

SECTION 500: PORTLAND CEMENT CONCRETE AND CONCRETE RELATED MATERIALS

500.1 DESCRIPTION

This work shall consist of producing and supplying Portland Cement Concrete and concrete related materials and the construction of concrete sidewalks, curb and gutter, valley gutters, curb ramps, footings for walls (all types), and other purposes as called for in the plans and specifications.

Before the first time any materials incorporated into the permanent work are utilized on the project, a Critical Activity Point (CAP) inspection will be performed. The Contractor will submit all material certifications and/or test results showing the material conforms to the contract requirements, and will identify the material storage locations and means of protecting the material from damage. Written approval from the City Engineer or designee will be required prior to the material being incorporated into the permanent work.

500.2 MATERIALS

500.2.1 Concrete Mix Designs

Before any concrete is placed, a NMDOT approved concrete mix design shall be submitted to the City Engineer or designee for written approval. An approved mix design may be used until the expiration date of the approved mix. Requests to extend this duration may be made to the City Engineer or designee and will be considered based on mix usage and performance, on a case by case basis.

The Contractor shall only use the materials listed on the approved mix design. The Contractor shall not substitute an approved material or material source listed on the approved mix design without written approval from the City Engineer or designee. Changes in an approved mix design cement source, admixture source or admixture dosage can be made without resubmittal of a revised mix design with approval from the City Engineer or designee. All other mix design changes will require resubmittal of a revised NMDOT approved concrete mix design.

If NMDOT does not have an approved mix design for the concrete required for certain mixes on the project, alternate concrete mixtures shall be designed in a Private Testing Laboratory (PTL) by a Professional Engineer registered in the State of New Mexico with a minimum of three (3) years of experience in testing, proportioning and designing of concrete mixes and who is directly responsible for all test results used for design purposes and submitted to the City Engineer or designee for approval. The laboratory mix design shall only be developed using the materials included in the project specific design.

Each concrete design mix shall be identified by a design mix number, unique to that design mix.

If the concrete mix does not perform as anticipated in the mix design, or either a change in materials or material suppliers from that specified in the approved mix design occurs during the project, use of the concrete mix design shall be cancelled by the City Engineer or designee.

The strength requirements for any mix design shall be based on the appropriate proportions of Portland cement, water, fine aggregate and coarse aggregate. All concrete placed within City right-of-

way, future City right-of-way (Development projects), or for any City project shall attain a minimum strength of 3,000 psi in twenty-eight (28) days, based on the average of at least two (2) cylinders, unless otherwise specified. This concrete shall have a slump of three to five (3-5) inches and may be reduced to one and one-half to 2 (1½ to 2) inches for slip form paving if prior authorization is given by the City Engineer or designee.

Concrete that fails to meet these requirements shall be subject to remedial action, including removal and replacement, at the sole discretion of the City Engineer or designee. If requested, the Contractor shall submit a Corrective Action Plan for the failing concrete incorporated into the work for approval by the City Engineer or designee.

The aggregate proportions shall produce a workable mix, with coarse aggregate used in the greatest amount consistent with the required workability. Field deviations from the design mix shall be made only with written approval of the City Engineer or designee.

All concrete shall have an air entrainment of three to six percent (3%-6%).

The maximum size of the aggregate shall not be larger than one-fifth (1/5) of the narrowest dimension between sides of the forms within which concrete is to be placed or larger than three-fourths (3/4) of the minimum clear spacing between reinforcing bars or between reinforcing bars and forms.

For unreinforced slabs, the maximum size aggregates shall not be larger than one-third (1/3) the slab thickness.

Certificates of compliance, mill reports, or laboratory test reports assuring compliance with these specifications shall be furnished by the Contractor before incorporating materials into the work.

500.2.1.1 Mix Design Submittals

The following, at a minimum, shall be included in the mix design submittal:

1. Mix design unique number (preferably NMDOT Material Lab SMB #);
2. Supplier name;
3. Production facility physical address, telephone number, and email address;
4. PTL's name;
5. The New Mexico registration number of the Professional Engineer who is responsible for the concrete mix design;
6. A comprehensive materials listing, including admixtures;
7. The properties of each component, including
 - a. Aggregate source names;
 - b. Aggregate source locations;
 - c. Aggregate testing results confirming they meet the specification requirements;
 - d. Aggregate non-ASR evidence (see 500.2.2 below);
 - e. Cement supplier name;
 - f. Cement source name;
 - g. Cement type;
 - h. Admixture type, supplier and dosage;
8. Concrete mixture properties;
9. Water/cement ratio;

10. Water source and location with passing test results;
11. Plastic Concrete Properties, including
 - a. Concrete temperature;
 - b. Desired slump;
 - c. Entrained air content;
 - d. Unit weight; and
12. Hardened Concrete Properties, including
 - a. Compressive strength tests (the average of three (3) cylinders tested at three (3) days, seven (7) days, fourteen (14) days, and twenty-eight (28) days.

500.2.2 Aggregates

The Contractor shall use aggregates that are the same as those used on the approved mix design. The Contractor shall not use aggregates from a different source from those used on the approved mix design.

The fine aggregate shall be in accordance with the requirements of ASTM C 33 and shall consist of clean and well-graded natural sand, manufactured sand, or a combination of both, and free of trash, debris, organics and any other deleterious materials.

The coarse aggregate shall conform to ASTM C 33, size number 57, one (1) inch to Number 4 sieve, unless clearance dimensions hereinafter govern or otherwise directed by the City Engineer or designee, and shall consist of clean crushed stone, crushed gravel, or natural washed gravel free of trash, debris, organics and any other deleterious materials.

The Contractor shall provide evidence that all aggregate sources are either considered non Alkali-Silica Reactive (ASR) by the New Mexico Department of Transportation Materials Bureau, or proof-of-potential-reactivity test results to show the proposed aggregates are non-ASR reactive.

If required, the Contractor shall furnish test certificates to the City Engineer or designee confirming that the aggregates meet all of the above requirements for fine and coarse aggregates as applicable to the design mix.

500.2.2.1 Stockpiles

The Contractor shall ensure the separation of stockpiles of different sizes or from different sources. The Contractor shall ensure that aggregates are not contaminated by material from adjacent stockpiles or from contact with the ground, dust, or other deleterious materials. The Contractor shall not use aggregates that become segregated or mixed with deleterious materials. The Contractor shall not use frozen lumps of aggregate in concrete batching.

The Contractor shall ensure that a front-end loader will not pick up non-complying materials from the bottoms of stockpiles that would contaminate the concrete mixtures.

500.2.3 Water

Water used in mixing mortar, grout, concrete, to cure, and to wash aggregate shall be clear, free from oil, salt, plant matter, or other deleterious materials. The water shall have a pH value greater than 4.5 but less than 8.5 as determined by AASHTO T 26.

Non-potable water sources shall be tested prior to use and shall not be used unless the requirements of ACI 318.3.4.3.2 are met. Residual water, wash water, or recycled water generated by equipment, mixer trucks, or central mixers shall not be used in concrete production.

The Contractor shall submit certifications to the City Engineer or designee prior to concrete placement showing the water meets the listed requirements.

500.2.4 Air-Entraining and Chemical Admixtures

The Contractor shall store admixtures in separate containers to avoid contamination, evaporation, and damage. The Contractor shall protect liquid admixtures from freezing and from damaging temperatures. For admixtures used as suspensions in non-stable solutions, the Contractor shall provide agitating equipment to ensure the thorough distribution of the ingredients.

All admixtures listed on the approved mix design shall be included in the concrete mixture; specific admixture proportions may be adjusted to meet project specific conditions or requirements. All admixtures added by hand and/or at the project site will be documented by the City on the batch tickets.

Air-entraining admixtures for Portland Cement Concrete shall conform to the requirements of ASTM C 260 as tested in accordance with ASTM C 233.

The Contractor shall submit certifications to the City Engineer or designee prior to concrete placement showing the admixtures meet the listed requirements.

500.2.4.1 Accelerating, Retarding, and Water-Reducing Admixtures

All admixtures, except air-entrainment agents, are prohibited unless included in an approved mix design:

- Water-reducing;
- Retarding;
- Accelerating;
- Water-reducing and retarding;
- Water-reducing and accelerating admixtures.

Any of the above, if used, shall conform to ASTM C 494.

Calcium chloride is prohibited as an admixture in any concrete mix for all projects within the City of Rio Rancho. Before approval of any admixture, the Contractor shall submit a mix design demonstrating that the admixture is compatible with local materials and will accomplish the desired result.

500.2.5 Ready Mixed Concrete

Ready mixed concrete shall be mixed and delivered in accordance with the requirements set forth in ASTM C 94 Alternate 2, except that a copy of all certificates and statements required by ASTM C 94 shall be provided to the City Engineer or designee by the Contractor. When ready mixed concrete is used, and unless otherwise specified, the supplier shall be required to provide concrete based on the following furnished information:

1. Minimum cement content in bags per cubic yards of concrete or equivalent units.
2. Surface-dry weights of fine and coarse aggregate.
3. Designated size, or sizes, of coarse aggregate.
4. Minimum strength requirements at twenty-eight (28) days in psi.
5. Slump desired at the point of delivery.
6. When air-entraining concrete is required, air-entrainment shall be three to six percent (3% to 6%) from samples taken from the transportation unit at the point of discharge.
7. The type of admixture, if used, other than air-entrainment, and the amount of admixture to be added per cubic yard of concrete mix.

500.2.6 Steel Reinforcement

1. General – Unless otherwise indicated in the plans and/or by a special provision(s) within the specifications, all steel reinforcing used in Portland Cement Concrete shall conform to the following ASTM Standards:

<u>Item</u>	<u>ASTM Designation</u>	<u>ASTM Title</u>
Steel Bars – deformed, minimum intermediate grade	A 615	Billet Steel or Axel Steel for Concrete Reinforcement of Structural Grade
	A 615 Grade 40	Deformed Bars of Intermediate grade with 40,000 psi min. Yield Strength
	A 615 Grade 75	High-Strength Billet Steel Bars for Concrete Reinforcement with 75,000 psi min. Yield Strength
	A 615 Grade 60	Deformed Billet Steel Bars for Concrete Reinforcement with 60,000 psi min. Yield Strength
	A 615	Minimum Requirements for the Deformation of Deformed Steel Bars for Concrete Reinforcement
Wire Mesh Reinforcement	A 185	Welded Steel Wire Fabric for Concrete Reinforcement

Support chairs for reinforcement may be metal or plastic.

2. Shop Drawings – If steel reinforcing details are not detailed in the plans, the Contractor shall submit four (4) copies of shop drawings for reinforcing steel stamped by a New Mexico Professional Engineer to the City Engineer or designee for approval before placement.

The Contractor shall submit certifications to the City Engineer or designee prior to placement showing the steel reinforcing meets the requirements listed above.

500.2.7 Welded Wire Fabric

Welded wire fabric shall be of the size and type as shown in the plans and shall conform to the requirements ASTM A 185.

The Contractor shall submit certifications to the City Engineer or designee prior to placement showing the welded wire fabric meets the listed requirements.

500.2.8 Joint Sealing Materials

See City of Rio Rancho Standard Drawings for joint sealing and joint sealant requirements for the type of work.

500.2.9 Curing Materials

1. Water used for curing concrete shall conform to the requirements hereinbefore stated in these Specifications for Portland Cement Concrete.
2. Waterproof paper used for curing concrete shall conform to ASTM C 171.
3. Liquid membrane compound used for curing concrete shall conform to ASTM C 309.
4. White polyethylene sheeting shall meet the requirements of AASHTO M 171.

The Contractor shall submit certifications to the City Engineer or designee prior to application showing the curing materials meet the above listed requirements.

500.2.10 Forms

1. The form material shall be able to conform to the shape, lines, and dimensions of the member as called for in the plans and able to maintain this conformance until the concrete hardens sufficiently to permit the removal of the forms. All forms used for exposed surfaces shall be clean, smooth, free of loose knots, dents, wrinkles, bends, warpage, protruding surfaces (all rivet heads, bolt and screw heads on metal forms contacting the concrete surface shall be counter sunk), and all other imperfections which will mar the smoothness required and/or continuity of alignment of the exposed concrete surface(s).
2. The Contractor shall apply form oil to prevent the forms from adhering to the concrete and shall be an approved clean and colorless mineral oil which will not discolor or otherwise injure the concrete surfaces. Form oil shall be applied before reinforcing steel is placed. Hazardous substances shall not be used (e.g. fuel oil, petroleum products, etc.)
3. Form ties shall be metal ties or anchorage within the forms. These shall be constructed to permit removal to depth of not less than one-half inch (1/2) inch from the face of the concrete without injury to the concrete. All fittings for metal ties shall be designed so that when removed the cavities resulting from such removal will be small. All cavities shall be filled in with a method approved the City Engineer or designee.

500.3 CONSTRUCTION REQUIREMENTS

500.3.1 General

See Section 505 Concrete Placement and Finishing for construction requirements.

500.4 METHOD OF MEASUREMENT

No measurement shall be made the production of concrete materials, unless otherwise specified in the plans or specifications. Reinforcing steel will be measured as specified in the plans.

500.5 BASIS OF PAYMENT

Payment for production of concrete or concrete materials will be in accordance with Section 505 Concrete Placement and Finishing for the item for which the concrete is used. No separate payment will be made for the materials utilized in placing the concrete, including welded wire mesh, joint sealant, curing or form materials, or for the materials required for filling cavities created by form tie removals.

Payment for steel reinforcement will be as indicated in the plans or specifications and shall include all costs of furnishing and installing the steel reinforcing, including the submittal of shop drawings, if required.