20" Ø prestressed concrete cylinder pipe including pipe supports, per linear foot.
- F. Unit Price No. 5: 20" Ø pipe access manhole complete with cover plate, frame, access ladder as detailed, each.
- G. Unit Price No. 6: Concrete thrust block, per cubic yard.
- H. Unit Price No. 7: For alternate M-1, 66" Ø steel pipe, concrete encased as detailed, per linear foot.

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SECTION 15020
REINFORCED CONCRETE PIPING

PART I - GENERAL

A. Description

1. The work covered by this division of the specifications includes the construction described including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.
2. Work Included: The work of this section shall include, but is not limited to, the following:
 - a. Cast in-place 66"Ø reinforced concrete pipe (RCP), bends, and transitions.
 - b. Steel pipe liner.
 - c. Manholes.
 - d. Sacrificial anode cathodic protection.
 - e. Corrosion protective pipe coating.
 - f. Alternate M-1: Steel pipe, concrete encased.
3. Related work included in this division but specified elsewhere:
 - a. Concrete, concrete forms. Section 15050
 - b. Concrete reinforcement. Section 15050
 - c. Pipe testing, examinations and inspections. Section 15040

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B. Submittals

1. Shop Drawings: Submit piping layout including dimensioned plans, profiles and sections; pipe details including joints, fittings, elbows, transitions, connections to existing pipes and steel pipe construction support details.
2. Product Data: Manufacturer's latest published data for materials and equipment.

PART II - PRODUCTS

A. Cast In-Place Reinforced Concrete Pipe - 66" I.D. Lines

1. Piping, joints and fittings shall be provided to withstand a continuous working pressure of 125 p.s.i.g.
2. Reinforcement: Concrete reinforcement shall be class A615, grade 60 concrete reinforcement unless otherwise noted on the Contract Drawings. Welded wire mesh fabric shall be class "W" unless noted otherwise on the Contract Drawings. Exposed ends or reinforcing bars shall be protected until concrete is placed. Minimum spacer bars shall be #4 at 12" O.C.
3. Concrete: Concrete shall be 4,000 p.s.i. 28-day strength unless noted otherwise on the Contract Drawings. (Refer to Section 15050 for additional information.) All anchor bolts shall be set with approved template. Exposed ends or anchor bolts shall be protected by greasing and wrapping with burlap. Concrete cover for reinforcing bars shall be measured from the outside face of the concrete to the nearest surface of the bar and shall be as follows:

Concrete exposed to earth - 3" cover
Concrete against membrane - 1-1/2" cover
Concrete exposed to weather or earth - 2" cover
All other concrete - 1" cover

4. Structural Steel: Structural steel shall be class A-36 structural steel. Rolled members with

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a natural camber shall be fabricated with the concave side on the bottom. Butt welds shall develop full strength of 500 tons.

B. Steel Piping for Bends and Transitions - 66" I.D. lines

1. Steel piping 66" in diameter shall be 3/8" wall electric-fusion welded steel plate conforming to ASTM A134. Material shall conform to ASTM A-285, Grade C. Changes in direction shall be accomplished by mitered sections fabricated from the above specified pipe. All miters in a specific turn shall be equal to circumscribed arc and no single miter (gore) shall exceed 22-1/2°.
2. Cathodic Protection: Cathodic protection shall be of the sacrificial anode type. Anodes shall be of zinc.
3. Welded Connections (Welding): Prior to the start of any welding, all corrosion products and other foreign matter shall be removed from the surfaces to be welded by either scraping, chipping or wire-brushing.
 - a. All pipe line welding shall conform to the American Petroleum Institute "Standard for Field Welding of Pipe Lines" (API Standard No. 1104) unless specifically excepted herein.
 - b. Welds shall be made by shielded metal-arc welding or submerged arc welding process. Direct current shall be used exclusively. Oxyacetylene welding may be used for socket welded joints or butt welded joints 2 inches or smaller in diameter.
 - c. Each welder shall be certified in accordance with API Standard No. 1104. Such certification shall have been obtained a maximum of one (1) year prior to the acceptance of the Proposal. Only recognized testing agencies, as approved by the Contractor, shall be acceptable for certification.

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- d. Each welder's certificate shall be on file at the site and shall be made available to the Contractor upon his request.
- e. Each welder shall be assigned an identification mark which shall be stamped on the pipe surface adjacent to each weld performed by him.
- f. No welding shall be performed on material whose temperature is below 40°F. Preheating from 20°F. to 40°F. will be permitted provided asbestos blankets shall be used to permit slow cooling of the weld and surrounding area. Below an ambient temperature of 20°F. no welding will be permitted.
- g. For butt welded joints, a 1/16 inch land shall be ground on the previously beveled end of pipe. Gas torch cutting of pipe shall be performed by jig mounted torch to produce the proper uniform smooth bevel.
- h. Wire-brushing shall be done with a powered wire bursh.
- i. The welding reinforcement shall not be less than 1/16 inch nor more than 1/8 inch above the normal surface of the joined sections.
- j. Both up-hand and down-hand welding will be permitted.
- k. All welds will be visually inspected by the Contractor. In addition, certain welds will be selected by the Contractor for radiographic inspection. Any weld deemed defective, in the opinion of Contractor shall be ground out for the full depth and rewelded to the Contractor's satisfaction, by the Subcontractor at his own expense. Removal of defective weld material by burning will not be permitted.

Reinforced
Concrete Pipe
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1. Welding rings shall be used at all butt welded joints. Rings shall be Robvon Type CC, Imperial Std. 136-S or approved equal.
4. Coating of 66" ID River Water Piping: The interior and exterior surfaces of the 66" I.D. steel pipe and fittings including access manholes, leak plates and other attachments shall be shop coated by an approved coating company such as "Energy Coatings Company of North Arlington, New Jersey" or as approved by the engineer.

(a) Interior Coating: The interior surfaces shall be prepared by sandblasting to a near white condition as per Steel Structures Painting Council SSPC-SP10-63. All sand shall be removed from the pipe and the surface thoroughly brushed down to remove dust. Provide coal tar epoxy coating "TARSET C-200" manufactured by Porter Paint Company. The coating shall be applied in two coats and the total dry fill thickness shall be a minimum of 16 mils. The finished coating shall be tested for pinholes using a 67-1/2 volt Tinker-Razor holiday detector instrument. Any pinholed areas shall be marked and touched up following the same procedure as above.

(b) Exterior Coating: Surfaces shall be prepared by sandblasting to a near white condition as per Steel Structures Painting Council SSPC-SSPC-SP10-63.

Provide one coat of Coal-Tar Enamel, Fibrous-Glass Mat, and Bonded Asbestos-Felt Wrap shall be brush, roller or spray applied to a thickness of approximately 6 mils and allowed to harden. Materials, method of application, tests and handling shall conform to the AWWA Standard C-203, Section A 1.5, 1973 edition.

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Concrete Pipe
15020-5

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The entire surface shall be carefully tested for pinholes using a 67-1/2 volt Tinker-Razor holiday detector instrument and any pinholes shall be marked and touched up as required.

- (c) After field welding and radiography are complete, all welded joints and coated areas damaged during construction shall be cleaned to bright metal by means of a coarse, power driven sanding disc and both interior and exterior surfaces shall be coated as specified above, "feathered-into" the existing coating for three to four inches. When the piping is completely coated, and just prior to encasement the entire surface shall be carefully tested for pinholes using a 67-1/2 volt Tinker-Razor holiday detector instrument as described hereinbefore.

C. Access Manholes, Clean-Out Manholes

1. Access manholes of reinforced concrete structure shall be constructed for the 66" I.D. and 20" I.D. river water intake lines. Manholes shall be provided with heavy-duty roadway cast iron frame and cover.
2. Access manholes having a depth of 2'-0" or greater shall be provided with steel ladder rungs anchored into the concrete.
3. Refer to contract drawings for dimensions and construction details.

D. Alternates

The Subcontractor shall state the amount to be added and/or deducted from the base bid to provide the following ALTERNATES.

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1. ALTERNATE M-1

Provide continuous 3/8" thick steel pipe, concrete encased, 66" I.D. river water intake piping including transitions, bends, offsets and straight runs.

Alternate reinforcing details for the concrete encasement shall be as shown on the drawings; steel pipe shall be as specified in Para. 'B' of this section.

Test pipe in accordance with Section 15040.

PART III - EXECUTION

- A. Run piping as shown on the drawing free of traps.
- B. Furnish and install all required valves, supports and appurtenances to render installation complete.
- C. Adjust location of pipes to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each pipe prior to construction and fabrication.
- D. Follow manufacturers' instructions for installing and connecting all piping systems.
- E. Cap openings in pipe lines during progress of the work.
- F. Steel piping sections shall be handled and temporarily supported in the final position by means of steel cable and coated lifting lugs welded to the pipe. The installation shall be scheduled so as to provide adequate access for welding of joints, field coating and spark testing of the entire piping run. The Subcontractor shall assure that no damage occurs to the pipe coating. Should damage occur, repeat pipe coating as described in Part II, Para. 'B' 4.

END OF SECTION

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SECTION 15030
PRESTRESSED CONCRETE
CYLINDER PIPE

PART I - GENERAL

A. DESCRIPTION

1. The work covered by this division of the specifications includes the construction described including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.
2. Work included: The work of the section includes but is not limited to the following:
 - a. 20"Ø prestressed concrete cylinder pipe (PCCP) including joints, and fittings.
 - b. Pipe manufacturer's installation supervision.
3. Related work included in this division but specified elsewhere:
 - a. Pipe testing, examinations and inspections. Section 15040

B. SUBMITTALS

1. Shop drawings: Submit shop drawings of pipe layout including: dimensioned plans, profiles and sections, pipe details including: joints, fittings, elbows, transitions, pipe lengths and connections to existing piping.
2. Product data: Submit manufacturer's latest published data for materials and equipment.

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Cylinder Pipe
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PART II - PRODUCTS

A. PRESTRESSED CONCRETE CYLINDER PIPE - 20" I.D. LINES

1. The pipe for the relocated auxiliary river water intake lines shall be 20" I.D. prestressed concrete cylinder pipe.
2. Prestressed Concrete Cylinder Pipe shall be of the type known as "Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids", and shall conform to the latest edition of AWWA Specification C 301. It shall be composed of continuous arc-welded steel cylinder with steel joint rings welded to its ends. The steel cylinder shall then be lined with concrete, wrapped with high tensile strength wire under tension and coated with a dense covering of cement mortar.
3. The pipe shall be made by a manufacturer experienced in producing pipe of the type, size and quality specified herein. The pipe manufacturer shall have a record of at least five years successful performance in producing this type of pipe.
4. Design: The pipe shall be designed for a working pressure of 125 p.s.i.g., in combination with the maximum earth load which will be applied after backfill is in place. A surge pressure allowance of 40% of the working pressure, and the applicable live load, shall also be taken into account in the design. The pipe shall withstand an internal hydrostatic pressure equal to at least 1.25 times the designed working pressure without inducing tensile stress in the core.
 - a. Pipe shall be furnished in twenty (20) foot nominal lengths, at the option of the manufacturer.
 - b. The steel cylinder shall not be less than 18 gauge. Each completed cylinder shall be subjected to a hydrostatic test, using water pressure sufficient to produce a minimum tensile stress of 20,000 psi in the cylinder walls and shall show no leakage. No cylinders shall be accepted without passing this test.

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- c. The average gross wrapping stress in the high tensile wire shall not exceed 75 per-cent of the minimum ultimate tensile strength of the wire. The minimum centerline spacing of the wire shall be that which produces a clear distance of $3/16$ inch between wires on the barrel of the pipe, and the maximum centerline spacing shall be $1-1/2$ inches. The minimum diameter of wire used shall be No. 8 gauge wire. The wrapped pipe shall be covered on the outside with a dense cement mortar coating, minimum $13/16$ inch thick.
 - d. The Manufacturer shall submit pipe design calculations to the Contractor for approval, before manufacturing pipe. Pipe shall be furnished to meet design conditions related to pile supports.
5. Joints: Each length of pipe shall be provided with steel bell and steel spigot ends. The spigot end shall be lined with concrete on its interior surface and the bell ring covered with mortar on its exterior surface. Each pipe shall be constructed with a self-centering expansion joint sealed with a rubber gasket. Portions of the joint rings which will be exposed after the pipe is manufactured shall be protected from corrosion by a minimum 0.002 inch thick resistant metallic coating, applied by an approved means.
6. Fittings & Specials: Elbows, tees adapters, reducers and other special fittings shall be of non-prestressed cylinder type construction and details of their reinforcement shall be submitted to the Contractor for approval prior to their manufacture. All shorts and closure cylinders shall be designed for maximum design condition so as to permit their use at any location along the entire line.
- a. All materials and workmanship shall be as provided in the latest edition of AWWA C301.
 - b. Elbows and tees shall be of steel cylinder type construction. Special pipes shall be provided with joint rings corresponding to those on adjoining straight pipe. Special ends shall be provided where required, to connect to cast in-place reinforced concrete pipe.

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PART III - EXECUTION

- A. All pipe shall be carefully examined for defects and no pipe known to be defective shall be laid. If any pipe is found to be broken or defective after being laid, it shall be removed and replaced by sound pipe without additional payment.
- B. Joint surfaces shall be protected from damage and shall be carefully examined before jointing. No damaged joint shall be used in the work.
- C. In laying pipe, it shall be carefully lowered into place by crane or other approved means. Just prior to lowering the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gasket shall be liberally lubricated with an approved type of vegetable oil soap. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid making sure that both pipes are properly aligned. The pipe is then forced "home" by automatic equipment or come-along. Before the joint is fully "home", the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the pipe manufacturer. If the gasket is found not to be in the proper position the pipes shall be separated and the damaged gasket replaced. In its final position, the joint between the pipes shall not be open at any point, more than the pipe manufacturer's recommended distance.
- D. When the pipes have been jointed a cloth band shall be fastened around the joint recess and a 1:2 mortar grout poured to fill the recess beneath the cloth band in accordance with the manufacturer's recommendations. Prefabricated joint protectors may be used as an alternative to mortaring the outside of the joints. If such protectors are used they shall be made from a high density polyether, polyurethane foam containing at least the equivalent of 9 bags per cubic yard of unhydrated Portland Cement. The protectors shall be of suitable cross section to fully protect the joint rings and shall be supplied in the form of continuous rings.

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- E. Care shall be taken to coordinate excavation to a point not below design pipe grade. Material excavated below adopted grade shall be replaced by material which meets with the approval of the Engineer, without any additional payment.
- F. Where foundation conditions so require, the pipe shall be laid on screened gravel or broken stone.
- G. Immediately after the pipe is brought to final position, it shall be thoroughly secured and properly bedded, and ample support shall be provided to prevent settlement or disturbances.
- H. Pipe shall be thoroughly cleaned and ample precautions shall be taken to prevent entrance of dirt and debris into the pipe after laying. Exposed ends of the pipe line shall be provided with temporary plugs or covers.
- I. Precautions shall be taken by the subcontractor to guard against flotation of the pipe line after it is laid.
- J. Supervise backfilling of trenches in accordance with manufacturer's requirements.
- K. The entire installation shall be under the supervision and approval of a certified manufacturers representative. Obtain manufacturers written certification of approved installation at the completion of each phase of construction including pipe testing.
- L. Run piping as shown on drawing, free of traps.
- M. Adjust location of pipes to accommodate the work to prevent interferences, both anticipated and encountered. Determine the location and exact route of each pipe prior to construction of fabrication.

END OF SECTION

Prestressed Concrete
Cylinder Pipe
15030-5

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SECTION 15040
PIPE TESTING, EXAMINATIONS AND INSPECTIONS

PART I - GENERAL

A. Description

1. The work covered by this division of the specifications includes the construction described including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.
2. Work included: The work of this section includes but is not limited to the following:
 - a. Hydrostatic pressure and leak testing of 66"Ø reinforced concrete pipe and 20"Ø prestressed concrete cylinder pipe.
 - b. Temporary pipe connections, pipe caps, tees, valves.
 - c. Testing equipment and labor.
3. Related work included in this division but specified elsewhere:
 - a. Reinforced concrete pipe specifications. Section 15020
 - b. Prestressed concrete cylinder pipe specifications. Section 15030

B. Submittals

1. Submit written testing procedures for each line test including pipe capping details.
2. Submit certified test reports of all tests.

- C. Perform preliminary tests and repair all leaks before notifying the Contractor of final tests. All final

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tests are to be observed by Contractor and the Port Authority of New York and New Jersey.

- D. Maintain a log book of all tests showing dates, personnel, observers' initials, etc.
- E. Be responsible for any damage resulting from failure of items under test.
- F. Examine all pipe for defects before laying and no defective or damaged pipe shall be laid.
- G. If the inspection of the completed system or any part thereof shows any structure, pipe, joint, or any other part of the system which is defective, remove and replace or repair the defective work as directed at no expense to the Contractor.
- H. Test entire pipe installation prior to connection to existing systems. Subsequent to final connections tests shall be made on the system as a whole as directed.
- I. Provide and operate all test equipment and apparatus required for the complete testing and inspection of all systems at such time and locations as may be directed by the Contractor and/or by the authorities having jurisdiction.
- J. Correct defects which develop from testing, and retest system.
- K. Conduct tests of sufficient duration to permit inspection of all joints and other areas where leaks might occur.
- L. When freezing is a hazard, take all precautions necessary to prevent damage. Correct any damage that results due to freezing at no expense to the Contractor.
- M. Subcontractors shall give a minimum of seven (7) days notice to the Contractor of time, date and place when any portion of the work is ready to be tested, examined and/or inspected.

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PART II - PRODUCTS

A. NOT USED

PART III - EXECUTION

A. Testing of 66" Ø Reinforced Concrete Pipe and 20" Ø Prestressed Concrete Cylinder Pipe

1. After completion of installation of each new section of piping and before final connections are made, the lines shall be filled with water and hydrostatically tested for tightness. Each new section of piping shall be subjected to a test pressure of 125 Psig for a period of two (2) hours with no noticeable pressure drop. Back-filling may be completed after hydrostatic test except where final connections are made to existing piping.
2. After final connections are completed, each new section of piping shall be subjected to a final hydrostatic test for tightness at the joints connecting to existing piping. A test pressure of 90 Psig shall be maintained for a sufficient period of time for the engineer to inspect each joint. The Sub-contractor shall provide temporary pumping equipment to be located in the Port Authority Pump Station at the site for hydrostatic testing.
3. The Sub-contractor shall be responsible for the installation and running of the pumping equipment and all temporary piping hook-ups. Each new section of piping shall require a separate temporary piping hook-up in the Pump Station and the point of connection to existing piping shall be as directed by Port Authority. All work and operations performed by the Sub-contractor in the Pump Station shall be coordinated by the Port Authority and must have prior approval. The temporary pumping equipment shall have a water delivery rate of 500 gallons per minute at 90 Psig discharge pressure, and shall be of the centrifugal type, either engine or motor driven.

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The pumping equipment shall be complete with relief valves which can maintain a maximum discharge pressure of 90 Psig at all delivery rates from 0 - 500 gallons per minute.

END OF SECTION

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SECTION 15050
CONCRETE FOR MECHANICAL WORK

PART I - GENERAL

A. DESCRIPTION

1. The work covered by this division of the specifications includes the construction described including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.
2. Work included: The work of this section shall include, but is not limited to, the following:
 - a. Reinforced concrete for piping systems.
 - b. Concrete pipe supports, support cradles, and pipe thrust blocks.
 - c. Reinforced concrete for pipe access manholes.
 - d. For alternate M-1: Concrete for steel pipe encasement.
 - e. Miscellaneous concrete members.
3. Related work included in this division but specified elsewhere:
 - a. Reinforced concrete piping. Section 15020
 - b. Alternate M-1: Steel pipe, concrete encased. Section 15020

B. SUBMITTALS

1. Shop drawings: Submit shop and placement drawings of: Reinforcing steel, pipe support details, pipe cradle details, pipe thrust block details, pipe access manhole details.
2. Submit design mix for 4,000 psi concrete.

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3. Submit design force calculations for each thrust block.

PART II - PRODUCTS

A. Concrete

1. Concrete for structural elements shall have a minimum 28-day strength of 4,000 psi and a maximum 4" slump.

B. Concrete Aggregates

1. Fine aggregate for concrete shall comply with the requirements of ASTM Specification C-33-81 Edition. It shall consist of clean, hard, strong, durable uncoated particles of mineral origin, free from salt, loam, shale, clay and other deleterious matter and shall be well graded from coarse to fine.
2. Coarse aggregate shall comply with the requirements of ASTM Specification C-33-81 Edition. It shall consist of crushed sound stone, composed of hard, strong, durable uncoated pieces free from soft, friable, thin, elongated or laminated fragments or a screened and washed bank run gravel.

C. Cement

1. Cement for all concrete shall be Portland Cement, Type II, of United States manufacture and of an approved brand complying with the requirements of ASTM Specification C-150-81.

D. Water

1. Water used in concrete shall be potable water.

E. Chemical Admixtures for Concrete

1. Water reducing and retarding admixtures shall be approved by the Contractor and shall meet the requirements of ASTM Specification C494-80.

F. Reinforcement

1. Bar reinforcement shall be new deformed billet steel bars, Grade 60 of United States manufacture conforming to the requirements of ASTM Specifica-

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tion A615-80.

G. Concrete Design

1. Concrete shall be composed of materials meeting the requirements of this section, proportioned so as to provide the minimum specified compressive strength for that portion of the work.
2. The working consistency of the concrete shall be the slump test described in ASTM Specification C-143-81 Current Edition.
3. Each of the constituent materials of the concrete shall be accurately measured by weight, unless otherwise specified or approved by the Contractor, and the method of measurement shall be such as to secure the specified proportions in each batch.
4. Coarse aggregate shall have a maximum size of 3/4 inch unless the size is otherwise limited by the spacing of the reinforcing in the concrete.
5. The Subcontractor shall employ and pay for, as part of his contract price, and approved Testing Laboratory to design a series of concrete mixes using the materials and sources which he proposed to employ during the Construction of the Work. Concrete design mixes shall produce an average strength 15% higher than the minimum 28-day strength specified.

PART III - EXECUTION

A. Batching of Material

1. The materials shall be measured in conformance with the requirements of the ASTM Specification C94-78. Weight-batch apparatus for conventional type mixers shall also meet the same requirements.
2. Bulk cement shall be weighed on scales having a degree of control and accuracy such that the delivered weight shall be correct within one percent. The scale and weight hopper shall be separate and distinct from those used for other materials. Cement may be batched on a bag basis; the weight of a bag of Portland Cement (U.S.) shall be taken as 94 pounds and only whole units are to be

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used with this method.

3. Aggregates shall be weighed on scales having a degree of control of accuracy such that the delivered weights are correct within two percent. Moisture, both free and absorbed, shall be corrected for and the free moisture shall be taken into account when dispensing the mixing water.
4. Water shall be measured by volume or weight with an accuracy and control within a one percent tolerance.
5. When the outdoor temperature is below 40°F or is likely to fall below 40°F during the 24-hour period after placing, adequate equipment shall be provided for heating the concrete material and protecting the concrete against freezing, but no frozen materials or materials containing ice shall be used. Temperatures of the separate materials, including the mixing water, when placed in the mixer, shall not exceed 140°F. When placed in forms, the concrete shall have a temperature between 50°F and 70°F.

B. MIXING CONCRETE

1. Unless otherwise authorized, the mixing of concrete shall be done in a batch mixer of approved type or in transit-mix equipment conforming to ASTM Specification C-94-78, using Alternate No. 2 method to determine quality. The volume of the mixed material for each batch shall not exceed the manufacturer's rated capacity of the mixer. If transit-mixed, the materials shall be brought to the site dry and the period of time from batching to the addition of water at the site of the pour shall not exceed thirty minutes.
2. Site mixed concrete shall be mixed in an approved batch mixer and the batching and mixing shall be of sufficient capacity and power to carry out each prearranged concrete operation without danger of delay or interruption until the unit or concrete pour is completed. The mixer drum shall be rotated at the speed recommended by the manufacturer and mixing of the concrete ingredients shall continue for not less than 1-1/2 minutes from the time all of the materials, including the water, are in the mixer drum. Mixing shall continue

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until all the ingredients are uniformly distributed throughout the batch and the mass of the concrete is homogeneous and uniform in color. Discharge of concrete shall be completed within a maximum period of 30 minutes. No new materials shall be permitted to enter the mixer until all of the preceeding batch has been discharged. Mixing and handling equipment shall be cleaned at frequent intervals while in use.

3. All concrete shall be used while fresh and before there is any evidence of initial set. Any concrete which has achieved its initial set shall be rejected and not used in the forming of pipe or piping encasement. No retempering of concrete will be permitted.

C. CONCRETE TESTING

1. In accordance with the general conditions and as amended herein tests of the concrete will be made by an approved independent testing and inspection laboratory hired by the Contractor. The Subcontractor shall provide casual labor and assistance to the testing laboratory personnel for the testing specified in this section.
2. At least one test of slump and air content shall be made on fresh concrete for each 50 cubic yards of each class of concrete (or fraction thereof) placed in any one day and in any event not less than one test for each class of concrete each day it is used. Slump shall be determined in accordance with ASTM Specification C-143-78. Air content shall be determined in accordance with ASTM Specification C-138-77 or C-231-81. Additional tests shall be made as required to demonstrate that the requirements of the Specifications are being met.
3. A set of three cylinders shall be molded for each 50 cubic yards, or fraction thereof, of each class of concrete placed in any one day's concreting, for testing at the age of 28 days. An additional two cylinders shall be molded at intervals as above for testing at the age of 7 days. Test cylinders shall be molded in accordance with ASTM Specification C-31-69.

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Mechanical Work
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2. Reinforcing cages for each element shall be completely assembled and securely tied and braced so as to maintain dimensional rigidity during placing of concrete.

F. FORMS

Forms shall conform to the shape, lines and dimensions of the elements shown on the Contract Drawings and shall be substantially free from surface defects and sufficiently tight to prevent leakage of mortar. They shall be properly braced so as to maintain position and shape during the placing of concrete. Forms shall meet the requirements of ACI-341-68, "Recommended Practice for Concrete Framework", and ACI-SP NO. 4, "Framework for Concrete".

Blockouts, shear keys, waterstops and other inserts shall be accurately located and securely fastened to the framework so as to maintain position and shape during the placing of concrete.

G. WATERSTOPS

Waterstops shall be 9" long x 3/8" thick flat dumbbell type made of polyvinyl chloride as manufactured by Manufacturers Progress Inc. Unlimited or approved equal. The waterstops shall be installed in long lengths and the ends of parts making up a continuous stop shall be spliced to form a continuous watertight seal. All splicing shall be done in accordance with the manufacturer's recommendations.

END OF SECTION

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Mechanical Work
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4. The standard age for strength test shall be 28 days and the strength of such test shall be the average of the breaking strengths of the three cylinders comprising the set. The 7 day tests will be used for purposes of job control once an age-strength relationship has been established by the testing laboratory for the materials and proportions used.
5. The average of any three consecutive 28 day strength tests representing each class of concrete shall be equal to or greater than the specified strength and not more than 10 percent shall have an average value less than 90 percent of the specified strength.
6. Any concrete which fails to meet the minimum strength requirements of these Specifications shall be considered rejected pending verification of the adequacy of the material by other means.

D. CONCRETE HANDLING & PLACING

1. Concrete for piping and piping encasement shall be placed in the dry. Before placing any concrete all equipment for mixing and transporting the concrete shall be clean, all debris and ice shall be removed from the spaces to be occupied by the concrete and the reinforcement thoroughly cleaned of ice or other deleterious coatings. All accumulated water shall be removed from the place of deposit before concrete is placed.

E. REINFORCEMENT

1. The Subcontractor shall prepare and submit shop drawings of bar reinforcement for the Contractor's approval in accordance with the requirements of the General Conditions. Such drawings shall show: the element identification, bending diagrams, cutting lists, inserts, spacers, etc. and shall completely demonstrate the location, size, spacing, length and bending of the bar reinforcement. Shop drawings for concrete reinforcement shall be prepared in accordance with the American Concrete Institute "Manual of Standard Practice: for Detailing Reinforced Concrete Structures", ACI-315-80.

Concrete For
Mechanical Work

ELECTRICAL SPECIFICATIONS
FOR
CONTRACTS OF CONSTRUCTION
FOR
BUILDING 'B'
WORLD TRADE CENTER RIVER WATER INTAKE
SYSTEM RELOCATIONS

AT

BATTERY PARK CITY COMMERCIAL CENTER

OWNER:

Battery Park City Authority, acting through BPC
Development Corporation, a subsidiary of the
New York State Urban Development Corporation

DEVELOPER:

Olympia & York Battery Park Company

DESIGN CONSULTANTS:

Design Architect: Cesar Pelli & Associates
Architects: Haines Lundberg Waehler
Mechanical & Electrical Engineer: Norman D.
Kurtz Consulting Engineers/member of The F+K
Group
Foundations & Soils Engineer: Mueser-Rutledge-
Johnston & DeSimone

CONTRACTOR:

Olympia & York Battery Park Company

April 7, 1982

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DIVISION 16000

ELECTRICAL

SECTION

TITLE

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16020	ELECTRICAL WORK
16030	CONCRETE FOR ELECTRICAL WORK

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SECTION 16010
ELECTRICAL
SPECIAL CONDITIONS

PART I - GENERAL

1.01 DESCRIPTION

A. General

1. The General Conditions for Contracts of Construction, referred to in the Contract Documents as the General Conditions, together with the following articles of the Electrical Special Conditions, which amend, modify and supplement various articles and provisions of the General Conditions are made part of the Contract and shall apply to all work under the Contract.
2. All articles or parts of articles of the General Conditions not so amended, modified or supplemented by these Special Conditions, shall remain in full force and effect. Should any discrepancy become apparent between the General Conditions and these Special Conditions, the Subcontractor shall notify the Contractor, in writing, and the Contractor shall interpret and decide such matters in accordance with the provisions of the General Conditions.

B. Work Included

The work covered by this subcontract includes the construction described in the Contract Documents including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction, and all services, facilities, tools and equipment necessary or used to perform and complete such construction. The work includes, but is not limited to the following:

1. Installation of power and signal lines in locations as shown on drawings.
2. Power (5KV and 600V) cables and signal cables.
3. Temporary power.
4. Power and signal manholes.

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5. Grounding.
6. Permits and Fees.
7. Concrete.
8. Coordination of system shutdowns.
9. Removal of existing abandoned lines and lines to be abandoned where interference may occur with installation of new work.
10. Staging of work to ensure uninterrupted river water service to the existing World Trade Center refrigeration plant.
11. All necessary form work for concrete encasement of ducts.
12. Coordination with existing and future utilities.

C. Related Work Not Included In This Division But Specified Elsewhere

1. Finish grading.
2. Supports including piles, pile bents, concrete platforms.
3. Excavation and backfill.
4. Sheet piling and dewatering.
5. Cutting and patching of existing foundation structures.

1.02 DRAWINGS AND RECORDS

A. Information Drawings

1. The following drawings will be available at the Contractor's offices to bidders for their convenience. These drawings and data are for information only and are not Contract Drawings. The data shown is not represented to be correct or up-to-date and should be evaluated on the basis of inspection of the premises and the bidder's interpretation of subsurface conditions.

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- a. Drawings CI-B-1 through CI-B-18 are boring data. The logs of borings from which these data were drafted are available at the Contractor's office.

<u>General</u>	<u>Title</u>
CI-B-1	Commercial Center - Boring Location Plan
CI-B-2	Commercial Center - Contours of Bottom of Fill
CI-B-3	Commercial Center - Contours of Tops of Rocks
CI-B-4	Commercial Center - Existing and Previous Structures
CI-B-5	Boring Location Plan - Bldg. A & Adjacent Streets
CI-B-6	Contours of Bottom of Fill - Bldg. A & Adjacent Streets
CI-B-7	Contours of Top of Rock - Bldg. A & Adjacent Streets
CI-B-*	Existing & Previous Structures - Bldg. A & Adjacent Streets
CI-B-10	Geologic Sections A4, A5 & A6
CI-B-11	Geologic Sections B1, B2 & B3
CI-B-12	Geologic Sections B4, B5 & B6
CI-B-13	Geologic Sections B7, B8 & B9
CI-B-14	Geologic Sections C1 & C2
CI-B-15	Geologic Sections C3, C4 & C5
CI-B-16	Geologic Sections D1, D2 & D3
CI-B-17	Geologic Sections D4 & D5
CI-B-18	Geologic Sections VI

- b. The following drawings pertaining to Battery Park City construction previous to the Work in this Contract will be available to the bidders at the office of the Contractor, as Information Drawings and are not Contract Drawings:

- (1) Contract Set BPCA 75-95A - Roadway & Utilities "As-Built" Dwg. Nos. II 6 - GEN. 1-3, II 6-R-1 to 8, II 6-ST- 1 to 14, II 6-EN 1 to 5 and II 6-E-1 to 19.
- (2) Contract Set BPCA 73-21 - Land Construction Areas.
- (3) Contract WTC 130.027 - Pump Station. River Water Line and Pump Station Utilities.

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(4) Contract WTC 541.00 Auxiliary Water
Line & Electrical Duct.

c. Boring Logs, Soil Samples and Rock Cores

Boring logs, soil samples and rock cores showing information obtained from test borings are available for inspection, for information purposes only, through the office of Battery Park City Authority, 40 Rector Street, New York, New York 10006.

B. Additional Information

Additional drawings may be available for inspection purposes only, at the office of the City of New York, Department of Ports and Terminals at South Street, New York.

1.03 COORDINATION OF WORK

- A. The electrical drawings show the general arrangement of manholes, duct banks, and appurtenances. Follow these drawings as closely as the actual construction and the work of other trades will permit. Conform the electrical work to the requirements shown on the drawings. Provide offsets, fittings, and accessories which may be required but not shown on the drawings. Investigate the site, structural and finish ground conditions affecting the work, and arrange the work accordingly. Provide such work and accessories as may be required to meet such conditions.
- B. Carefully check space requirements with other trades to insure that all material can be installed in the spaces allotted thereto.
- C. The Subcontractor shall transmit to other trades, all information required for work to be provided under their respective Sections, in ample time for installation.
- D. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment.

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- E. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades, and report any discrepancies between them to the Contractor and obtain from him written instructions for changes necessary in the electrical work. Install and coordinate the electrical work in cooperation with other trades installing interrelated work. Before installation, take proper provisions to avoid interferences in a manner approved by the Contractor. All changes required in the work of the Subcontractor, caused by his neglect to do so, to be made by him at his own expense.
- F. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale similar to that of the design drawings, prepared on tracing medium of the same size as contract drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the drawings as to the area to which it applies. Do not submit these drawings to the Contractor for approval. At completion, however, include a set of such drawings with each set of as-built drawings. When directed by the Contractor, submit drawings for approval, clearly showing the electrical work and its relation to the work of other trades before commencing shop fabrication or erection in the field.
- G. Before commencing work, examine all adjoining work on which this work is in any way dependent for perfect workmanship and report any conditions which prevent performance of first class work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

1.04 USE OF SITE AND LOAD LIMITATIONS

- A. The Subcontractor shall review all available data on the location and types of pipe lines and other facilities connecting the WTC pump station with the WTC, together with cooling water discharge lines and other existing underground utilities. The Subcontractor shall not operate equipment over the facilities and shall take care not to damage them or otherwise impair their use. The Subcontractor shall make investigation to verify the location of these facilities before proceeding with construction and/or operations in their vicinity.

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- B. Subcontractor shall note that the "Port Authority of New York and New Jersey" (PANYNJ) must review and approve the proposed construction operations within sixty (60) feet of their facilities before work is started. No equipment or materials shall be set, placed, stored, erected, or crossed on or over the facilities of the "Port Authority of New York and New Jersey" without written authorization from the Contractor. The "Port Authority of New York and New Jersey" facilities are defined as all areas within the easements provided to "PANYNJ" for the "PATH-Tubes", river water intake lines, river water pump room, and river water outfall lines.

1.05 SUBCONTRACTOR'S RESPONSIBILITY FOR EVALUATION

- A. The Contractor, Developer and Engineer make no representations, regarding the character or extent of the subsoils, water levels, existing structural, mechanical and electrical installations, above or below ground or other subsurface conditions which may be encountered during the Work. The Subcontractor must make his own evaluation of existing conditions which may affect methods or cost of performing the Work, based on his own examination of the facility or other information. Failure to examine the drawings or other information shall not relieve the Subcontractor of his responsibility for satisfactory accomplishment of the Work.

1.06 SHUT-DOWNS

A. Shut-Down of Existing Facilities

1. Subcontractor shall include in his progress schedule dates for shut-down of existing systems and connection to existing systems.
2. All shut-downs shall be arranged by the Subcontractor through the Contractor under the supervision of the "PANYNJ". All related costs shall be the responsibility of the Subcontractor.
3. The Subcontractor shall advise the Contractor a minimum of fourteen (14) days in advance of the dates the Subcontractor will be prepared to tie into or work on the existing lines.

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1.07 EXISTING STRUCTURES AND UTILITIES

- A. The Subcontractor shall use utmost caution and proper care in the prosecution of the Work to assure the stability of the existing bulkhead walls, Marginal St., Sewer Outfalls, World Trade Center cooling water facilities, PATH Tubes and other structures, utilities, installations and services. In the event that the Contractor determines that any such structure or installations have been damaged as a result of the Subcontractor's operations, repairs or replacement shall be performed to the satisfaction of the Contractor and the Owners of the property, all at the sole cost and expense of the Subcontractor.

1.08 RULES FOR WELDING AND BURNING

- A. The Subcontractor shall secure a copy of the "Rules for Welding and Burning" for the Department of Ports and Terminals. These rules cover requirements for safety in connection with Work on waterfront structures. The Subcontractor shall comply with these rules at all times and keep a copy available at the site for use of his employees and others.

1.09 FIRE ACCESS TO FIRE APPARATUS

- A. The Subcontractor shall not interfere with access to hydrants and fire alarm boxes. In no case shall the Subcontractor's material or equipment be within twenty (20) feet of a hydrant or fire alarm box.

1.10 EQUIPMENT AND MATERIALS

- A. If products and materials are specified or indicated on the drawings for a specific item or system, the Subcontractor shall use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of shop drawings.
- B. All products and materials shall be new, clean, free of defects and free of damage and corrosion.
- C. Ship and store all products and materials in a manner which will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair.

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- D. Make certain that all materials selected directly or by suppliers conform to the requirements of the contract drawings and specifications. Transmittal of such specifications and drawings information to persons manufacturing and supplying materials to the project, and rigid adherence thereto, is the Subcontractor's responsibility. Approval of a manufacturer's name by the Contractor does not release the Subcontractor of the responsibility for providing materials which comply in all respects with the requirements in the Contract Documents.
- E. Applicable equipment and materials to be listed by Underwriters' Laboratories and Manufactured in accordance with UL, ASTM, AIEE, ASME, AWWA, or ANSI standards, and as approved by local authorities having jurisdiction.

1.11 CODES AND FEES

A. Codes

- 1. Comply with all current codes, ordinances and regulations, as well as with requirements of NFPA, UL, National Electrical Code, N.Y.C. Electrical Code and all other applicable codes.
- 2. Comply with the requirements of the New York City Building Code, Port Authority of New York and New Jersey Construction Guidelines, and the Construction Guidelines of Battery Park City Authority, and other agencies or authorities having jurisdiction over any part of the Work and secure all necessary permits.
- 3. Where codes or standards are listed herein, the applicable portions apply.
- 4. Plans, specifications, codes and standards are all minimum requirements. Where requirements differ, apply the more stringent.
- 5. Should any change in plans or specifications be required to comply with Governmental regulations, the Subcontractor to notify the Contractor at the time of submitting his bid.
- 6. The codes and standards listed in the Specifications can be obtained from the organizations listed as follows:

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and layout shall not relieve Subcontractor from responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, quality and installation details to efficiently perform the requirements and intent of the Contract. Such approval shall not relieve the Subcontractor from responsibility for errors, omissions or inadequacies of any sort on submitted data or shop drawings.

- F. Each shop drawing shall contain job title and reference to the applicable drawing and specification article.
- G. Within fifteen (15) days after award of Contract, submit for approval, a list of all material and equipment manufacturers whose products are proposed, as well as names of all Subcontractors whom this Trade proposes to employ.
- H. Within three (3) weeks after award of Contract, submit a list of all shop drawings which will be submitted in the course of the project. List to show disposition of each item, including date of submission, approval, and the like. List to be kept up-to-date throughout entire construction period.
- I. Submit shop drawings and manufacturer's data for the following items in accordance with the Contract Documents:
 - 1. Coordinated, detailed shop layout drawings of all services and distribution systems, including plans, profiles and sections.
 - 2. Location and size of related piles, concrete platforms, manholes, and other foundations and supports.
 - 3. Schedule of ducts and fittings, materials and application.
 - 4. Details of splices, elbows, manholes, connections to existing duct runs, and miscellaneous appurtenances.
 - 5. Corrosion protective coatings.
 - 6. Other shop drawings and submittals as requested within the specifications.

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Abbreviations

ANSI	American National Standard Institute, Inc.
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
PANYNJ	Port Authority of New York and New Jersey
IEEE	Institute of Electric & Electronic Engineers

B. Fees

1. Pay all required fees.
2. Pay royalties or fees required in connection with the use of patented devices and systems.

1.12 SHOP DRAWINGS

- A. Prepare and submit detailed shop drawings for electrical work and other distribution services.
- B. The work described in any shop drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with all trades on the job. Each submitted shop drawing shall include a certification that all related job conditions have been checked and that no conflict exists.
- C. All drawings shall be submitted sufficiently in advance of field requirements to allow ample time for checking. All submittals shall be complete and contain all required and detailed information. Shop drawings with multiple parts shall be submitted as a package.
- D. If submittals differ from the Contract Document requirements, make specific mention of such difference in a letter of transmittal, with request for substitution, together with reasons for same.
- E. Approval of any submitted data or shop drawings for material, equipment apparatus, devices, arrangement

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7. Single line and plan drawings for temporary power.

1.13 CONNECTIONS WITH EXISTING SITE SYSTEMS

- A. Make any connections of the proposed systems to existing systems with a minimum amount of disturbance to the existing lines.
- B. Make all connections to existing lines in accordance with the requirements of the Port Authority of New York and New Jersey.
- C. Replace or reconstruct at no additional cost to the Owner any existing equipment or structure which is damaged while making connections to it.

1.14 GUARANTEE

- A. The General Conditions are amended to include the following:
 - 1. The Subcontractor shall submit a single guarantee stating that all portions of the work are in accordance with contract requirements. Guarantee all work against faulty and improper material and workmanship for a period of five (5) years from date of final acceptance by the Contractor, except that where guarantees or warranties for longer terms are specified herein, such longer term to apply. Within 24 hours after notification, correct any deficiencies which occur during the guarantee period at no additional cost to Contractor, all to the satisfaction of the Contractor.

1.15 UNIT PRICES

- A. State and hold firm for the duration of the construction contract, unit prices for the following items. Reflect in the unit price costs for the addition as well as the deletion of each item including profit, overhead, and insurance of each trade involved. Specifically reflect in the unit price the final price of the installed and operating item to the Owner, in full accordance with plans, specifications and Contract Documents. Prices shall include all labor and material miscellaneous appurtenances etc. for equipment fully installed in place.

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- | | |
|--|-------------------------|
| 1. Type B Manholes | \$_____ each |
| 2. Type C-1 manholes | \$_____ each |
| 3. Concrete | \$_____ per cubic yard |
| 4. 4" cement asbestos conduit | \$_____ per linear foot |
| 5. #3/0 5KV cable | \$_____ per linear foot |
| 6. #250MCM, 600V cable | \$_____ per linear foot |
| 7. #2 5KV cable | \$_____ per linear foot |
| 8. 30/C #12 cable | \$_____ per linear foot |
| 9. #3/0 5KV cable splice | \$_____ each |
| 10. #250MCM 600 V cable splice | \$_____ each |
| 11. #2 5KV cable splice | \$_____ each |
| 12. 30/C #12 cable splice | \$_____ each |
| 13. Steel reinforcement bars | \$_____ per pound |
| 14. Temporary power | \$_____ lump sum |
| 15. Operating expense for
temporary power | \$_____ per day |

END OF SECTION

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II. MATERIALS AND WORKMANSHIP

A. Asbestos Cement Conduit

1. Unless otherwise specified or shown on the Contract Drawings, all conduits shall be asbestos cement conduit (Type I) with a concrete encasement. Concrete encasement shall conform to the requirements of Class "D" concrete as specified in Section 16030 of the Specifications. Conduit banks containing 5KV class cables shall contain a red dye or other distinctive marking as approved by the Port Authority.
2. Type I asbestos cement conduit shall be thin-wall asbestos cement conduit conforming to the requirements for Type I conduit of the Federal Specifications for Conduit and Fittings; Asbestos Cement (for Electrical Purposes) (Designation: W-C-571).
3. Asbestos cement conduits shall be installed in true alignment and sloped for drainage wherever possible. They shall be coupled together by applying a thin coat of an approved asphalt base cement to the tapered surfaces of the end of the conduit and driving the joint tight by a method which will not damage the conduit or the couplings. At his option, the Subcontractor may substitute plastic couplings in which case the cement may be omitted. The ends of asbestos cement conduit runs shall be sealed immediately after installation by means of paraffin-impregnated wooden plugs or by other approved means.
4. Flexible fittings shall be installed in all asbestos cement conduits crossing expansion joints, or firmly attached to independent structures. Except as otherwise specified, flexible fittings shall be similar and equal to those manufactured by the Johns-Manville Corporation. Asbestos cement conduit runs subject to motion in excess of the capacities of the standard fittings shall be provided with other approved means of compensating for the motion. Two-piece flexible fittings

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SECTION 16020
ELECTRICAL

I. GENERAL DESCRIPTION OF ELECTRICAL WORK

A. Description

1. The work covered by this section of the specifications includes the construction described, including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.
2. Work included: The work of this section includes, but is not limited to, the following:
 - a. Underground electric duct banks.
 - b. Power and communication manholes.
 - c. Wire and cable.
 - d. Concrete.
 - e. Temporary light and power.
3. Related work included in this division but specified elsewhere.
 - a. Concrete - Section 16030

B. Inspections and Street Closings

1. All work will be subject to inspection and approval of the Port Authority Architect.
2. Electrical Subcontractor shall obtain all necessary city and state agency approvals for closing areas of Marginal and West Streets necessary for the installation of electrical work under this Contract. Streets shall be restored to their original condition as soon as possible after completion of work by Electrical Subcontractor. All necessary signs, barriers, etc., shall be furnished, installed, and maintained by the Electrical Subcontractor as directed by appropriate agencies having jurisdiction.

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shall be installed that only one end is free to move with respect to the conduit.

5. The setting of flexible fittings installed in asbestos cement conduit runs shall be as directed by the Port Authority Engineer.
6. Changes of direction in asbestos cement conduits shall be made by the use of wide bends, sweeps and offsets and not by the use of elbows.
7. Asbestos cement conduits which terminate in the concrete walls of manholes, handholes or other concrete structures shall be provided with manufactured end bells or with end bells formed in the concrete by means of properly shaped wooden plugs.
8. Asbestos cement conduit duct bank arrangements shall be in accordance with Port Authority Standard Drawing 405.012 and as shown on Drawings.

B. Cleaning and Testing Conduit

1. After conduits and accessories have been installed and all concreting operations completed, all conduit runs shall be satisfactorily cleared of all obstructions and foreign matter. Any defects which might damage cable upon installation shall be corrected.
2. Empty conduits installed under this contract shall be tested in the presence of the Port Authority Engineer by pulling through each conduit a flexible cylindrical mandrel having an outside diameter one-quarter inch less than the inside diameter of the conduit.
3. The use of rope to pull a brush or a mandrel will not be permitted. Only steel cable shall be used. Any defects or stoppages occurring in portions of the conduit runs installed by the Subcontractor shall be corrected at the Subcontractor's own expense.

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2. Six hundred volt wire and cable.

a. General

- (1) The insulation or covering of each wire or cable shall be factory color-coded by the use of colored compounds or coatings. The accompanying color-code chart shall be followed consistently throughout the project.
- (2) When limited quantities of cable are involved, the Engineer may permit the use of the following methods in lieu of the cable manufacturer's color coding. Each cable must be coded (see color chart below) at all terminal points, in all manholes, boxes or other similar enclosures by:
 - (a) Dry Locations: Spiral application of three-quarter (3/4) inch wide, colored pressure sensitive plastic tape, half lapped for a distance of not less than six (6) inches. To prevent unwinding, the last two wraps of tape shall be applied with no tension. The tape shall be applied with no tension. The tape shall be applied so as not to obliterate identification markings on the cable.
 - (b) Wet Locations: Application of three, three-sixteenth (3/16) inch wide, colored, fungus inert, self-extinguishing, self-locking, nylon cable ties spaced three (3) inches apart. The ties shall be snugly applied with a special tool or pliers, and any excess removed.

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C. Electrical Manholes

1. Concrete for electrical manholes shall conform to the requirements of Class "D" concrete as specified in Section 16030 of the Specifications.
2. Electrical manholes shall be constructed as shown on the Contract Drawings and in accordance with the Port Authority Standard Drawings 015.010 and 425.101.
3. Frames and covers for manholes shall be similar and equal to Flockhart Foundry Co. Code 60454 with raised cast letters and nameplate on cover.
4. In each manhole installed under this Contract, the Sub-contractor shall furnish and install Manhole Cable Racking Assemblies.
5. A manhole cable rack assembly shall consist of one rack Catalog No. D08B3, for rack hooks, Catalog No. D01S6; and eight insulators, Catalog No. DE501 all manufactured by Line Materials Industries.
6. Approved racking assemblies as manufactured by Oliver Iron and Steel Corp. the Locke Insulator Corp. or Hubbard may be used in lieu of those specified, but the hole spacing for mounting of racks shall be same as those specified.
7. Inserts for electrical manholes shall be similar and equal to Series P-3000 "Unistrut" hot-dipped galvanized concrete inserts in lengths as indicated on the Contract Drawings, complete with end caps, 1/2 inch spring nuts, 1/2 inch steel bolts, and waxed cardboard closer strips. All metallic components for manholes inserts shall be hot-dipped galvanized.

D. Wire and Cable

1. The Contract Drawings show the location, type, number and size of wires and cables to be used for this Contract. Complete Specifications for each of the types of wires and cables are contained herein.

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(2) Qualification Tests

In addition to these tests required by each cable specification, samples of the cables (at least two of each size to be supplied) shall be immersed in water as per (IPCEA Publication Standards S-19-81, Section 6.9.2, except that the temperature shall be 90°C, and the sample shall be continuously energized with 600 volts, 60 hertz. At the end of two weeks, the samples shall be de-energized and immersed in water at room temperature (20°C) for at least six hours, and then submitted to the following tests while still immersed in water:

Insulation Resistance: Measured insulation resistance, in megohms based on a thousand conductor feet, shall not be less than that indicated in table No. 40, UL Standard No. 44.

Direct-Current Voltage Test: The samples shall withstand for five (5) minutes a direct-current voltage equal to the dielectric test potential indicated in UL Standard No. 44 (Table No. 37).

- (3) Type USE-E - Ethylene-propylene rubber insulation, heavy-duty thermosetting jacket, multiple rates "USE-RHH-RHW", Interim Standard No. 1 to IPCEA Publication S-6-8-516, UL Standard No. 854.
- (4) Type Use-R - Rubber insulation, heavy-duty neoprene jacket, multiple rated "USE-RHH-RHW", Interim IPCEA Publication S-19-81, UL Standards No. 44 and 854.

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(3) Color-code chart

<u>Conductor</u>	<u>System Voltage</u>	
	<u>20SY/120V</u>	<u>480Y/277V</u>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	White
Grounding	Green	Green

b. Factory Tests

The optional spark test shall not be acceptable in lieu of the regular dielectric-withstand and insulation-resistance tank tests.

c. General-Purpose Cables and Wires

(1) General

Cables shall be single conductor, Class B stranded for AWG sizes 8 and larger, and solid for AWG sized 10 and smaller.

(2) Building Wires and Cables (Dry Locations)

Type XHHW - Cross-linked synthetic polymer insulated, UL Standard No. 44.

Type THNN - Double rated THNN-THWN, thermoplastic insulated and jacketed, gasoline-oil resistance II, UL Standard No. 83

d. Power Cables (Wet or Dry Locations)

- (1) Cross-linked-polyethylene insulation, unless otherwise indicated, shall not be considered to meet the requirements of these types of cable.

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3. Five Thousand Volt Cable

a. Cables shall be ethylene-propylene rubber insulated conforming to AEIC Standard No. 6 (Table C-1, Column A) or cross-linked thermosetting polyethylene insulated conforming to AEIC Standard No.5 (Table C-1, Column A).

b. Construction shall be as follows for single conductor cables (jacketed):

- (1) Copper conductor, Class B stranded
- (2) Conductor shielding
- (3) Insulation as per paragraph a. above
- (4) Semi-conducting insulation shielding
- (5) Polyvinyl-chloride jacket or black polyethylene jacket
- (6) Maximum outer diameters (inches):

AWG/kcm.l AWG/kcm.l

#8 - 0.63	#2/0 - 0.97
#6 - 0.69	#3/0 - 1.03
#4 - 0.72	#4/0 - 1.09
#2 - 0.78	250 - 1.14
#1 - 0.82	350 - 1.24
#0 - 0.90	500 - 1.40

c. Construction shall be as follows for single conductor cables (non-jacketed):

- (1) Same as jacketed single conductor cable described above except with no overall jacket (item b(5) above).
- (2) Maximum outer diameters (inches):

AWG/kcm.l AWG/kcm.l

#8 - 0.52	#2/0 - 0.83
#6 - 0.60	#3/0 - 0.92

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#4 - 0.64 #4/0 - 0.98
#2 - 0.70 250 - 1.03
#1 - 0.74 350 - 1.13
#0 - 0.79 500 - 1.29

4. Control cables shall be identical to those installed in existing duct runs. Verify types with Port Authority Engineer.
5. Cables shall be color coded to match existing cables. Painting or taping of cables to achieve color coding will not be permitted.
6. Before pulling wires and cables, the Sub-contractor shall clean the raceway system of all foreign matter. No wires and cables shall be pulled until all operations which are likely to damage the conductors have been completed.
7. Lubricants for pulling wires and cables into conduits and ducts shall be any of the materials specified below for the types of outer coverings shown:

- a. Neoprene or polyvinyl chloride jacketed wires and cables.

Albentonite Cable Pulling Compound
Compounders 12E168 Pulling Compound
Electro Compound Co. Poly-Eas
Ideal Yellow 77 Wire Pulling Lubricant
Mac Products CA-15 Pulling Compound
Minerallac Pull-In Compound No. 100
Slikon Cable Pulling Compound
Y-er Eas

- b. Polyethylene covered cables (high molecular weight, low density polyethylene jackets or Unipass type cross-linked polyethylene wires and cables).

Albentonite Cable Pulling Compound
Compounders 12E168 Pulling Compound
Electro Compound Co. Poly-Eas
Mac Products CA-15 Pulling Compound

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8. Splices and terminations in wires and cables shall be made as shown on the Contract Drawings or as specified herein.

9. The splicing of 600 volt conductors shall be as follows:

a. General Purpose Power Cables

(1) Splices - Dry Locations: AWG sizes No. 10 and smaller (Catalog cuts will be accepted in lieu of shop drawings). Compression type insulated butt connectors shall be applied to the butted conductors by means of a tool providing controlled indentation. Two, half lapped layers of vinyl tape extending a distance of not less than one inch from the connector shall be applied.

(2) Splices - Dry Locations: AWG sizes No. 8 and larger Over butted conductors with pencilled insulation apply:

(a) Connector - split sleeve solderless type or solderless compression type.

(b) Fill indents of connectors with Scotchfil.

(c) Splicing tape as per cable manufacturer's recommendations.

(d) Two half-lapped layers of vinyl tape, or a heat shrinkable tubing.

(3) Splices - Wet Locations

(a) Same as above, except that where vinyl tape (step 4) is used, it shall be covered with two coats of sealer ("Scotchkote").

(b) Use a poured epoxy type splicing kit consisting of connector, buty-

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rate or equivalent splicing case
and epoxy insulation.

(c) Use solid dielectric preformed
connectors.

(4) Terminations - Dry Locations: AWG
sizes No. 10 and smaller (Catalog cuts
will be accepted in place of shop draw-
ings).

(a) Insulated.

(5) Terminations - Dru Locations No. 8 AWG
and larger.

(a) Solder type ring tongue terminals.

(b) Bolted hex screw type ring tongue
lugs.

b. Grounding Wires and Cables

(1) In locations not readily accessible
after installation, splices and termi-
nations shall be made by using a welded
type connection installed in accordance
with the manufacturer's recommenda-
tion. Where the use of welded connec-
tion would be a hazard, connectors of
the solderless, high conductivity,
corrosion resistant, compression type
shall be used.

(2) In other locations:

(a) Splices - Use a solderless high
conductivity corrosin resistant,
compressin type connector.

(b) Terminations - (Clamp type pres-
sure connector suitable for such
use.

(3) All underground connections shall be
covered with two coats of asphalt base
paint.

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c. Control Cables

- (1) Splices shall be according to the manufacturer's recommendation.
- (2) Terminations shall be indenter type ring tongue terminals.

10. Splices in 600 volt multi-conductor rubber or plastic-insulated, control, signal or communication cables with non-metallic covering, shall be made in accordance with the Port Authority Standard Drawings. Where the Contract Drawing requires splices for which there is no standard Drawing, the splices shall be similar in make-up to the most applicable splice for which there is a standard Drawing. The Contractor shall submit Shop Drawings of all splices for which there are no standard Drawings for approval.

11. Cable Splicing and Terminating Materials

a. All materials required for making splices or terminations on specified wire or cable shall be supplied in complete kits by individual cable manufacturer or by one of the following companies:

- (1) Plymouth Rubber Co. - Canton, Mass.
- (2) Cables Associates, Inc. - Long Island City, N.Y.
- (3) Amerace-Esna Corp. Elastimold Division, Esna Park, Hackettstown, N.Y.
- (4) Max Products Inc., - Kearny, N.J.
- (5) OZ Electrical Mfg. Co., - Brooklyn, N.Y.
- (6) PLM Products - Cleveland, Ohio.

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7. Mac Products, Inc.

- k. Insulating splicing tape:
 - (1) Bishop Biseal 3.
 - (2) Plymouth Plymorone.
 - (3) Okonite - Okonex CLF.
 - (4) Scotch Brand No. 23.
- l. Vinyl Tape:
 - (1) Bishop No. 85.
 - (2) Scotch Brand No. 33 Plus.
 - (3) Scotch Brand No. 88.
 - (4) Plymouth Slipknot CW.
- m. Sealer used to waterproof vinyl covering tape:
 - "Scotchkote" electrical coating.
- n. Aluminum Oxide Cloth used for buffing cable insulation:
 - (1) Aloxite Cloth.
 - (2) Minnesota Mining & Mfg. "3-M-ITE Cloth"
- o. Cleaning Fluid
 - Fluids used to clean splice and termination surfaces:
 - (1) Dynasol
 - (2) F0178
 - (3) Lekrosol
 - (4) Vythene
 - (5) Mac Products
- p. Adhesives for use prior to application of splicing tape:
 - (1) MAC Splicing Cement
 - (2) GE A50-F-68 Rubber Cement
 - (3) G & W Rubber Cement
 - (4) Okonite Rubber Cement

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- (c) Thomas & Betts Sta-kon
- (d) Hollingsworth
- (e) Mac Products
- (f) ILSCO

h. Welded type connectors shall be as manufactured by:

- (a) Burndy
- (b) Cadweld

i. Terminals

(1) Solder terminals shall be high conductivity, corrosion resistant type as manufactured by Dossert and ILSCO.

(2) Insulated, compression terminals:

- (a) American Pamcor Plasti-Grip
- (b) Fargo
- (c) OZ
- (d) Thomas & Betts
- (e) Mac Products
- (f) ILSCO

(3) Welded type terminals shall be as manufactured by:

- (a) Burndy
- (b) Cadweld

j. Heat Shrinkable Tubing

Heat shrinkable tubing shall be either irradiated modified polyvinyl chloride or irradiated modified polyolefin as manufactured by:

- 1. Alpha Wire Corporation
- 2. Belden Mfg. Co.
- 3. Electronized Chemicals Corporation
- 4. Encore Electro Plastics Inc.
- 5. Penntube Plastics Co., Inc.
- 6. Rayclad Tubes, Inc.

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- q. Poured Epoxy Kits
 - (1) 3M Co. Scotchcast Brand
 - (2) P.S.I. Products, Inc. Clear Type
- r. Insulating putty or Filler Tape (for filling irregular surfaces, indentations, etc.).
 - (1) Scotchfill Insulation Putty
 - (2) Okonite Filler Tape
 - (3) Slipknot Filler Tape (Plymouth)
- s. Preformed (Prefabricated Terminals and Splices)
 - (1) American-Esna Co., Elastimold Division
 - (2) Minnesota Mining & Manufacturing Co.
- t. Grounding Wires and Cables
 - (a) Use bare, uninsulated cable only where shown in the Contract Drawings or approved by the Engineer.
 - (b) Insulated grounding cable shall be of the type specified herein or shown on the Contract Drawings, color coded in green.
 - (c) Where the type of grounding cable is not indicated:
 - 1. Low voltage (below 660-Volt) circuits - Use same type of cable as circuit wires.
 - 2. High-voltage (above 600-Volt) circuits - Use cables with 600-Volt insulation similar to that of the phase wires.
- u. Any splice or termination other than one of those described above, but the components of which are in accordance with the requirements of this specification, may be submitted for approval.

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- (7) Minnesota Mining and Mfg. Co. - St. Paul, Minn.
- b. The individual components of the kits shall be in accordance with the specifications contained hereafter.
 - c. Any tape supplied in any splice or terminal kit shall have been manufactured no longer than six (6) months prior to its use, and shall be dated by the tape manufacturer to so indicate.
 - d. It shall be the Contractor's responsibility to insure that all materials furnished are compatible and that no one material will adversely affect the physical or electrical properties of any other, or of the wire or cable itself.
 - e. Connectors
 - (1) Split sleeve solder connectors shall be high conductivity, corrosion, resistant type as manufactured by:
 - (a) Dossert
 - (b) Rusgreen
 - (c) Mac Products
 - f. Solderless, uninsulated, compression connectors shall be high conductivity, corrosion resistant type as manufactured by:
 - (a) Burndy
 - (b) Dossert
 - (c) Fargo
 - (d) Thomas & Betts
 - (e) Mac Products
 - (f) ILSCO
 - g. Insulated, indenter type compression butt connectors:
 - (a) American Pamcor Plasti-Grip.
 - (b) Burndy Insulink

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12. Those splices and terminations which are not shown on the Contract Drawings and are not specified herein, shall be made in accordance with the cable manufacturers' printed recommendations provided such recommendations are approved by the Port Authority Engineer.
13. Materials specified herein or called for on the Contract Drawings shall be as follows:
 - a. Friction tape shall conform to the "Tentative Specifications for Friction Tape for General Use for Electrical Purposes" (Designation: D69) of the American Society for Testing and Materials.
 - b. Plastic tape shall be similar and equal to "Scotch Electrical Tape No. 33" of the Minnesota Mining and Manufacturing Company. Equal tapes of the Bishop Manufacturing Corporation or the Permacel Tape Corp. will be acceptable.
 - c. Tapes and other splicing materials shall be used only during the period recommended by the manufacturer and only if their condition is such as to meet the manufacturer's standards.
14. The Sub-Contractor shall fasten a cable tag to each end of each cable, wire or group of wires comprising a circuit or feeder and to each of the foregoing in the manholes through which such wires run or at which they terminate. Each tag shall bear the respective circuit feeder or cable designation and shall be fastened to conductors at both ends of the tag with a 1/16 inch diameter monel metal wire. The ends of the tag shall be rolled around the wire in a manner approved by the Port Authority Engineer. The circuit and feeder designations for tags shall be as directed by the Port Authority Engineer. Tags shall be placed on wires so that they will be readily visible and where a circuit or feeder contains two or more conductors, the tie wires for the tag

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shall be wrapped around all conductors of that particular circuit or feeder. Tags shall consist of 28 gauge monel metal strips three-quarters of an inch wide embossed with the proper designation in five-sixteenths of an inch letters and numbers.

15. Cables which have been manufactured more than two (2) years prior to installation will not be acceptable.
16. Cables shall be kept dry at all times.
17. Seal cable ends with watertight caps if splicing or terminating does not follow at once.

E. Duct Banks (Concrete Encased Conduits)

1. Concrete encasement of conduits shall conform to the duct bank details shown on the Contract drawings.
2. The dead ending of duct banks shall be done as shown on the Contract drawings.
3. No variation from a straight line of greater than one-half (1/2) inch in fifty (50) feet will be permitted when installing an encased duct bank.
4. Reinforce junctions with existing duct banks (or duct banks installed by others) with steel wire mesh 30-1010 (American Welded Wire Fabric), encased in four (4) inches additional thickness of concrete around each duct bank. The additional encasement shall extend at least four (4) feet in each direction from the junction.
5. Where the pouring of concrete is interrupted for one (1) hour or more, reinforce the concrete encasement at the point of interruption with steel wire mesh 33-1010 (American Welded Wire Fabric) or other reinforcement in a manner acceptable to the Port Authority Engineer.
6. Preformed (precast) duct banks will not be permitted.

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F. Grounding Assembly for Electrical Manhole

1. The electrical materials for the grounding assembly for electrical manholes shall be in accordance with Port Authority Standard Drawing 430.240. The materials shall be similar to the following items of the Burndy Engineering Co., Inc., except as otherwise noted. Equivalent connections as manufactured by O.Z. Electrical Manufacturing Co. or Thomas & Betts will be acceptable.
2. Equipment shall be as follows:
 - a. Cable Clamp - Type GB except with hex head silicon bronze bolt and approved brass insert in concrete wall.
 - b. Ground connector - Type GC
 - c. Ground rod connector - Type GP
 - d. Cable connector - Type NT
 - e. Ground rod - copperweld rods as manufactured by the Copperweld Steel Co. or equivalent as manufactured by Anaconda Wire and Cable or Hubbard & Co.

G. Arcproofing

1. If the arcproofing on a cable has been disturbed for any reason it shall be reinstalled as soon as possible after the disturbance.
2. Arcproofing is not required on secondary and control cables.
3. All new cable and all existing cables in electric manholes (power) which are to be spliced or reconnected shall be arcproofed with two wrappings of arcproofing tape over the entire exposed length of cable, including splices. The first wrap shall be wound half-lapped, the second butt-lapped. Cables shall be grouped by circuits and

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the arcproofing applied over the group of wires or cables comprising the group except that splices shall be arcproofed individually. The width of arcproofing tape shall be 1-1/2 inches where the diameter of the circumscribing circle for the groups of wire or cables to be arcproofed is less than 1-3/4 inches. For larger diameters, the tape shall be 3" wide. The arcproofing shall be bound with adhesive-backed glass cloth tape or glass cloth binding cord applied at the ends of the tape and at 24 inch intervals along its entire length.

4. All distribution and primary cables are to be arcproofed in manholes where there is more than one primary feeder by application of one (1) half-lapped and one (1) butt-lapped layer of asbestos arcproofing tape, or one (1) half-lapped layer of carbon fiber or glass cloth arcproofing tape applied for the entire length of the cable. The width of arcproofing tape shall be 1-1/2 inches where the diameter of the individual cable is less than 1-3/4 inches, and 3 inches where the cable diameter is greater. The arcproofing tape shall be stuffed into the duct mouth and shall be bound with adhesive-backed glass cloth tape or glass cloth binding cord applied at the ends of the tape and at 24 inch intervals along its entire length.

5. Arcproofing Materials

- a. Tape shall be:

- (1) Scotch Brand 7700
 - (2) Johns Manville
 - (3) Bishop No. 43
 - (4) Quelcor Queipyre
 - (5) Plymouth Plyarc

- b. Glass Cloth Tape shall be:

- (1) Scotch Brand No. 27
 - (2) Plymouth Piyglass
 - (3) Permacel 21D
 - (4) Bishop No. 77

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c. Fiberglass Tie Cord shall be:

- (1) Bishop
- (2) Quelcor

H. Testing of High Voltage Cables

1. Wires and cables shall be tested at the cable manufacturer's plant in accordance with requirements of the Insulated Power cable Engineers Association (IPCEA) and AEIC Standards. The contractor shall make all arrangements for the tests.
2. All wires and cables shall be tested in accordance with the requirements of the above publications for voltage test. For cable rated less than 5,000 volts, only the A.C. test will be required. For cables rated at 5,000 volts, the IPCEA and AEIC direct current test procedures for cables rated 5,001 volts and higher will be required in addition to the A.C. test procedure as described below.
3. A Direct Current Test, similar to that performed on 5001 volt and higher rated cable except that the following voltage levels shall apply:
 - a. Ethylene Propylene Rubber Insulated Polyethylene Jacketed - 35.0 KV.
 - b. Cross-Linked Thermosetting-Polyethylene Insulated Cable 35.0 KV.
4. Where required by the Port Authority Engineer, a D.C. test shall be performed on the installed cable at the time of installation and thirty (30) days after installation. The applicable D.C. voltage values are as follows:
 - a. Ethylene Propylene Rubber insulated polyethylene jacketed - 25.0 KV.
 - b. Cross-Linked Thermosetting-Polyethylene Insulated Cable - 25.0 KV.

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5. Field tests

- a. Tests shall be conducted by a competent qualified organization maintaining skilled personnel experienced in applying high potential cable tests. The Subcontractor shall submit to the Engineer the name of the organization and personnel who are to conduct the tests, for approval.
- b. A complete record of all high potential tests shall be kept. The record shall include but not be limited to:
 - (1) Applied test voltage.
 - (2) Time duration of test.
 - (3) Test readings.
 - (4) Time, date and temperature at which tests were conducted.

6. Submit six copies of all test data to the Engineer for the Port Authority's records and approval.
7. All high potential tests shall be conducted in the presence of the Port Authority Engineer. The subcontractor shall give at least 24 hours notice to the Engineer in writing, in advance of the time at which the above tests are to be conducted.
8. The Port Authority Engineer reserves the right to determine the adequacy of all cables based on the tests. Where, in the opinion of the Port Authority Engineer, the test data indicates a marginal cable, the acceptance or rejection of the particular cable by the Port Authority Engineer shall be final. All rejected cables shall be reworked or replaced as required, entirely at the subcontractor's expense.
9. All communication with the Port Authority shall be through Olympia and York.

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I. Final Field Tests

1. After completion of the entire electrical installation and before final acceptance testing, thoroughly clean and touch up damaged finishes of all equipment installed.
2. In addition to other tests which may be required in the various other Sections, perform field tests in the presence of the Port Authority Engineer, to demonstrate the reliability of the electrical installation. Give the Port Authority Engineer 48 hours advance notice of such tests. The following field tests shall be performed:
 - a. Operate all electrical systems and equipment for a period of 24 hours, unless, in the opinion of the Port Authority Engineer, a different test period is required to prove the operation and performance of a system and its equipment.
 - b. Test all wires and cables installed under this Contract with a 1000 volt Megohmmeter. Furnish the Port Authority Engineer a copy of the results together with an outline of the method used. If, in the opinion of the Engineer, and readings are lower than required by good practice or applicable codes, promptly replace the materials or equipment involved.
 - c. Run a direct current high voltage proof test, on all shielded cables rated above 2 KV immediately after installation is completed. This test shall be performed before such cables are placed in regular service. Conduct tests in accordance with recommended standards for the cable involved.
 - d. Should the foregoing tests reveal any defects, promptly correct such defects and re-run the tests until the entire installation is satisfactory in all respects.

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J. 5KV Splices

1. Splices shall be disconnectable type, 600-Amp modular splices as manufactured by Amerace-Esna Corp., Elastimold Division or an approved equal.

In addition, each splice shall be covered with a heat shrinkable tubing.

2. Heat shrinkable tubing shall be either irradiated modified polyvinyl-chloride or irradiated modified polyolefin as manufactured by:
 - a. Alpha Wire Corporation
 - b. Belden Mfg. Co.
 - c. Electronized Chemicals Corporation
 - d. Icore Electro Plastics Inc.
 - e. Penntube Plastics Co., Inc.
 - f. Rayclad Tubes, Inc.
 - g. Mac Products, Inc.

K. Emergency Generators

1. Electrical Sub-Contractor shall furnish emergency generators and distribution equipment for temporary power to pump house as shown on Drawings.
2. Emergency generators shall be 900 KW each, 277/480 volts, 3 phase, 4 wire. One unit shall be standby.
3. Provide automatic transfer switch, transformer(s), distribution equipment, etc., as shown on plans.
4. No splicing of conduit runs being relocated will be permitted until all temporary power equipment has been installed unless otherwise directed by Port Authority Architect. Temporary power shall be connected to the pump station before any interconnection of new and existing cables, duct banks, etc. will be permitted.
5. Sub-contractor shall furnish all necessary fuel oil and tanks and provide an on-site electrician for duration of temporary power.

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6. All temporary power equipment including generators, transformer(s), distribution equipment, etc., shall become the property of the Sub-contractor upon completion of the work of this Contract.
7. The temporary electrical power distribution installation, powered by the diesel generator, shall be tested in the presence of the WTC representative before connections to the pump station equipment will be permitted. Test shall include use of dummy load banks.
8. All labor required to staff and service both the temporary power distribution system and the power generating system shall be furnished by the Electrical Subcontractor.

III. INSTALLATION AND EXECUTION

- A. No shutdowns will be permitted without written approval of Port Authority Architect. Electrical Subcontractor shall assume that shutdowns will take place on Sundays. All necessary overtime shall be included in Sub-Contractor's bid.
- B. Where work is to be performed in existing manholes, the Electrical Sub-contractor shall include cost of pumping water from manholes.
- C. All new manholes, conduit banks, etc., shall be installed in place to the greatest extent practicable prior to the disconnection or interruption of power to the pump house in order to minimize outage times.
- D. Subsequent to the completion of the electrical work, certain cooling water lines will be installed in close proximity to the electric ducts and manholes. Electrical Sub-Contractor shall closely maintain all clearances.
- E. Sub-contractor shall submit Shop Drawings showing dimensioned routing with sections and profiles of electrical runs a minimum of 30 days prior to installation.

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- F. Shop drawings, approved by the Engineer of Record, will be submitted to the Port Authority prior to start of construction.
- G. At completion of construction, a set of reproducible as-built construction and shop drawings shall be delivered to the Owner by the Subcontractor for submission to the Port Authority.
- H. All existing duct banks and cables shall remain intact until new duct banks and cables are ready for connection to the existing system.
- I. All power and signal interruptions, connections, testing, etc., shall be as approved by the World Trade Center Architect.

END OF SECTION

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SECTION 16030
CONCRETE FOR ELECTRICAL WORK

PART I - GENERAL

A. DESCRIPTION

1. The work covered by this section of the specifications includes the construction described including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction.
2. Work included: The work of this section shall include, but is not limited to, the following:
 - a. Reinforced concrete for electrical systems.

B. SUBMITTALS

1. Shop drawings: Submit shop and placement drawings of: Reinforcing steel, manhole details.
2. Submit design mix.

PART II - PRODUCTS

A. CONCRETE

1. Concrete shall have a minimum 28-day strength of 3000 pounds per square inch.

B. Concrete Aggregates

1. Fine aggregate shall be clean, natural siliceous sand consisting of hard, strong, durable, uncoated particles, and shall be free from injurious amounts of soft or flaky particles, shale, loam, alkali, organic matter, or other deleterious substances. It shall contain not more than three per cent (3%) by weight of silt or other particles capable of passing through a No. 200 sieve. The percentage of material finer than No. 200 sieve shall be determined in accordance with the Standard Method of Test for Amount of Material Finer

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than No. 200 Sieve in Aggregates (A.S.T.M. Designation: C117) of the American Society for Testing and Materials.

2. Coarse aggregate shall consist of clean, hard, strong, durable gravel or crushed stone. Crushed stone shall be dolomitic limestone or trap rock. Coarse aggregate shall be free from injurious amounts of soft, friable, thin, elongated or laminated pieces, alkali, loam, clay, organic or other deleterious matter, and shall be free from an amount of material finer than No. 200 sieve in excess of one-half of one percent, and shall be graded in accordance with ASTM designation C136.

C. CEMENT

1. Cement shall be Portland Cement, Type IA, complying with the requirements of ASTM Designation C-175.

D. WATER

1. Water for mixing and curing concrete and mortar shall be fresh, clean water suitable for drinking purposes.

E. REINFORCEMENT

1. Reinforcement shall be as shown on drawings and as specified in this Section.

F. FORMS

1. Forms shall be constructed and of sufficient strength so that the finished concrete will conform to the shapes, lines and dimensions shown on the Contract Drawings. They shall be substantially built and sufficiently tight to prevent leakage of water and grout and shall be properly and securely braced in order to maintain their true position and shape within the required tolerances. If any form loses its proper shape or position, it shall be immediately repaired to the satisfaction of the Constructor or removed and immediately replaced with a new form.
2. The inside of forms shall be thoroughly cleaned before concrete is placed in contact with the form, and except where a scored finish is re-

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including the mixing water, when placed in the mixer, shall not exceed 140°F. When placed in forms, the concrete shall have a temperature between 50°F and 70°F.

B. MIXING CONCRETE

1. Unless otherwise authorized, the mixing of concrete shall be done in a batch mixer of approved type or in transit-mix equipment conforming to ASTM Specification C-94-78, using Alternate No. 2 method to determine quality. The volume of the mixed material for each batch shall not exceed the manufacturer's rated capacity of the mixer. If transit-mixed, the materials shall be brought to the site dry and the period of time from batching to the addition of water at the site of the pour shall not exceed thirty minutes.
2. Site mixed concrete shall be mixed in an approved batch mixer and the batching and mixing shall be of sufficient capacity and power to carry out each prearranged concrete operation without danger of delay or interruption until the unit or concrete pour is completed. The mixer drum shall be rotated at the speed recommended by the manufacturer and mixing of the concrete ingredients shall continue for not less than 1-1/2 minutes from the time all of the materials, including the water, are in the mixer drum. Mixing shall continue until all the ingredients are uniformly distributed throughout the batch and the mass of the concrete is homogeneous and uniform in color. Discharge of concrete shall be completed within a maximum period of 30 minutes. No new materials shall be permitted to enter the mixer until all of the preceding batch has been discharged. Mixing and handling equipment shall be cleaned at frequent intervals while in use.
3. All concrete shall be used while fresh and before there is any evidence of initial set. Any concrete which has achieved its initial set shall be rejected and not used in the forming of pipe or piping encasement. No retempering of concrete will be permitted.

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quired, shall be coated with a non-staining mineral oil or other approved material, applied before reinforcement is placed.

G. PROPORTIONING INGREDIENTS

1. Concrete shall be mixed in accordance with the following proportions as per World Trade Center requirements:

<u>Ingredients</u>	<u>Quantity and Slump</u>
Cement - pounds	94
Fine Aggregate - pounds	225
Coarse Aggregate - pounds	6.25
Water - maximum gallons	375
Slump - maximum inches	4

PART III - EXECUTION

A. Batching of Material

1. Bulk cement shall be weighed on scales having a degree of control and accuracy such that the delivered weight shall be correct within one percent. The scale and weight hopper shall be separate and distinct from those used for other materials. Cement may be batched on a bag basis; the weight of a bag of Portland Cement (U.S.) shall be taken as 94 pounds and only whole units are to be used with this method.
2. Aggregates shall be weighed on scales having a degree of control of accuracy such that the delivered weights are correct within two percent. Moisture, both free and absorbed, shall be corrected for and the free moisture shall be taken into account when dispensing the mixing water.
3. Water shall be measured by volume or weight with an accuracy and control within a one percent tolerance.
4. When the outdoor temperature is below 40°F or is likely to fall below 40°F during the 24-hour period after placing, adequate equipment shall be provide for heating the concrete material and protecting the concrete against freezing, but no frozen materials or materials containing ice shall be used. Temperatures of the separate materials,

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6. Any concrete which fails to meet the minimum strength requirements of these Specifications shall be considered rejected pending verification of the adequacy of the material by other means.

D. CONCRETE HANDLING & PLACING

1. Concrete for duct bank encasement and manholes shall be placed in the dry. Before placing any concrete all equipment for mixing and transporting the concrete shall be clean, all debris and ice shall be removed from the spaces to be occupied by the concrete and the reinforcement thoroughly cleaned of ice or other deleterious coatings. All accumulated water shall be removed from the place of deposit before concrete is placed.

E. REINFORCEMENT

1. The Subcontractor shall prepare and submit shop drawings of bar reinforcement for the Contractor's approval in accordance with the requirements of the General Conditions. Such drawings shall show: the element identification, bending diagrams, cutting lists, inserts, spacers, etc. and shall completely demonstrate the location, size, spacing, length and bending of the bar reinforcement. Shop drawings for concrete reinforcement shall be prepared in accordance with the American Concrete Institute "Manual of Standard Practice: for Detailing Reinforced Concrete Structures", ACI-315-80.
2. Reinforcing cages for each element shall be completely assembled and securely tied and braced so as to maintain dimensional rigidity during placing of concrete.

F. FORMS

Forms shall conform to the shape, lines and dimensions of the elements shown on the Contract Drawings and shall be substantially free from surface defects and sufficiently tight to prevent leakage of mortar. They shall be properly braced so as to maintain position and shape during the placing of concrete. Forms shall meet the requirements of ACI-341-68, "Recommended Practice for Concrete Framework", and ACI-SP NO. 4, "Framework for Concrete".

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C. CONCRETE TESTING

1. In accordance with the general conditions and as amended herein tests of the concrete will be made by an approved independent testing and inspection shall be by a laboratory hired by the Contractor. The Subcontractor shall provide casual labor and assistance to the testing laboratory personnel for the testing specified in this section.
2. At least one test of slump and air content shall be made on fresh concrete for each 50 cubic yards of each class of concrete (or fraction thereof) placed in any one day and in any event not less than one test for each class of concrete each day it is used. Slump shall be determined in accordance with ASTM Specification C-143-78. Air content shall be determined in accordance with ASTM Specification C-138-77 or C-231-81. Additional tests shall be made as required to demonstrate that the requirements of the Specifications are being met.
3. A set of three cylinders shall be molded for each 50 cubic yards, or fraction thereof, of each class of concrete placed in any one day's concreting, for testing at the age of 28 days. An additional two cylinders shall be molded at intervals as above for testing at the age of 7 days. Test cylinders shall be molded in accordance with ASTM Specification C-31-69.
4. The standard age for strength test shall be 28 days and the strength of such test shall be the average of the breaking strengths of the three cylinders comprising the set. The 7 day tests will be used for purposes of job control once an age-strength relationship has been established by the testing laboratory for the materials and proportions used.
5. The average of any three consecutive 28 day strength tests representing each class of concrete shall be equal to or greater than the specified strength and not more than 10 percent shall have an average value less than 90 percent of the specified strength.

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Blockouts, shear keys, waterstops and other inserts shall be accurately located and securely fastened to the framework so as to maintain position and shape during the placing of concrete.

G. WATERSTOPS

Waterstops shall be 9" long x 3/8" thick flat dumbbell type made of polyvinyl chloride as manufactured by Manufacturers Progress Inc. Unlimited or approved equal. The waterstops shall be installed in long lengths and the ends of parts making up a continuous stop shall be spliced to form a continuous watertight seal. All splicing shall be done in accordance with the manufacturer's recommendations.

END OF SECTION

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