

NORTH MARIN WATER DISTRICT

STANDARD SPECIFICATIONS

SECTION 03300 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes cast-in-place concrete for the following:

1. New Tank or Pump Station Foundations.
2. Equipment Pads
3. Thrust Blocks
4. Public Right-of-Way: sidewalk, curb and gutter

B. Related Sections (Capital Improvement Projects only):

1. Section 03100 – Concrete Formwork.
2. Section 03200 – Concrete Reinforcement.
3. Section 03600 – Grout

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Local Codes and Standards:

1. Uniform Construction Standards, All Cities and County of Marin, latest edition.
2. City of Novato Design and Construction Standards 2014, or latest version.

B. Commercial Standards:

ACI 301	Specifications for Structural Concrete.
ACI 305	Hot Weather Concreting.
ACI 318	Building Code Requirements for Structural Concrete.
ASTM C33	Standard Specification for Concrete Aggregates.
ASTM C94	Standard Specification for Ready-Mixed Concrete.
ASTM C150	Standard Specification for Portland Cement.
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete.

ASTM C494	Standard Specification for Chemical Admixtures for Concrete.
ASTM C595	Standard Specification for Blended Hydraulic Cements.
ASTM C1017	Standard Specification for Chemical Admixtures for use in Producing Flowing Concrete.
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
ASTM D994	Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
ASTM D1190	Standard Specification for Concrete Joint Sealer Hot-Applied Elastic Type.
ASTM E1643	Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
ASTM E1745	Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.03 SUBMITTALS

- A. Section 01300 – Submittals for Requirements for Submittal.
- B. **Mix Designs:** Prior to beginning the WORK, the CONTRACTOR shall submit to the DISTRICT ENGINEER, for review, preliminary concrete mix designs that show the proportions and gradations of all materials proposed for each class and type of concrete specified herein. Mix designs shall satisfy the requirements of ACI 318. The mix designs shall be certified by an independent testing laboratory acceptable to the DISTRICT ENGINEER and shall demonstrate compliance with ACI 318 that the average strength is sufficient to achieve the minimum strength specified. All costs related to such mix design shall be borne by the CONTRACTOR. This Specification sets the minimum requirements for mix design that meets all requirements specified herein.
- C. **Certified Delivery Tickets:** Where ready-mix concrete is used, the CONTRACTOR shall furnish certified weighmaster delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the public weighmaster's signature, and the total quantities by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant, as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

- D. When a water-reducing admixture is to be used, the CONTRACTOR shall furnish mix designs for concrete both with and without the admixture.

1.04 QUALITY ASSURANCE

- A. Unless otherwise specified, all formwork shall conform to ACI 347.
- B. The cost of all laboratory tests on cement, aggregates, and concrete will be borne by the DISTRICT. However, the CONTRACTOR shall be charged for the cost of any additional tests and investigation on WORK performed that does not meet the requirements of the Contract Documents.
- C. Concrete for testing shall be supplied by the CONTRACTOR at no additional cost to the DISTRICT, and the CONTRACTOR shall provide assistance to the DISTRICT ENGINEER in obtaining samples and disposing and cleaning up excess material. Concrete samples for slump, air content, and test cylinders will be taken at the placement (discharge) end of the line.
- D. Field Compression Tests:
 - 1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the DISTRICT ENGINEER to ensure continued compliance with the Contract Documents. Each set of test specimens will be a minimum of four (4) cylinders.
 - 2. Compression test specimens for concrete shall be made in accordance with ASTM C 31, Section 9.2. Specimens shall be 6-inch diameter by 12-inch high cylinders.
 - 3. Compression tests shall be performed in accordance with ASTM C 39. One (1) test cylinder will be tested at seven (7) days and two (2) test cylinders will be tested at twenty-eight (28) days. The remaining cylinder will be held to verify test results, if needed.
 - 4. For Thrust Blocks or equipment pads, the need for compressions test will be at the discretion of the District.
 - 5. For Public Right-of-Way work including sidewalk, curb and gutter, the need for compression testing shall be at the discretion of the DISTRICT or the agency with jurisdiction's encroachment permit requirements (City of Novato, County of Marin, or Caltrans).
- E. Evaluation and Acceptance of Concrete
 - 1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, Chapter 5, "Concrete Quality," and as specified herein.
 - 2. A statistical analysis of compression test results will be performed according to the requirements of ACI 214. The standard deviation of the test results shall not exceed 640 psi.

3. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.
4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any three (3) consecutive tests being below the specified compressive strength is 1 in 100. The required average strength shall be calculated by Criterion No. 3 of ACI 214 using the actual standard of deviation.
5. All concrete that fails to meet the ACI requirements and these Contract Documents is subject to removal and replacement at the expense of the CONTRACTOR.

PART 2- PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I Portland type.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.

2.02 ADMIXTURES

- A. Furnish materials in accordance with local standards.
- B. Air Entrainment: ASTM C260
- C. Chemical: ASTM C494 Type A – Water Reducing, Type B – Retarding
- D. Fly Ash: ASTM C618 Class F.

2.03 ACCESSORIES

Non-Shrink Grout: ASTM C1107, Grade A

2.04 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler: ASTM D1751.
- B. Expansion and Contraction Joint Devices: ASTM B221.

2.05 EPOXY ADHESIVES

- A. Epoxy adhesives for bonding freshly mixed, plastic concrete to hardened concrete shall be Sikadur 32 Hi-Mod Epoxy Adhesive, as manufactured by Sika Chemical Corporation; Concsive Liquid (LPL), as manufactured by Master

Builders; BurkEpoxy mV, as manufactured by the Burke Company, or approved equal.

2.06 ANCHOR ROD EPOXY ADHESIVE

- A. Epoxy adhesives for installing anchor rods in existing concrete shall be Sikadur AnchorFix-4 structural epoxy, as manufactured by Sika Chemical Corporation; or approved equal.

2.07 CONCRETE MIX

- A. Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C94.
- B. Select proportions for normal weight concrete in accordance with ACI 301 trial mixtures.
- C. Hand mixed concrete materials type and proportions shall be submitted and approved by the DISTRICT ENGINEER prior to application on site. The maximum slump shall be 4" to 6".

1. Packaged, dry, combined concrete products shall meet ASTM C387.
2. Use of Quikrete or Sakrete packaged products is acceptable.

D. Concrete by Use

1. Foundations and Equipment Pads: Provide concrete to the following criteria:

<u>Unit</u>	<u>Measurement</u>
Compressive Strength (28 day)	4,000 psi
Coarse Aggregate	ASTM C 33, #467 or #57
Fine Aggregate	ASTM C 33
Water/Cement Ratio (maximum)	0.45 by weight
Slump	4-in (plus or minus 1-inch)

2. Thrust Blocks: Provide concrete to the following criteria:

<u>Unit</u>	<u>Measurement</u>
Compressive Strength (28 day)	3,000 psi
Coarse Aggregate	ASTM C33, #57
Fine Aggregate	ASTM C 33
Water/Cement Ratio (maximum)	0.50 by weight
Slump	5-in (plus or minus 1-inch)

3. Sidewalks, Curb and Gutter (public right of way):

<u>Unit</u>	<u>Measurement</u>
Compressive Strength (28 day)	3,000 psi

Coarse Aggregate	1" max, Caltrans Section 90-2
Fine Aggregate	Caltrans Section 90-2
Colorant (City of Novato)	2 lbs/CY Lamp Black; 1 lbs/CY jet black*
<i>*not used on certain city streets</i>	

- D. Admixtures: Include admixture types and quantities indicated in concrete mix designs approved through submittal process.
1. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

PART 3- EXECUTION

3.01 EXAMINATION

- A. Verify requirements for concrete cover over reinforcement.
- B. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.02 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301, ACI 318.
- B. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.
- C. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 12-inches and seal watertight.
- D. Separate slabs on grade from vertical surfaces with ½-inch thick joint filler.
- E. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- F. Place concrete continuously between predetermined expansion, control, and construction joints.
- G. Saw cut joints within 12 hours after placing. Use 3/16-inch thick blade, cut into ¼- inch depth of slab thickness.
- H. Screed slabs on grade level, maintaining surface flatness of maximum ¼-inch in 10 feet.
- I. Follow City of Novato standards for transverse expansion joints, control joints and doweling into existing concrete.

3.03 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.04 FIELD QUALITY CONTROL

- A. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
- B. Three concrete test cylinders will be taken for every 200 or less cu yards of concrete placed.
- C. One slump test will be taken for every delivery truck of concrete.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.05 PATCHING

- A. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify DISTRICT ENGINEER upon discovery.
- B. Patch imperfections in accordance with ACI 301.

3.06 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or Construction of defective concrete will be determined by DISTRICT ENGINEER.
- C. Public Right-of-Way work: The Agency with Jurisdiction (encroachment permit issuer) may determine needed repair for any defective work.

END OF SECTION