conEdison

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
4 IRVING PLACE
NEW YORK, NY 10003

DISTRIBUTION ENGINEERING
Tools and Structures

EO-1008
REVISION 15

Plain and Reinforced Concrete

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1.0 Purpose

This specification covers the furnishing of all labor, materials, equipment, tools, services and all other items necessary for the complete and approved installation of all precast, cast-in-place plain and reinforced concrete work, which includes ready mixed, job-site mixed, and plant-mixed concrete, as indicated on the contract drawings and/or specified herein.

2.0 Application

This specification applies to the Con Edison electrical distribution system.

3.0 General Requirement

3.1 General Work Requirement

Concrete shall consist of portland cement, fine and coarse aggregates, admixtures and clean water thoroughly mixed in quantities as specified by the latest edition and latest addenda of ACI, ASTM standards, Engineering Documents, NYC or local building codes, and the rules concerning safety & health from OSHA and EPA. Completed mix must obtain the required concrete strength as outlined in this specification.

3.2 Items of Work

The specific items of work are outlined in the "Project Specifications and Contract Drawings".

3.3 Work by Others

3.3.1 Controlled Inspection

3.3.2 Inspection and Testing of Concrete

3.4 Reference Specifications

The work covered by this specification shall conform to the latest edition and latest addenda thereto of the following standards and specifications:

3.4.1 ACI — American Concrete Institute

117 Standard Specifications for Tolerances for Concrete Construction and Materials

237R Self-Consolidating Concrete

304R Guide for Measuring, Mixing, Transporting and Placing Concrete

305R Hot Weather Concreting

306.1 Standard Specification for Cold Weather Concreting

306R Cold Weather Concreting

308R Guide to Curing Concrete

309R Guide for Consolidation of Concrete

318 Building Code Requirements for Reinforced Concrete

3.4.2 ASTM — American Society for Testing and Materials

A185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

A615 Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A775 Standard Specification for Epoxy-Coated Steel Reinforcing Bars

C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field

C33 Standard Specification for Concrete Aggregates

C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

C94 Standard Specification for Ready-Mixed Concrete

C143 Standard Test Method for Slump of Hydraulic Cement Concrete

C150 Standard Specification for Portland Cement

C151 Standard Specification for Sheet Materials for Curing Concrete

C172 Standard Practice for Sampling Freshly Mixed Concrete

C260 Standard Specification for Air-Entraining Admixtures for Concrete

C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

C494 Standard Specification for Chemical Admixtures for Concrete

C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C989 Standard Specification for Granulated Blast-Furnace Slag for Use in Concrete and Mortars

C1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

3.4.3 EO — Engineering Documents / Specifications

a EO-1125 — Specification for Field-Mixed Concrete in Small Batches.

b EO-5228 — Specification for Fabrication of Precast Concrete Distribution Structures.

c EO-100167 — Purchase Recommendation for Packaged, Dry, Combined Materials for Mortar and Concrete.

d EO-1007 — Specification for Membrane Method of Waterproofing for Electrical Distribution Structures.

e EO-100285 — Purchase Recommendation for Plain and Reinforced Concrete.

f EO-100642 — Purchase Recommendation for Membrane Waterproofing Systems for Electrical Distribution Structures.

g EO-100271 — Purchase Recommendation for Rapid Setting Concrete Dry Gravel Mix.

3.4.4 Approved Product List by EH&S

EH&S approved product list for use of admixtures in concrete.

See CRS-Chemical Reporting System at

https://otis.osmanager4.com/conedison#/chemical

and

EO-100285.

3.4.5 Building Codes

Building Codes of the City and State of New York including Westchester County and other Municipalities as applicable.

3.4.6 Occupational Safety and Health Administration (OSHA)

a 29 CFR 1910 — Occupational Safety and Health Standards.

b 29 CFR 1926 — Safety and Health Regulations for Construction

3.4.7 New York City, DOT Requirements

Standard Highway Specifications, New York City Department of Transportation.

3.5 Quality Control

3.5.1 Concrete Strength Tests

a Minimum Strength
All concrete shall have minimum 28 days strength as specified in the project specification and contract drawings, unless noted otherwise.

b Investigation of Low Strength Test Results,
If any strength test (see ACI 318-08) of laboratory-cured cylinders falls below fc' by more than the value given in ACI 318. then tests and structural analysis shall be taken as per ACI 318 at the contractor's expense.

3.5.2 Special Inspection and Concrete Testing

Concrete shall be controlled in accordance with the requirements of Building Codes of the City and State of New York including Westchester County and other local Municipalities, as well as NYC Buildings Bulletin 2009-026. Special inspection and concrete testing shall be performed by the special inspection agency and concrete testing laboratory accepted by New York City Building

Department.

3.5.3 Frequency of Testing

Samples for strength tests of concrete placed for manholes or any other load bearing structures shall be taken once a day or one for each structural element. i.e. floor slab, wall and roof slab, respectively. At the time fresh concrete is sampled to fabricate specimens for strength tests, the slump and air content tests and temperature of concrete shall be performed.

3.5.4 Concrete Testing Laboratory

All compressive strength tests of concrete, tests on cement, aggregates, slump and air content shall be done for Con Edison by an independent licensed concrete testing laboratory, see section 3.5.2.

3.5.5 Report Requirement

Special inspection agency, see section 3.5.2, shall keep records of inspections for a period of 6 years to conform to the provisions of sections BC 1704, BC 1903 and BC 1905 of the Building Codes of the State and City of New York and NYC Buildings Bulletin 2009-026. The agency shall submit to Con Edison Construction Management one hard copy and one electronic copy for them to keep in the project folder.

3.6 Rejection of Concrete

Final acceptance by Con Edison of all concrete work done by the contractor shall be predicated on meeting the job specific requirements, contract document and accepted ACI industry standards. The acceptance parameters include but are not limited to: compressive strength, mix design, slump, air entrainments, rebar placement and size. Additionally, the acceptance is contingent upon the finished condition of the concrete including general condition and no unacceptable evidence of honey combing, cracking, air bubbles or spalling. Con Edison reserves the right to assign an independent agency to conduct further investigation which may include nondestructive tests and strength tests of cores for those concrete strength tests that failed to meet specifications and any suspected defective concrete. If the results of subsequent physical testing or analytical modeling, stated in 3.5.1 to 3.5.4, reveals that the contactor placed concrete is defective and unacceptable, all costs for this investigative work shall be at the contractor's expense and the concrete in dispute shall be removed, replaced and tested until the strength and quality meet the requirements in this specification, at the contractor's expense.

4.0 Material and Product Specifications

4.1 General

4.1.1 Products and manufacturers listed in section 3.4.3 and 3.4.4 are all subject to compliance with the applicable codes and standard requirements.

4.2 Cement

4.2.1 Cement used in the concrete mix shall be Portland cement and shall conform to ASTM C150.

4.2.2 Cements of a special nature for specific purposes shall conform to the specifications of latest edition of ASTM and ACI 318, and shall be submitted to Con Edison Construction Management (CM) for approval prior to the finalization of contract/construction drawings.

4.2.3 Neither fly ash nor slag is allowed to be used in concrete.

4.3 Aggregates

4.3.1 Fine aggregate shall be natural sand conforming to ASTM C33, Section 6.1

4.3.2 Coarse aggregate shall be crushed stone conforming to size number 67 in accordance with ASTM C33, Table 2, unless otherwise indicated.

4.3.3 Coarse aggregates for sidewalk slabs shall be grits which shall pass a sieve having 3/8 inch square openings and not less than 90% shall be retained on a No. 4 sieve.

4.4 Water

Water used in mixing concrete shall conform to ASTM C1602.

4.5 Admixtures

4.5.1 Admixtures listed in EO-100285 shall be added to the concrete as specified in contract drawings and/or the detailed project specification and strictly follow the manufacturer's

recommendations. Admixtures shall be added only through calibrated dispensing devices. Dispensers shall be inspected and certified as to accuracy by the manufacturer of the admixture. Descriptions of admixtures, and data indicating quantities intended for use, shall be submitted to Construction Management and Distribution Engineering Tools and Structures Engineer for approval.

4.5.2 An air-entraining admixture shall be added to the mix for all concrete. Air-entraining admixtures shall conform to ASTM C260. Air-entraining admixtures shall be added to the concrete mixtures immediately before or during mixing.

4.6 Steel Reinforcement

4.6.1 All reinforcement and accessories shall be free of loose rust, loose scale, grease, oil, and other coatings or foreign substances that would reduce the bonding qualities.

4.6.2 Bars

a Bar reinforcement, sizes No. 3 through No. 8 inclusive, shall be deformed, new billet steel bars conforming to ASTM A615, Grade 60, as indicated on the applicable drawings. Reinforcing bars shall be epoxy coated for all underground and wet structures in accordance with ASTM A775. Epoxy coating damaged as a result of handling or cutting of reinforcing bars shall be field coated with epoxy patching material conforming to ASTM A775.

b Each bar shall be branded in the deforming process to identify the manufacturer, size, type and grade of steel.

4.6.3 Welded Wire Fabric

Welded wire fabric shall be epoxy-coated in accordance with ASTM A884. The size or sizes indicated on the drawings, shall conform to ASTM A185. Epoxy coating damaged as a result of handling or cutting of fabric members shall be field coated with epoxy patching material conforming to ASTM A775.

4.6.4 Tie Wire

Tie wire for securing reinforcement in place shall be 16 gauge or heavier, black annealed plastic-coated wire.

4.6.5 Bar Supports

a Bar supports shall be standardized and non-corrosive wire bar supports conforming to the material specifications of the Manual of Standard Practice of the CRSI and contract drawings. Bar supports shall be sufficient in number and strength to properly carry the reinforcing bars and normal construction loads supported thereon.

b Precast concrete blocks, plain or provided with embedded coated tie wires, and dowel blocks, conforming to the Manual of Standard Practice of the CRSI shall be used to support bars in footings and slabs on ground.

4.7 Classification of Concrete

4.7.1 Concrete shall be furnished in accordance with the following Consolidated Edison (Con Edison) classifications:

Con Edison Company Classification	Type of Structures	Min. 28-Day Compression Strength, Psi
Class I	Watertight Structures: Cast-in-Place, Precast and Self Consolidated Concrete (SCC) or Special Structures	5,000
Class II	Non- Watertight Structures	4,500
Others	Duct Banks, Sidewalks and General Use	3,500

4.8 Curing Materials

4.8.1 Waterproof paper for curing concrete shall conform to ASTM C171.

4.8.2 Membrane forming compounds for curing concrete shall conform to

ASTM C309.

4.8.3 Polyethylene sheet used for curing concrete shall conform to the moisture retention requirements of ASTM C171. Polyethylene sheet shall be free of visible defects, uniform in appearance, and not less than 0.004 inches thick.

4.8.4 Polyethylene-coated waterproof paper for curing concrete shall conform to the moisture retention requirements of ASTM C171. The polyethylene coating shall have a minimum thickness of 0.002 inches, and shall be permanently bonded to the waterproof paper.

4.9 Forms and Form-Ties

4.9.1 For underground construction that requires Class I or II concrete structure with watertight treatment, fiberglass form tie system made by RJD Industrial, INC. or approved equal shall be used. No timber or wood forms shall be constructed. No other form tie or snap tie is allowed for watertight concrete construction.

4.9.2 For above ground construction that requires Class I or II non-watertight concrete structure, steel, timber or wood forms may be constructed. Metal forms shall conform to ACI 347 and Section BC 1906 of the Building Code of the City of New York or other local municipal building codes. The materials used shall produce or facilitate obtaining the specified surface finish of the concrete.

4.9.3 All form ties shall have removable or snap-off ends and shall be fixed or adjustable in length. The portion of the tie remaining in the concrete after the removal of the exterior parts shall not project beyond the surface of the concrete and shall be at least one inch back from any surface that will be exposed to view. Plug both ends of the form tie opening with non-shrink cement grout with minimum thickness of one inch.

4.9.4 Unexposed Concrete Surfaces
No. 2 common or better lumber, or any material specified for exposed surfaces shall be used.

4.9.5 Exposed Concrete Surfaces
Plywood or metal forms in accordance with the following requirements shall be used:

a Plywood shall be APA Structural I Plyform, mill-oiled not less

than 5-ply and at least 1/2 inch thick.

b Metal used for forms shall comply with the American Iron and Steel Institute requirements for light gauge, cold-formed steel. Metal forms shall produce surfaces equal to those provided by wood forms.

4.10 Form Oil (Parting Agent)

4.10.1 A colorless mineral oil, free of kerosene shall be used. Flash point shall be not less than 300□°F, determined in accordance with ASTM D 92. Freezing point shall be less than -20°F**.**

4.10.2 The Contractor shall verify with the admixture manufacturer that the form oil used is compatible with the admixtures included in the concrete mix. The Contractor shall notify the Construction Management in writing that such verification has been made.

4.10.3 Avoid dropping oil on the reinforcement bars or any exposed concrete surface.

4.11 Concrete Proportions and Consistency

4.11.1 Concrete material shall be mixed in such proportions as to achieve the specified compressive strength at the age of twenty-eight days. The contractor shall be responsible for the proper concrete design mix in accordance with sections 4.1 to 4.5**.**

4.11.2 Concrete mix proportioning shall produce concrete with slump and air content designed to minimize bleeding and segregation.

4.11.3 Slump for all concrete that does not contain a super-plasticizer admixture shall be a minimum of 4 inches and a maximum of 6 inches unless noted otherwise.

4.11.4 Unless noted otherwise, normal weight concrete structure for vaults and manholes subject to freezing- and-thawing exposures shall be assigned to Exposure Class F2 (severe exposure) of ACI 318 and air-entrained with air content of (6 +/- 1.5) %.

4.11.5 The water / cement ratio for concrete subject to special exposure conditions shall meet the requirements of section BC 1904 of the New York City Building Code or other applicable municipal local codes.

4.11.6 If the contractor intends to use self-consolidating concrete, (SCC), polyarboxylate based high-range water-reducer (HRWA) shall be used and meet the requirements of ASTM C-494/C, Type F or G and ACI 237. The contractor shall submit the design concrete mix with the admixture to Construction Management and Distribution Engineering Tools and Structures Engineer for review and comments prior to placing the order of SCC.

4.11.7 The slump of the concrete shall remain the same throughout the period required to unload the truck or mixer. Discharge of the contents shall be completed within 1-1/2 hours, after the introduction of mixing water to the cement and aggregates or the introduction of cement to the aggregates. During hot weather, when the temperature is above 80°F., the time limit shall be reduced to 45 minutes.

4.11.8 For all concrete, air-entrainment shall be accomplished by adding an air-entraining agent to the mix, in accordance with paragraph 4.5.

4.11.9 The source of supply for the fine or coarse aggregate shall not be changed during the course of the job. If the contractor wishes to change the source of supply for aggregates, the contractor must submit redesign concrete mix using the new source supply to Construction Management and Distribution Engineering Tools and Structures Engineer for review and approval.

4.11.10 The Contractor shall submit design mix to Construction Management and Distribution Engineering Tools and Structures Engineer for review and acceptance, a minimum of three weeks prior to the concrete mix being used for this project. The mixes as specified and filed with Construction Management shall not be adjusted except as specified herein, without the approval of the Construction Management and Distribution Engineering Tools and Structures Engineer. The Contractor shall submit to the Con Edison Construction Representative 2 copies of the concrete mix as accepted by Construction Management.

5.0 Concrete Mixing, Placing, Curing, Testing

5.1 Mixing Concrete

5.1.1 All concrete shall be mixed thoroughly and uniformly in accordance with ACI 318.

5.1.2 After mixing of materials has been completed, the use of additional water to make the mixture more workable will not be allowed. Concrete that has attained initial set shall not be placed, nor shall it be retempered or re-mixed in any way for use.

5.2 Preparation of Equipment and Convey, Place of Deposit

5.2.1 Preparation of equipment and place of deposit of concrete shall be done in accordance with ACI 304R and ACI 318.

5.2.2 Concrete shall not be placed until all reinforcement and embedded items, including pipes, conduits, frames, cut-outs, recess and shelf angles, anchor bolts, inserts, sleeves and other items that are called for on the drawings to be placed in the concrete, have been set in position.

5.2.3 The Construction Management Inspector shall timely arrange for the special inspection agency to inspect formwork for rigidity of supports, and reinforcing for correct placement and alignment. The special inspection agency will file with the Construction Management attestation that this inspection has been made.

5.2.4 Concrete shall not be allowed to drop freely more than 5 feet and shall be deposited in forms in a manner to avoid inclined construction joints.

5.2.5 When a continuous pour of concrete is being made, deliveries of mixed concrete shall be made at the place of deposit at intervals not exceeding one-half hour. Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section.

5.2.6 Tops of rough slabs shall be brought to the level indicated on the drawings within a tolerance of plus or minus 1/4 inch.

5.2.7 All concrete shall be thoroughly compacted in accordance with section 5.6, immediately after placing, and shall be thoroughly worked around the reinforcement, embedded fixtures, and into the corners of the forms.

5.2.8 Chute Placement

a Concrete may be conveyed by approved chutes. The chute shall be metal or metal-lined wood with sections set at approximately the same slope to assure a continuous uniform flow throughout the length of the chute without segregation or loss of the materials.

b Aluminum shall not be used for construction of metal chutes or for lining of wooden chutes.

c The chute shall be thoroughly cleaned before and after each run. Waste material and flushing water shall be discharged outside the forms.

5.2.9 Pump Placement

a Pump placement of concrete shall be in accordance with ACI 304.2R, Placing Concrete by Pumping Methods.

b Where it is proposed by the Contractor to convey or place concrete by pumping, a description of the proposed pumping system, equipment, and procedures to be used shall be submitted by the Contractor, for information only, to the Con Edison Construction Management include output of system in cubic yards per hour, and pump range in feet, horizontally and vertically.

c In addition, the concrete mix shall contain a super-plasticizer admixture with air-entraining agent providing air content stated in section 4.11.4. Mix shall have adequate lubricating characteristics, including low mix-to-line-surface friction and low internal friction within the mix. Adjustments in mix design necessary to ensure efficiency of operation, including satisfactory pumping rates with smooth even flow shall be made by the Contractor at his expense and at no additional cost to Con Edison.

d Aluminum pipelines shall not be used when placing concrete by pumping.

5.3 Concrete Tests

5.3.1 Construction Management shall coordinate and arrange for the Concrete Testing Laboratory described in section 3.5, to perform all required tests including slump and compression tests to determine the strength classifications of the adjusted design mixes.

5.3.2 During construction, test samples of the concrete mix shall be taken at the hose discharge point by the Testing Laboratory Representative. Test samples used to determine slump and strength requirements shall be taken at the receiving hopper of the pump.

5.4 Cold Weather Requirements

5.4.1 Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing or near freezing weather. The contractor shall conform to the cold weather requirements of ACI 318, section 5.12, ACI 306R and ACI 306.1 unless otherwise designated.

5.4.2 If at any time during the progress of the work the surrounding air temperature is 40°F or less, or within 24 hours is expected to drop that low, the water, the aggregate or both should be heated so that the temperature of the concrete when placed is not less than 50°□F nor more than 70°□F.

5.4.3 Concrete shall not be placed when the outside temperature is below 32° F, unless the work is protected and heat is supplied to raise the ambient temperature to 50° F. During cold weather, the surface of freshly poured concrete shall be suitably protected to prevent the surface from dropping below 50□°F for a period of seven days for normal Portland cement concrete, and for a period of three days for high-early strength cement concrete.

5.4.4 In no event shall concrete be deposited on a frozen subgrade, nor shall frozen materials be used in the concrete. Salt, chemicals, or other foreign materials shall not be mixed with the concrete to prevent freezing or to accelerate its setting. Any concrete damaged by freezing shall be removed and replaced at the expense of the Contractor.

5.5 Hot Weather Requirements

5.5.1 Whenever the temperature of the surrounding air exceeds 85□°F, freshly poured concrete shall be protected to prevent rapid drying and to avoid high temperatures. The Contractor shall conform to the requirements of ACI 305R and ACI 318.

5.5.2 Newly placed concrete shall be maintained at a surface temperature not exceeding 75°F during the curing period.

5.5.3 Any concrete damaged by accelerated evaporation shall be removed and replaced at the expense of the Contractor.

5.5.4 When the ambient temperature exceeds 65°F, a retarding admixture, as specified in section 4.5 Admixtures, shall be added to the 5000-psi concrete mix.

5.6 Consolidation

Procedures for consolidation of concrete shall comply with the requirements of ACI 309R. Concrete shall be placed in layers not over 18 inches deep. Each layer shall be consolidated by mechanical internal-vibrating equipment supplemented by hand spading, rodding and tamping as required. Vibrators shall not be used to transport concrete inside forms. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing objectionable segregation. The vibrator shall not be inserted into lower courses that have begun to set.

5.7 Concrete Finishes

Immediately after removal of the forms all fines and loose material shall be removed; honeycombs, voids and holes over 1/2 inch in diameter shall be cut out to solid concrete, thoroughly wetted, brush-coated with neat cement grout, and filled with cement mortar composed of 1 part Portland cement to 2 parts fine aggregate. Mortar shall be finished flush and in the same plane as adjacent surfaces. Undersides of floor slabs and other exposed surfaces of concrete need not be rubbed free of form marks, unless otherwise designated on the drawings.

6.0 Right to Inspect and Identify All Concrete Work

Con Edison reserve the right to inspect and identify all concrete work at the mixing plant and job site, whether field-poured or precast concrete.

7.0 Design Changes Must Obtain Approval

If there are proposed changes to the design, such changes shall be submitted to

Construction Management and Distribution Engineering Tools and Structures Engineer for approval prior to fabrication / construction.

Revision 15 1) Section 3.4.2, adds ASTM C-151 Standard Specification for Sheet Materials for Curing Concrete 2) Section 3.4.4, removes CRS-Chemical Reporting System at https://intapps7.coned.com/crsv/webform1.aspx, and adds Chemical /SDS Search System at https://otis.osmanager4.com/conedison#/chemical	FILE Purchase and Test Manual No. 6, Section 7