



LISBON CHANNEL ARKANSAS CHANNEL TO SUGAR CHANNEL

BID & CONTRACT DOCUMENTS

VOLUME 2 of 2: PROJECT SPECIFICATIONS

Southern Sandoval County Arroyo Flood Control
Authority

IFB # 2026-01

SSCAFCA PROJECT NUMBER: BL_P0036-03

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Southern Sandoval County Arroyo Flood Control Authority

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The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal as a professional engineer licensed to practice in the state of New Mexico, is affixed below:

The seal is circular with the text "JAMES E. LOPEZ" at the top, "NEW MEXICO" in the center, and "LICENSED PROFESSIONAL ENGINEER" at the bottom. The license number "24897" is in the middle. A signature is written across the seal.

10/01/2026

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SSCAFCA SPECIFICATIONS

TECHNICAL SPECIFICATION 1510

EXCAVATION, OVER-EXCAVATION, BORROW, AND FILL

Revised 08/20/2025

1510.1 GENERAL

- 1510.1.1 Excavation, over-excavation, borrow, and fill shall consist of all earthwork operations involved in grading and construction in accordance with the plans and specifications, except for: Excavation and backfill for structures, Excavation and backfill for trenching, and any other earthwork operations separately designated.

1510.2 REFERENCES

This section incorporates the following publications by reference:

- | | |
|---------------|-----------------------|
| • ASTM D-1557 | This publication: |
| • ASTM D-422 | • NM APWA Section 201 |
| • ASTM D-4318 | • SSCAFCA 1513 |
| • ASTM D-6938 | • SSCAFCA 1514 |

1510.3 MATERIAL CLASSIFICATIONS

1510.3.1 UNSUITABLE MATERIAL

Unsuitable materials shall include all material that contains debris, roots, organic matter, stones or boulders too large to be used in the intended construction, or other materials that are determined by the Engineer to be unsuitable. Otherwise suitable materials, which are unsuitable due to excess moisture content, will not be classified as unsuitable material unless it cannot be dried by manipulation, aeration or blending with other materials satisfactorily as determined by the Engineer.

Material that is unsuitable for the intended use shall be excavated and removed from the site or otherwise disposed of as approved by the Engineer. Unsuitable material shall be disposed of in accordance with environmental requirements and as approved by the Project Manager.

1510.3.2 FILL MATERIAL

All fill material shall be free of vegetation and debris. Clods or hard lumps of earth of 6 inches in greatest dimension shall be broken up. Fill materials shall be free of vegetation and debris and contain no rocks larger than 3 inches. All fill and backfill material, including selection and blending of material, shall be subject to approval by the Engineer. All fill material shall conform to the requirements for Structural Fill as outlined below.

1510.3.3 STRUCTURAL FILL AND BACKFILL

Structural fill and backfill shall consist of material excavated from on-site or Borrow Material that meets the requirements described in this section. The blended excavated site soils from within the area will be generally suitable for use as structural fill. Blending of soils shall be considered incidental to the Work and no separate payment will be made for this effort. Gradation of the fill material, as determined in accordance with ASTM D-422, shall be as follows:

Sieve Size (Square Openings)	Percent Passing (by Weight)
3 inch	100
No. 4	60-100
No. 200	5-40

All structural fill shall be blended as necessary to produce a homogeneous material. The plasticity index of the structural fill shall be no greater than 15 when tested in accordance with ASTM D-4318.

1510.3.4 BORROW MATERIAL

Borrow material is defined as material obtained from an approved borrow source to be used as structural fill material for construction. If borrow material is required, the Contractor shall identify a borrow site and obtain soils tests to verify compliance of the material with structural fill requirements per this specification. The Contractor shall not import any borrow material prior to verification that material meets the requirements contained herein and he has received approval to import the material by the Owner.

1510.3.5 SURPLUS MATERIAL

The Contractor shall make all arrangements for disposal of surplus material in accordance with environmental requirements and as approved by the Project Manager. If the material is disposed of on-site, the Contractor shall place material in locations as designated by the Owner. Do not remove materials from the project limits without the approval of the Owner. The Contractor shall satisfy themselves that there is sufficient material available for the completion all items requiring fill material before disposing of any indicated surplus material inside or outside of the project area. Any shortage of material caused by premature disposal of surplus material by the Contractor shall be replaced by the Contractor and no payment will be made for such replacement.

1510.4 CONSTRUCTION REQUIREMENTS

1510.4.1 GENERAL

Contractor shall perform necessary clearing, grubbing and stripping in accordance with [Section 201](#) of the Specifications and [Supplemental Technical Specification 201](#), "Clearing and Grubbing", prior to any excavation, grading, or other earthwork operations. Excavation, fill construction and backfill shall be finished to reasonably smooth and uniform surfaces.

All slopes and cuts should be made in accordance with CFR 29 Part 1926 Subpart P, and all other applicable regulations.

1510.4.2 EXCAVATION

Excavation shall consist of the removal of earth involved in grading and construction according to the plans, except other excavations separately designated.

Temporary construction excavations shall be made in accordance with CFR 29 Part 1926 Subpart P, and all other applicable regulations. Surface water shall be routed such that it does not flow down the face of the excavation slopes. Where insufficient space exists for open cut excavations, a shoring system will be required. All required shoring systems shall be considered incidental to the cost of excavation and no additional payment will be made for this item. All excavations shall comply with all applicable safety regulations.

1510.4.3 OVER-EXCAVATION

Over-excavation shall consist of removal and replacement (backfill) of earth to the limits and depths provided in the plans. Backfill of over-excavated areas shall be in accordance with 1510.3.2.

1510.4.4 FILL CONSTRUCTION

Fill construction shall consist of constructing embankments, the placing and compacting of approved material within areas where unsuitable material has been removed; and the placing and compacting of suitable materials in holes, pits, and other depressions.

1510.4.5 PLACING AND COMPACTING

Fill or backfill, consisting of soil approved by the Engineer and/or recommended in the project's Geotechnical Report, should be placed in controlled compacted layers not exceeding 8 inches (compacted) with approved compaction equipment. All fill material should be blended as necessary to produce a homogeneous fill.

The fill should be raised uniformly and should be benched into the native soils. All compaction should be accomplished to a minimum of 95 percent of maximum dry density. No lifts of high permeability material or material differing substantially from the lift below shall be permitted.

At locations where it would be impractical to use mobile power compacting equipment, fill layers shall be compacted to the specified requirements by any approved method that will obtain the specified compaction.

1510.5 TESTING

- 1510.5.1 Tests for degree of compaction should be determined in accordance with ASTM D-1556 or ASTM D-6938.
- 1510.5.2 A compaction test is required on every lift or every 500 SY, whichever is less.
- 1510.5.3 Continuous, full time observation and field tests should be conducted during fill and backfill placement by a representative of the Engineer to assist the contractor in evaluating the required degree of compaction. If less than the required compaction is obtained, additional compaction effort should be made with adjustment of the moisture content as necessary until 95 percent compaction is obtained.

1510.6 MEASUREMENT AND PAYMENT

1510.6.1 UNSUITABLE MATERIAL

The removal and disposal of unsuitable material will be paid for as “[Excavation, Removal, and Disposal of Unsuitable Material](#)” for the quantities involved. This item will be created via Change Order, if the situation arises.

1510.6.2 EXCAVATION

Payment will be made on the unit price per cubic yard for “[Unclassified Excavation](#)” as provided in the Unit Price Bid Proposal. Payment will include the cost for all excavation, removal, storage and disposal of unsuitable material, hauling of surplus material to the designated location(s), hauling of select material within the construction site, placement, and compaction.

No payment will be made for excavation of stockpiled materials, structural excavation of previously placed materials and over depth (over-excavation) cuts. No payment will be made for shrink or swell. Excavation beyond the limits shown in the plans will not be included in measurement or payment.

1510.6.3 OVER-EXCAVATION

Payment will be made on the unit price per cubic yard for “[Over-Excavation](#)” as provided in the Unit Price Bid Proposal. Payment will include the cost for all excavation, removal, storage and disposal of unsuitable material, hauling of select material within the construction site, placement, and compaction.

No payment will be made for excavation of stockpiled materials. No payment will be made for shrink or swell. Excavation beyond the authorized over-excavation limits shown in the plans will not be included in measurement or payment.

1510.6.4 BORROW

Borrow material will be measured by the cubic yard in-place after compaction. Field topographic surveys, as described in [SSCAFCA Technical Specification 1513 or 1514 "Construction Staking"](#), will be used to determine in-place quantities.

Payment will be made on the unit price per cubic yard for ["Borrow"](#) as provided in the Unit Price Bid Proposal. Payment will include excavation & haul from Borrow Area, moisture conditioning, required blending of soils, placement, compaction, and other related work.

END OF SECTION

TECHNICAL SPECIFICATION 1511

NPDES COMPLIANCE

Revised 01/07/2026

1511.1 SCOPE OF WORK

The work under this section includes compliance with the U.S. Environmental Protection Agency (EPA), National Pollutant Discharge Elimination System (NPDES) Regulations for Storm Water Discharges from construction sites. This work consists of implementing and maintaining a plan to control erosion, pollution, sediment and runoff during the construction of the project.

1511.2 MEASUREMENT AND PAYMENT

1511.2.1 UNIT PRICE BID PROPOSALS

For Unit Price Bid Proposals, NPDES Compliance shall be a Lump Sum (LS) item, paid for as follows:

1511.2.1.1 Fifteen (15) percent of the Lump Sum unit price amount shall be paid after the Contractor has completed an EPA Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity Under a NPDES General Permit, Form 3510-9, or a Low Erosivity Waiver (LEW) form, if applicable. A copy of the NOI or LEW form must be delivered to the Owner and the original filed with the EPA. All required erosion control measures sufficient to begin construction must also be in place. This will be defined in the plan specifications and/or the SWPPP.

1511.2.1.2 Payment for an additional sixty percent (60%) of the Lump Sum unit price amount shall be prorated based on the Actual Percent Complete on the Application for Payment as approved by the Architect, Engineer or Landscape Architect. For example, if the Contractor is 20% complete, the contractor can take the 20% (0.2) and multiply it by 60% (0.6) of the Lump Sum unit price amount and receive that portion.

In order to receive payments, the field inspection forms must be sent in with the Application for Payment each month. If there are deficiencies maintaining or implementing the SWPPP and its Best Management Practices (BMPs), the payment will be withheld until the deficiencies are corrected.

1511.2.1.3 The remaining twenty-five (25) percent of the Lump Sum unit price amount will be based on the completion of an EPA Notice of Termination (NOT) of Coverage Under a NPDES General Permit for Storm Water Discharges Associated with Construction Activity and BMP removal. A copy of the NOT must be delivered to the Owner and the original filed with the EPA. BMPs must be removed as defined in the plan specifications or SWPPP. This is done in case there are some BMPs that must remain until final stabilization is met, and that there are no more NPDES concerns for the Contractor.

END OF SECTION

TECHNICAL SPECIFICATION 1512

CONTROL OF STORM WATER AND NUISANCE FLOW

Revised 08/19/2025

1512.1 DESCRIPTION

This specification covers the requirements to control storm water and nuisance flows through the project area during construction.

Two (2) types of flow can be expected;

- 1) Continuous or intermittent flow through existing flow paths;
- 2) Local sheet flow from adjacent properties or adjacent streets.

1512.2 CONSTRUCTION REQUIREMENTS

All permanent work shall be performed in areas free from storm water and/or nuisance flows.

The CONTRACTOR shall construct and maintain diversion methods necessary to divert storm water and/or nuisance flows away from work areas, or otherwise ensure work is not damaged from storm water or nuisance flows. Diversion methods may include the use of sandbag and/or diversion channels, sandbag and/or earthen berms, pumping and/or piping around, over, or through work areas, or any method or combination of methods required to control storm water and/or nuisance flows within the project area.

The CONTRACTOR shall furnish, install, maintain, and operate all necessary pumping and other dewatering equipment required for dewatering the affected work areas. This effort shall also include removal of ice and/or snow within the work area, if applicable. The cost of dewatering work, including labor, shall be included in the lump sum price for this bid item.

The CONTRACTOR shall be responsible for removal of any sediment deposited by storm and nuisance water. The cost of sediment removal work shall be included in the lump sum price for this bid item.

If the CONTRACTOR's diversion methods are unsuccessful, at no additional cost to SSCAFCA, the CONTRACTOR will be responsible for providing a plan [within two working days](#) to repair all damage, including damage to the existing arroyo and/or flood control facility and damage to new work within the project area. The plan shall be acceptable to SSCAFCA. The cost of implementing this plan shall be included in the lump sum price for this bid item.

1512.3 BASIS OF PAYMENT

Control of Storm Water and Nuisance Flow will be measured on a Lump Sum (LS) basis and payment of this item will be made as a percentage of the dollar amount of work completed to date, minus the Mobilization bid item.

<u>Pay Item</u>	<u>Pay Unit</u>
Control of Storm Water and Nuisance Flow	LS

END OF SECTION

TECHNICAL SPECIFICATION 1513

CONSTRUCTION SURVEY & STAKING

Revised 08/20/2025

1513.1 DESCRIPTION

This work consists of construction survey and construction staking lines, grades, and layouts by the CONTRACTOR in accordance with the plans and specifications and as directed by the ENGINEER for the control and completion of the project.

1513.2 MATERIALS

CONTRACTOR shall furnish all stakes, templates, straightedges, surveying equipment and other devices necessary for establishing, checking, marking, and maintaining points, including P.I.'s, P.C.'s, P.T.'s, and lines, grades and layouts. As directed by the OWNER and/or ENGINEER, points shall be referenced so that they may later be re-established.

1513.3 CONSTRUCTION REQUIREMENTS

CONTRACTOR shall be responsible for all control, slope stakes, cut stakes, offset stakes, benchmarks, blue tops or other staking necessary for proper execution of the work, or as requested by the OWNER and/or ENGINEER, to assure compliance with the plans. [The OWNER and/or ENGINEER may request additional survey information at their discretion.](#)

1513.4 CONSTRUCTION SURVEYS

CONTRACTOR shall obtain and pay for the services of a Professional Surveyor licensed in the State of New Mexico to perform surveys consisting of the following phases:

- 1513.4.1 Phase 1 EG Survey: A topographic survey, with a contour resolution of 1-foot or less, to accurately reflect the Project Site [existing ground \(EG\)](#) elevations. Unless otherwise directed by the OWNER and/or ENGINEER, Phase 1 Survey shall **not** occur before Clear & Grub and Removals bid items are completed. Phase 1 Survey shall include Borrow Area, if applicable.

Phase 1 Survey shall include development of an EG digital terrain model (DTM) of the Project Site, which will be used to determine earthwork quantities to be paid to CONTRACTOR. The Phase 1 Survey DTM shall be submitted to the ENGINEER for [review and written acceptance](#) prior to proceeding with any earthwork.

- 1513.4.2 Phase 2 FG Survey: An as-built topographic survey, with a contour resolution of 1-foot or less, to accurately reflect the Project Site [finished ground \(FG\)](#) elevations and to determine final earthwork quantities to be paid to CONTRACTOR. Phase 2 Survey shall include Borrow Area, if applicable.

Phase 2 survey shall have sufficient detail to demonstrate compliance with the design grades, structure elevations, inverts, alignments/profiles, etc. shown on the construction plans. It is the responsibility of the CONTRACTOR to coordinate with the surveyor on a regular basis to provide as-built information to incorporate in the Phase 2 survey, especially for project elements that will be buried in the FG condition.

Phase 2 survey shall be stamped, signed, and certified by a Licensed Professional Surveyor and provided in pdf format.

Phase 2 Survey also includes development of an FG DTM of the Project Site. The Phase 2 Survey DTM shall be submitted to the ENGINEER for review and written acceptance prior to final Pay Application. Earthwork volumes shall not include surfacing treatments such as rock, riprap, concrete, etc. Earthwork volume computations shall be performed by the surveyor based on the "average end area" computation.

Phase 2 Survey shall be such that methods and computations can be fully verified and are subject to approval by the OWNER and/or ENGINEER. The OWNER and/or ENGINEER may request additional survey information at their discretion.

1513.5 METHOD OF MEASUREMENT

Submit a construction-staking schedule of values as part of each Pay Application to the Project Manager for approval.

1513.6 BASIS OF PAYMENT

SSCAFCA will make partial payments in accordance with the approved construction-staking schedule of values.

<u>Pay Item</u>	<u>Pay Unit</u>
Construction Staking	Lump Sum

END OF SECTION

TECHNICAL SPECIFICATION 1515

REMOVAL OF STRUCTURES & OBSTRUCTIONS

Revised 01/07/2026

1515.1 DESCRIPTION

This work shall consist of removing and disposing of surface and subsurface features to clear the project site for construction. This includes concrete debris, fences, structures, pavements, curb and gutter, sidewalks, buried pipes, and any other items listed within the construction plans. All removal and salvage features included in these items will be designated in the contract.

1515.2 MATERIALS

Suitable materials are those materials which can be compacted to the required embankment densities and meet all other contract requirements for embankment materials. If applicable, the project Geotechnical Report would include this information.

1515.3 CONSTRUCTION REQUIREMENTS

1515.3.1 SUITABLE MATERIALS

Suitable materials are those materials which can be compacted to the required embankment densities and meet all other contract requirements for embankment materials. If applicable, the project Geotechnical Report would include this information.

1515.3.1.1 Marking of Removal Limits

Prior to work on the site, the Contractor shall establish the right-of-way lines and construction limits confining the removal operations and will designate those surface and subsurface features for removal and those for preservation. The Owner or designee shall be offered the opportunity to review the removal limits before work commences.

1515.3.1.2 Temporary Erosion Control

Ensure all erosion control requirements and all necessary temporary sediment and erosion control protection devices (TESCP), if called for in the contract, are installed prior to initiating removal operations on the construction site. The TESCP items will be paid for under the SWPPP pay item.

1515.3.1.3 Protection of Site Features

The Contractor shall preserve and protect all existing improvements, adjacent property, utilities, and surface or subsurface features not to be removed from injury or damage resulting from their operations. This may require the Contractor to install temporary signing, temporary fencing, or other temporary features at their cost. Should any damage occur to these site features due to the Contractor's operations, the Owner or designee may withhold payment until the damage is remediated or require the damaged items to be replaced at the Contractor's expense.

1515.3.2 REMOVAL AND SALVAGE OPERATIONS

Remove all surface features and subsurface features designated for removal in the contract and dispose of them at a properly permitted disposal site. Provide the Owner or designee with a copy of the written permission from the property owner and copies of any other necessary disposal permits or approvals.

Carefully remove and salvage all surface features and subsurface features designated for salvage in the contract and store and deliver these materials in accordance with the contract requirements. The Contractor shall repair any damage to salvageable items that occurs during their removal, storage, or delivery operations at no cost to the Owner.

Backfill holes created by structure or obstruction removals as per SSCAFCA Standard Specification 1510 with suitable materials, unless the area is within the area of new construction.

1515.3.2.1 Removal of Pavements, Sidewalks, Curb and Gutter

Pavements, sidewalks, and curb and gutter shall be removed to neat saw cut lines as identified in the Contract, and dispose of them off the project site.

1515.3.2.2 Removal of Culverts and Drainage Structures

The Contractor shall sequence the removal of existing culverts and drainage structures so drainage is maintained on the project. This may require installation of temporary drainage features at Contractor's sole cost.

1515.3.2.3 Removal of Sanitary Sewer and Water Utilities

The Contractor shall sequence the removal of existing sanitary sewer and water utilities to minimize the impacts to local businesses and residents. The sequencing of removals shall be coordinated with SSCAFCA prior to performing removal operations in the field.

1515.3.2.4 Removal of Bridges and Arroyo Features

If the Contract includes the removal of a bridge or feature in an arroyo, remove the existing structures down to the arroyo bottom elevation OR an elevation sufficient to allow for proposed grading, proposed over-excavation, or proposed installation of infrastructure, as shown in the Contract documents.

Remove existing structures outside the arroyo to one (1) foot below ground surface, unless otherwise directed in the Contract.

1515.3.2.5 Removal and/or Salvage of Fencing

If the contract includes removal of fencing materials, remove all fence materials, including posts and post foundations and backfill holes with suitable materials.

If the Contract includes salvaging of fencing materials, place barbed wire into single-strand rolls and minimize the damage to fence posts when pulling them.

1515.3.2.6 Hauling and Stockpiling Salvageable Material

If the Contract requires the Contractor to haul and stockpile salvageable material, load, haul, unload, and stockpile the materials in accordance with the Contract.

Place the salvageable material on blocks or other approved materials and maintain the stockpile area, as directed by the Owner or designee.

1515.3.2.7 Site Appearance

The site shall have a neat and finished appearance when removal operations are finished, except for areas where construction activities are planned.

1515.3.2.8 Disposal

Dispose of all removal items outside the project at a permitted location. If applicable, a disposal plan, including written permission from private property owners used for debris material disposal, shall be submitted to the Owner or designee prior to commencement of disposal activities.

1515.3.2.9 Burying

No burying of any removed debris will be allowed on the project site.

1515.3.2.10 Burning

No burning of any removed debris will be allowed on the project site. In addition, no accumulation of combustible materials shall be stored on the project site near property lines or areas where an unexpected fire could cause damage to existing site features.

1515.4 METHOD OF MEASUREMENT

No measurement will be made for lump sum removal of structures and obstructions.

No measurement of the removal of surfacing will be made if the lump sum basis of payment is used.

Removal of surfacing will be made by the Square Yard if Square Yard basis of payment is used.

1515.5 BASIS OF PAYMENT

<u>Pay Item</u>	<u>Pay Unit</u>
Surfacing	Square Yard

Additional payment for minor removals not specified in the Contract shall not be made.

Unknown buried features not identified in the Contract are not included in this item.

Payments shall be made based on percentage of the pay item completed at the date of monthly Pay Application submittal.

END OF SECTION

APWA SPECIFICATIONS

SECTION 109

RIPRAP STONE

109.1 GENERAL

The riprap stone provided and installed under this specification shall be angular rock, stone or recycled Portland cement concrete complying with the requirements of this specification. The material shall be certified to comply with the specification in accordance with the requirements of Section 13. If a change in material and/or source from that authorized occurs during a project, the CONTRACTOR shall resubmit to include the changed material and/or source for authorization by the ENGINEER. A riprap material shall not be used on a project without written authorization of the ENGINEER.

109.2 REFERENCES

109.2.1 ASTM:

C88
C127

109.2.2 AASHTO:

T103

109.2.3 This Publication

603
610

109.3 MATERIAL

109.3.1 Riprap stone shall be stone, rock or recycled Portland cement concrete complying with this specification. The material shall be free of seams, fractures and coatings and of such characteristics that it will not disintegrate when subject to the action of flowing water.

109.3.2 The minimum specific gravity of the stone shall be 2.65 for sizes and gradation specified in TABLE 209.A, as determined in accordance with ASTM C127, latest edition. If the specific gravity of a stone is less than 2.65, the minimum size of the stone and the depth of the riprap shall be increased in accordance with TABLE 109.8.

109.3.3 The maximum resistance to abrasion shall be fifty (50) percent determined in accordance with the requirements of ASTM C535.

109.3.4 The maximum soundness loss shall be twenty (20) percent determined in accordance with ASTM C88.

109.3.5 The maximum loss to freeze thaw shall be ten (10) percent for 12 cycles determined in accordance with the AASHTO T103, Ledge R, Procedure A.

109.4 SHAPE AND GRADATION

109.4.1 Riprap material shall be rectangular in shape rectangular in shape having maximum to minimum dimension ratio not more than 3:1.

109.4.2 Riprap stone shall comply with the gradation requirements of TABLES 109.A and A 109.B.

109.4.3 Waste Portland cement concrete complying with the requirements of this specification may be used as riprap as specified in the plans and specification, as directed by the ENGINEER.

109.5 PLACEMENT

109.5.1 The placement of riprap stone shall be to the line and grade shown on the plans or as authorized by the ENGINEER. The depth of the riprap shown on the plans shall be adjusted based on Table 109.B for the specific gravity of the material provided. The surface tolerances shall be within the maximum variations shown in Table 109.C.

109.6 MEASUREMENT AND PAYMENT

109.6.1 Riprap shall be measured by the cubic yard (cy) placed to the lines and grades in the plans and specifications complete in place.

109.6.2 Payment for riprap will be made at the contract unit price per cubic yard for the type of riprap required, which payment shall include all material, labor and equipment required in placing riprap stone as specified in Section 603 and/or 610.

TABLE 109.A
CLASSIFICATION GRADATION

DESIGNATION	MAX. DIMENSIONS inches (m)	% SMALLER	Km [1]
A. GABIONS			
TYPE VL	12 (0.30) 9 (0.25) 50-70 6 (0.15) 35-55 3 (0.08) 10	100	6
TYPE L	18 (0.45) 12 (0.30) 6 (0.15) 30-55 3 (0.08) 10	100 50-70	9
B. RIPRAP			
TYPE M	24 (0.60) 18 (0.45) 12 (0.30) 6 (0.15)	100 50-70 30-55 10	12
TYPE H	36 (0.90) 24 (0.60) 12 (0.30)	100 50-70 30-55	18
TYPE VH	48 (1.20) 36 (0.90) 18 (0.45) 9 (0.23)	100 50-70 30-55 10	24

[1] Km = mean particle size

TABLE 109.B
SPECIFIC GRAVITY MULTIPLIER

SPECIFIC GRAVITY	MULTIPLIER
2.65	1.00
2.65	1.05
2.50	1.15
2.40	1.25
2.30	1.35
<2.30	REJECT

TABLE 109.C
CONSTRUCTION TOLERANCES

RIPRAP DESIGNATION	MAXIMUM VARIATION FROM SPECIFIED FINISH GRADE inches (meters)
TYPE VL +/-	3 (0.08)
TYPE L	6 (0.15)
TYPE M	9 (0.25)
TYPE H	12 (0.30)
TYPE VH +/-	12 (0.30)

SECTION 123

REINFORCED CONCRETE PIPE

123.1 GENERAL

123.1.1 These specifications cover reinforced concrete pipe intended to be used for the construction of storm drains, sewers, and related structures.

123.1.2 The size and class of the concrete pipe to be furnished shall be as shown on the plans or as specified under the item of work for the project of which the pipe is a part.

123.1.3 Unless otherwise specified, pipe will shall be either cast, spun, or manufactured by an approved equal method.

123.1.4 The interior surface shall be smooth and well finished. Joints shall be of such type and design and so constructed as to be adequate for the purpose intended so that, when laid, the pipe will form a continuous conduit with smooth and uniform interior surface.

123.1.5 Bell and spigot shall be free from any deleterious substance or condition which might prevent a satisfactory seal at the joints.

123.1.6 Pipe stronger than that specified may be furnished at the manufacturer's option and at his own expense, provided such pipe conforms in all other respects to the applicable provisions of these specifications.

123.1.7 Reinforced concrete pipe utilized for sanitary sewers shall be fully lined with no longitudinal seams in accordance with Section 122.

123.2 REFERENCES

123.2.1 ASTM:

C-33	C-76
C-150	C-260
C-361	C-441
C-443	C-494
C-618	

123.2.2 American Concrete Pipe Association (ACPA)

Concrete Pipe Design Manual

123.2.3 This Publication

Section 102

Section 122

123.3 PIPE LINE LAYOUTS

123.3.1 When specials and radius pipe and/or fittings are required, the required number of sets of the pipe line layout be furnished to the ENGINEER prior to the manufacture of the concrete pipe. Storm inlet or inlet connector pipe need not be included in the pipe line layout; however, pipe stubs shall be included. In lieu of including storm inlet connector pipe line layout, a list of storm inlet connector pipes shall accompany the layout. The connector pipe list shall contain the following information:

123.3.1.1 Size, class, and wall type.

123.3.1.2 Station at which pipe joins main line.

123.3.1.3 Number of sections of pipe, length or section, type of sections (straight, horizontal bevel, vertical bevel, etc.).

123.4 MATERIALS

123.4.1 Reinforced Concrete Pipe shall consist of a mixture of Portland cement, aggregates, water and admixtures, proportioned and manufactured accordance with the requirements of ASTM C76, latest edition, and this specification. The pipe shall be certified in accordance with the requirements of Section 13 of these specifications. Certification of compliance shall be submitted by the CONTRACTOR and approved by the ENGINEER prior to manufacture of the Reinforced Concrete Pipe, Reinforced Concrete Pipe shall not be

used on a project without written approval of the ENGINEER.

123.4.2 Portland cement shall comply either with the requirements of ASTM C 150. Types I, II, III, and V, Low Alkali (LA) cements, or as specified herein. in the Supplementary Technical Specifications, plans, or as approved by the ENGINEER. The CONTRACTOR shall submit certification of compliance signed by the cement manufacturer, identifying the cement type and source (plant location), stating the portland cement used in the Reinforced Concrete Pipe delivered to the project complies with this specification. Portland cement concrete used in the manufacture of Reinforced Concrete Pipe shall have a minimum cementitious content of 470 lbs./cu.yd.. except as either specified herein, as specified in the Supplemental Technical Specifications, or as approved by the ENGINEER. Portland cement shall be of the same source and type for all Reinforced Concrete Pipe delivered to a project.

123.4.2.1 Portland cement concrete for Reinforced Concrete Pipe shall be proportioned to provide a minimum cementitious content of 470 lbs./c.y. (5 sks/c.y.) and a maximum water (W) to cementitious material ratio by weight, $W:(C+TA)=0.40$. Cementitious material shall consist of portland cement and class F fly ash complying with this specification. The fly ash shall be proportioned to provide a fly ash (FA) to portland cement (C) ratio by weight, $FA:C=1:1$.

123.4.3 Mineral admixtures shall be "Class F fly ash" and comply with the requirements of ASTM C 618 including Table 4 "Supplementary Optional Physical Requirements."

- A. Uniformity requirements, air entraining agent dosage for 18.0% vol of mortar, shall not vary by more than 20%
- B. Reactivity with cement alkalis: Reduction of mortar bar expansion at 14 days, minimum (ASTM C441) 65%

Reactivity with cement alkalis shall be determined in accordance with the requirements of ASTM C441, using DOW CORNING glass rod base for aggregates. The CONTRACTOR shall submit

certification of compliance identifying the type fly ash and source (plant location), stating the fly ash used in the Reinforced Concrete Pipe delivered to the project complies with this specification. Fly ash shall be of the same source and type for all Reinforced Concrete Pipe delivered to the project.

123.4.4 Admixtures of any type, shall not be used without written approval--of the ENGINEER. The CONTRACTOR shall submit certification of compliance signed by the admixture manufacturer, identifying the admixture and its source (plant location), stating the admixture(s) used complies with this specification. Admixtures shall be of the same source for all reinforced concrete Pipe delivered to a project.

123.4.4.1 Air entraining admixtures shall be used in all Reinforced Concrete Pipe provided under this specification. It shall conform to the requirements of ASTM C 260. Entrained air content shall comply with the following requirements:

Nominal Max Size Aggregate Range	Air Cont. (%)
(inches)	
3/8, 1/2 & 3/4	4 - 8
1	4 - 7
1-1/2	3 - 6

or as required by the Supplementary Technical Specifications, on the plans and/or as approved by the ENGINEER.

123.4.4.2 Chemical admixtures shall conform to either the requirements of ASTM C 494, and/or as specified in the Supplementary Technical Specifications, on the plans, and/or as approved by the ENGINEER.

123.4.4.3 Neither calcium chloride nor non-calcium chloride accelerating admixtures shall be used in Reinforced Concrete Pipe provided to a project under this specification.

123.4.4 Aggregates shall be assumed to be alkali-reactive. Variance for a specific aggregate may be approved by the Engineer upon written request by the CONTRACTOR and submittal of test data, as required by the ENGINEER. Aggregates shall comply with the requirements of ASTM C 33 and ASTM C 76 and as specified herein. Aggregates

shall be of the same source and type for all Reinforced Concrete Pipe manufactured and delivered to the project.

123.4.5 Reinforcement shall comply with the requirements of this specification and Section 102. The CONTRACTOR shall submit certification of compliance signed by the reinforcement manufacturer, identifying the material and its source (plant location), stating the reinforcement complies with this specification. Reinforcement shall be of the same source for all Reinforced Concrete Pipe delivered to the project.

123.5 CAUSES FOR REJECTION

Such inspection of pipe as may be deemed necessary by the ENGINEER will be made at the place of manufacture and pipe may be rejected for any of the reasons described in ASTM C 76, unless it can be repaired in accordance with the requirements noted therein and the approval of the ENGINEER.

123.6 ACCEPTANCE

Basis of acceptance shall be in compliance with ASTM C 76.

123.6.1 D-LOAD BEARING STRENGTH METHOD

123.6.1.1 The ENGINEER will select at random at the point of manufacture test specimens of the pipe to be furnished for the project.

123.6.1.2 The required number of test specimens and the test pipe shall conform in all respects to the applicable requirements of ASTM C 76. The pipe shall be tested by one of the two standard methods of testing; namely, (A) the three-edge bearing, (B) the sand bearing, as prescribed in ASTM C 76, and the required strength of the pipe specimens undergoing the bearing tests shall conform with the D-Load requirements designated therein.

123.6.2 STRUCTURAL DESIGN METHOD:

Where structural details of the pipe are shown on the plans, the manufacture of pipe shall be checked by making the appropriate tests on the concrete placed in the pipe forms, by inspection of the steel reinforcing cages that are to be used in the pipe, and by inspection of the fabrication of the pipe.

123.6.3 "DOWNGRADING" OF PIPE:

123.6.3.1 For the purpose of these specifications, "downgraded" pipe shall be defined as pipe which is to be used under loads less than that for which they have been designed.

123.6.3.2 Pipe manufactured in accordance with these specifications which have not met their designed test loads may be "downgraded" by the ENGINEER and used provided that:

123.6.3.2.1 Enough load tests are made to establish the load under which they may be used. The number of tests to be made shall be as determined by the ENGINEER; this may require the testing of each section for acceptance.

123.6.3.2.2 The comply with the test and inspection requirements of these specifications.

123.6.3.3 Individual specimens of pipe embodying major repairs or having numerous hairline cracks extending the full length of the section on the inside of the pipe at the minor axis or on the outside of the pipe at the major axis may be tested for acceptance at the discretion of the ENGINEER.

123.6.4 STOCKPILED PIPE:

123.6.4.1 Stockpiled pipe may be used only when approved by the ENGINEER provided the pipe meets all other specified requirements.

123.6.4.2 For the purpose of these specifications, "stockpiled" pipe shall be defined as pipe manufactured in quantity which will meet requirements of this section but which was not manufactured for use in specific projects; however, pipe which has been rejected by another agency will not be considered as "stockpiled" pipe, nor will such pipe be accepted.

123.7 JOINTS

123.7.1 For circular pipe, rubber gasket joints shall be required. Such joints shall conform to the requirements of ASTM C 443 and the requirements set forth in this document. The joint shall be designed for not less than 15%, or more than 50%

deformation of the rubber gasket when the pipe is joined off-center with all manufacturing tolerances considered. Minimum manufacturing tolerances shall be assumed to result in a centered annular space of 1.75 times the nominal design annular space. Joint mating surfaces shall be parallel and not be greater than 3.5° slopes. In addition to the hydrostatic joint test requirements per ASTM C 443, the pipe shall be loaded to cause maximum joint annular space to occur at the top. The pipe shall then be subjected to an internal hydrostatic pressure of 13 psi for 10 minutes. The test set up shall include a minimum of (2) pipe sections per lot. Bulkheaded end joints are acceptable, only mating pipe joints are allowed. Moisture or beads of water appearing on the surface of the joint will not be considered as leakage. If leakage of joints should initially occur, the manufacturer shall have the option to allow the pipe to soak under pressure for up to 24 hours and then retest. Any leakage during such retest will constitute failure of the test.

Pipe with beveled ends or pipe joints specifically designed to allow unsymmetrical joint closure may be provided for use around curves, the radii of which are shown on the drawings. Unless otherwise shown on the plans or specified in the Supplementary Specifications, either one or both ends may be beveled up to a maximum of 5 degrees, as required to provide well fitted joints. Beveled ends may conform to the Typical Method of Designing Curved Concrete Pipe sewers, as shown in the ACPA Concrete Handbook. Deflections per joint shall be limited to the manufacturer's standards for each particular diameter and type of pipe used.

123.7.2 For elliptical or arch reinforced concrete pipe, the joints shall be either bell and spigot or tongue and groove. Mastic material, such as RAMNEK, KENT SEAL, or approved equal, will be used to seal the joints.

123.7.3 Cement mortar joint fillers will not be accepted for round, elliptical, or arch reinforced concrete pipe.

123.7.4 If required by the ENGINEER to meet specified laying tolerances, the pipe shall be "match marked" at the place of manufacture, and laying diagrams furnished

to the CONTRACTOR by the manufacturer shall be subject to approval by the ENGINEER.

123.8 DIMENSIONS

123.8.1 LENGTH

123.8.1.1 The nominal length shall be as supplied by the manufacturer unless otherwise specified in the Supplementary Technical Specifications on the plans or required for bends or special joints.

123.8.1.2 Except for special shapes, the plane of the ends of the pipe shall be perpendicular to the longitudinal axis of the pipe, with the exception that variations in laying lengths of two opposite sides of pipe shall be not more than 1/8 inch per foot of diameter with a maximum of 5/8 inch in any length of pipe.

123.8.2 WALL THICKNESS

The wall thickness of pipe shall conform to the requirements indicated for Wall B or Wall C. reinforced concrete pipe specified in ASTM C 76 unless otherwise specified.

123.9 REINFORCEMENT

Fabrication and placement of reinforcement for the various sizes and strengths of pipe shall conform to the applicable requirements of ASTM C 76.

123.10 CURING REQUIREMENTS

The pipe shall be cured in conformance with the applicable requirements of ASTM C 76.

123.11 MARKINGS:

123.11.1 Each section of pipe shall be marked in conformance with the requirements of ASTM C 76. The ENGINEER may at the place of manufacture, indicate his acceptance of the pipe for delivery to the job by marking the pipe with the Contracting Agency's mark. Such acceptance, however, shall not be considered a final acceptance.

123.11.2. If the pipe is subsequently rejected, the mark placed thereon by the ENGINEER shall be defaced. No pipe will be marked, "Reject." Only pipe accepted shall be marked, "Accepted."

123.12 LOW-HEAD PRESSURE PIPE

Reinforced concrete low-head pressure pipe shall conform to the requirements of ASTM C 361.

123.13 SELECTION FOR CLASS OF PIPE

123.13.1 The classes of reinforced concrete pipe and the D-Load to produce a 0.01-in. crack for each class of pipe are specified in ASTM C 76.

123.13.2 The appropriate formulas, tables and figures contained in the "Concrete Pipe Design Manual," prepared by the American Concrete Pipe Association, will be used, to determine the class of pipe to be installed between manholes or for a culvert. It is essential that maximum trench width, class of bedding and soil weight be considered in the pipe class selection.

123.13.3 The construction plans will indicate the following information for each length of pipe between manholes or for a culvert: the nominal diameter of the pipe, the class of pipe, the class of bedding and the maximum trench width at top of pipe.

123.14 MEASUREMENT AND PAYMENT

123.14.1 The measurement and payment for the materials specified in this section will be made as specified in section will be made as specified in the applicable section of these specifications or as specified in the supplemental technical specifications or as called for in the plans and as shown in the Bid Proposal.

SUPPLEMENTAL TECHNICAL SPECIFICATION

APWA (2006) SECTION 201

CLEARING AND GRUBBING

Revised 07/24/2020

1. In the Subsection 201.1 GENERAL, delete the second sentence and replace with the following: Clearing and grubbing shall be performed in advance of the grading operations.
2. In the Subsection 201.4.1 CONSTRUCTION METHODS, add the following:

Clearing and grubbing operations shall include stripping of the existing ground surface. Stripping shall be achieved only by cutting, i.e., ground depressions or narrow sections of tributary arroyos should not be inadvertently filled during the foundation preparation. The resulting area shall be cut to provide a uniform, relatively level surface.

3. In Subsection 201.5 LIMIT LINES, add the following:

Unless otherwise approved by the Engineer or otherwise specifically designated on the plans, limits of clearing & grubbing shall not exceed slope limits as shown with finished grade contours on plans.

END OF SECTION

SECTION 201

CLEARING AND GRUBBING

201.1 GENERAL

This work shall consist of removing natural and man-made objectionable material from the right-of-way, construction areas, road approaches, material and borrow sites, areas through which ditches and channels are to be excavated, and such other areas as may be shown on the plans. Clearing and grubbing shall be performed in advance of grading operations except that in cuts over 3 feet in depth, grubbing may be done simultaneously with excavation, provided stumps, roots, embedded wood, foundations and slabs are removed as specified. Clearing and grubbing shall be in accordance with the requirements herein specified, such as erosion control requirements. Demolition of structures, other than foundations or slabs, shall be as shown on the plans.

201.2 REFERENCES

201.3 PRESERVATION OF PROPERTY

Existing improvements, adjacent property, utility and other facilities, and trees and plants not to be removed shall be protected from injury or damage resulting from the CONTRACTOR's operations. Only trees and plants designated or marked for removal by the ENGINEER shall be removed.

201.4 CONSTRUCTION METHODS

201.4.1 The natural ground surface shall be cleared of vegetable growth, such as trees, tree stumps, logs, roots or downed trees, brush, grass, weeds, and surface boulders, as well as fences, walls, rubbish, foundations and slabs.

201.4.2 Unless otherwise shown on the plans, the entire area of the project within the limit lines specified below shall be cleared and grubbed. No payment will be made to the CONTRACTOR for clearing and grubbing outside these limits, unless such work is authorized by the ENGINEER.

201.5 LIMIT LINES: Except when limit lines for clearing and grubbing are shown on the plans or are staked by the ENGINEER, clearing and grubbing shall extend only within reasonable limits of the work area.

201.6 REMOVAL OF TREES AND TREE BRANCHES

201.6.1 Trees shall be removed in such a manner as not to injure standing trees, plants, and improvements which are to remain. Tree branches extending over a roadway and which clear finish grade by 12 feet or

less shall be cut off close to the boles in a workmanlike manner.

201.6.2 Trees requiring trimming to facilitate normal construction operations shall be trimmed by a tree surgeon.

201.7 REMOVAL AND DISPOSAL OF DEBRIS

Debris to be removed shall be disposed of outside the right-of-way at a location satisfactory to the ENGINEER, except when burning of combustible debris is permitted. The area to be graded and adjacent areas shall be left with a neat and finished appearance. No accumulation of flammable material shall remain on or adjacent to the property line. In case burning precedes construction operations, the piles may be placed in the center of the area; otherwise, the piles shall be placed in the most convenient location at the side of the area and beyond slope lines where they may be burned without damage to surrounding forest cover or adjacent property. Burning shall be done in conformance with local regulations and at such times and in such manner as to prevent the fire from spreading to areas adjoining the construction site. In areas where burning is prohibited by local regulations, all removed material shall be disposed in an approved solid waste disposal site.

201.8 REMOVAL AND DISPOSAL OF SALVAGEABLE ITEMS

Items and materials of salvage value as shown on the plans or as determined by the ENGINEER, unless incorporated in the new work, shall remain the property of the OWNER and shall be delivered to approved storage areas as directed by the ENGINEER. Such items and materials shall be carefully removed and delivered in such a manner as to permit re-use.

201.9 MEASUREMENT AND PAYMENT

201.9.1 CLEARING AND GRUBBING:

201.9.1.1 When the proposal includes an item for clearing and grubbing, the quantity for measurement shall be as indicated in the Bid Proposal.

201.9.1.2 The unit price per acre paid for clearing and grubbing shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in clearing and grubbing as shown on the plans, as provided in these specifications and as directed by

the ENGINEER, including the removal and disposal of resulting material.

201.9.1.3 When the Bid Proposal does not include a pay item for clearing and grubbing as above specified and unless otherwise specified in the Supplementary Specifications, full compensation for any necessary clearing and grubbing required to perform construction operations specified shall be considered as included in the price paid for other items of work and no additional compensation will be allowed therefore.

201.9.2 REMOVAL AND DISPOSAL OF TREES: If the Bid Proposal includes separate estimates of quantities for the removal of trees, the trees shall be classified by size as follows:

201.9.2.1 Trees less than 12 inches in circumference at 3 feet above the original ground surface shall be considered as included in the price for clearing and grubbing or excavation, and no additional compensation will be allowed therefor.

201.9.2.2 Trees between 12 and 30 inches in circumference shall be measured as a unit price for each tree in the item provided in the Bid Proposal for trees of this dimension.

201.9.2.3 Trees more than 30 inches in circumference shall be measured as a unit price for each tree in the item provided in the Bid Proposal for trees of this dimension.

SECTION 301

SUBGRADE PREPARATION

301 GENERAL

301.1 The work performed under this specification shall include, but not be limited to providing the equipment, labor and materials for the preparation of soil subgrade and maintenance of the prepared subgrade for the construction of graded aggregate base, asphalt treated base, cement treated base, asphalt concrete, Portland cement concrete, sidewalks, curb and gutter, drive pads, valley gutter, median pavements and/or any other roadway improvements.

301.2 REFERENCES

301.2.1 ASTM:

C136	D423
D424	D698
D1140	D1557
D2844	D2922
D3017	

301.2.2 This publication Section 204

301.3 MATERIAL

301.3.1 Subgrade material may be on site soil, combinations of pulverized asphalt concrete and soil, and/or pulverized Portland cement concrete and soil, imported soils, complying with the requirements of this specification. Flowing, sugar sands shall not be used for subgrade material.

301.3.2 All soft and unstable material and other portions of the subgrade which will not compact readily or serve the intended purposes shall be removed and replaced with suitable material from excavation or borrow or suitable materials shall be added and, by manipulations, be incorporated into the subgrade to produce a material meeting subgrade requirements.

301.3.3 All subgrade material shall have a minimum Resistance Value (R-Value), as determined by ASTM D-2844, equal to or greater than the design R-Value for the pavement section. If the subgrade soils encountered during construction have a R-Value less than the design R-Value, those subgrade materials shall be removed to a depth of not less than two (2') feet below the finished subgrade elevation or as authorized by the ENGINEER and to the horizontal limits authorized by the ENGINEER, and replaced with subgrade material having an R-

Value greater than the design R-Value. On small projects, in areas that just involve replacement of existing roadway items or when no design R-Value has been established this R-Value requirement may be waived if authorized by the ENGINEER.

301.4 SUBGRADE COMPACTION

301.4.1 Subgrade preparation shall extend to one foot (1') beyond the limits of the improvement to be placed on the subgrade except when that improvement abuts an existing structure and/or the limits of the right of way. Where an improvement abuts an existing structure and/or the limits of right of way, the subgrade preparation shall extend to the edge of the existing structure and/or the limits of right of way, as specified in the plans, specifications, supplemental technical specifications or as directed by the ENGINEER. Where existing structures are in the right of way or construction easements, subgrade preparation shall extend to the face of the structure, as specified above. Subgrade preparation shall not extend below the bottom of the foundation of an existing structure without specific authorization by the ENGINEER.

301.4.1.1 Subgrade preparation for roadway improvements shall be performed after completion of earthwork construction, subsurface utility installation and trenching back fill within the limits specified, as directed by the ENGINEER. The subgrade preparation shall extend the full width of the roadway to either one (1) foot back of new curb and gutter, and/or to the face of existing structures, and/or the limits of right of way, as specified in the plans and specifications, as directed by the ENGINEER.

301.4.1.2 Subgrade preparation for sidewalks and drive pads shall extend a minimum of one (1') beyond the free edge of the improvement, and/or to the limits of right of way, and/or to the face of existing structures.

301.4.1.3 The subgrade preparation for roadway construction without curb and gutter, shall extend one (1') beyond the edge of the pavement, and/or to the face of existing structures, and/or to the limits of right of way, as specified in the plans and specifications, as authorized by the ENGINEER.

301.4.1.4 Subgrade preparation shall extend the full width of roadway medians four (4) feet wide or less. In areas that the medians are wider than four feet (4') the subgrade compaction shall extend one foot

(1') beyond the median edge of the pavement or back of the median curb.

301.4.2. The subgrade for arterial/collector roadway shall be ripped to a minimum depth of one (1) foot, brought to uniform moisture content, and compacted to the requirements of plans and specification, as authorized by the ENGINEER. Subgrade material with either 20 per cent or more material passing a no. 200 sieve shall be uniformly mixed and moisture conditioned using a tractor mounted mixer or disced after ripping, as specified in the plans and specifications, as authorized by the ENGINEER. The subgrade for reconstructed curb and gutter, sidewalks, drive pads, residential roadways, bicycle paths and other roadways shall be scarified to a minimum depth of six (6) inches, brought to uniform compaction moisture content, and compacted to the requirements of plans and specification, as authorized by the ENGINEER.

301.4.3 Subgrade area shall be compacted to a dry density greater than 95 per cent of maximum dry density in a moisture range of optimum moisture $\pm 2\%$ as determined in accordance with ASTM D1557, unless the material contains 35% or more material finer than the No.200 sieve. If the subgrade material has 35% or more material finer than the No.200 sieve, the subgrade shall be compacted to a dry density greater than 95 percent of maximum dry density in a moisture content range of at least optimum moisture to optimum moisture $+4\%$, as determined in accordance with ASTM D698.

301.4.4 Areas on which roadway pavement items are to be placed shall be compacted uniformly to the required subgrade density at the same time. Obtaining the required subgrade density in trench areas at a different time than obtaining the required subgrade density in the adjacent pavement areas will not be permitted.

301.4.5 Upon completion of the subgrade preparation, the CONTRACTOR shall maintain the compacted subgrade density and moisture content at the specified levels until the next lift of material is completed. The CONTRACTOR shall provide continuous moisture protection of the subgrade by either sprinkling or the application of a prime coat, as directed by the ENGINEER.

301.5 SUBGRADE TOLERANCES

Subgrade upon which pavement, sidewalk, curb and gutter, drive pads, or other structures are to be placed shall not vary more than $+1/4$ inch or $-1/2$ inch per 10 foot in any direction from the specified grade and cross section. Subgrade upon which base material is to be placed shall not vary more than $+1/2$ inch or -1 inch per 20 foot in any direction from the specified grade and cross section. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

301.6 TESTING:

301.6.1 A sample of each type of soil encountered shall be classified in accordance with the requirements of ASTM D2487, the moisture density relationship determined in accordance either ASTM D698 or D1557, whichever is applicable and an estimated resistance R-value assigned based on plasticity index, PI, and percent material passing the No.200 sieve.

301.6.2 Compaction tests shall be taken for each 500 sy or less, as directed by the ENGINEER. Compaction tests shall be taken in accordance with ASTM D2922 and D3017. Areas represented by non complying tests shall be reworked as specified, and retested for compliance.

301.6.3 Test reports shall include but not be limited to the requirements of TABLE 301.A.

TABLE 301.A
TEST REPORT INFORMATION

A. Field Data

Date of Sampling/Field Test
Project Number or
Permit Number
Project Title
Location of sample/field test as defined by the project plans and specifications
Time of Sampling/field testing
Field test results with reference specification limits

B. Laboratory Data

Soil classification
Soil gradation
Plasticity index

Liquid limit
Optimum moisture/maximum dry density relationship and graph
Estimated soil resistance R-Value

301.6.4 Test results shall be reported to the ENGINEER, CONTRACTOR, and Materials and Testing Laboratory, Construction Division, Public Works Department, in writing, within 4 working days of completion of the sampling and or field test. Non-complying test shall be reported within 1 working day of completion of the test.

301.7 MEASUREMENT AND PAYMENT:

301.7.1 Measurement for payment of roadway subgrade preparation will be by the square yard to the limits of the surfacing, as authorized by the ENGINEER. Payment for subgrade preparation shall include all labor and equipment required to shape, mix, add moisture, compact, bring to grade and maintaining the prepared subgrade moisture and density until the next course of material is placed.

301.7.2 The measurement of payment for subgrade preparation for non-pavement roadway items such as curb and gutter, valley gutter, drive pads and sidewalks etc., shall be included in that item. No separate payment will be made.

SECTION 302

AGGREGATE BASE COURSE CONSTRUCTION

302.1 GENERAL

The work provided under this specification shall include the furnishing, placement and compaction of aggregate base course (ABC) to the lines, grades, dimensions, moisture, density and typical sections as specified in the plans and specifications, and or as directed by the ENGINEER. The CONTRACTOR shall be solely responsible for the aggregate base course either batched at and/or delivered to the site. A job mix formula for aggregate base course, shall be certified in accordance with the requirements of Section 13 of these specifications. Each job mix formula submitted and authorized for use under this specification shall be identified by a number, unique to that job mix formula and aggregate production plant/pit. If a change in material(s) from that specified in the job mix formula occur during a project, the CONTRACTOR shall submit a new job mix formula to include the changed materials for approval by the ENGINEER. A job mix formula shall not be used on a project without written approval of the ENGINEER. A job mix formula, upon request by an aggregate supplier, may be authorized by the OWNER for a period of 14 months, from the date of sampling of aggregates used in the job mix formula.

302.2 REFERENCES

302.2.1 ASTM:

C136	D75
D422	D423
D424	D1557
D2419	D2844
D2922	D2940
D3017	

302.2.2 This Publication:

Section 113
Section 301

302.3 MATERIALS

302.3.1.1 Aggregate base course shall be coarse aggregate of either crushed stone, or crushed gravel, or crushed asphalt concrete, or crushed Portland cement concrete, or any combination, and natural sand, the combination of materials conforming to the requirements of ASTM D2940 and the plans and specifications, as authorized by the ENGINEER.

302.3.1.2 Coarse aggregates retained on the No.4 sieve shall consists of durable particles of either

crushed gravel, or crushed asphalt concrete pavement, or crushed portland cement concrete, or any combination, capable of withstanding the effects of handling, spreading and compacting without degradation production of deleterious fines. At least 50% of the particles retained on the 3/8-inch sieve, shall have two or more fractured faces. Coarse aggregate shall comply with the requirements of TABLE 302.A.

302.3.1.3 Fine aggregate passing the No.4 sieve shall consists of fines from the operation of crushing coarse aggregate; where available and suitable, natural sand or finer mineral matter or both, may be added. Fine aggregate shall comply with the requirements of TABLE 302.A.

302.3.1.4 The job mix formula and gradation shall comply with the requirements of TABLE 302.B, and have the same or similar characteristic gradation curve as either range limit, when graphically plotted on a standard "0.45 POWER" Gradation Chart.

302.3.1.5 Aggregate base course furnished and placed under this specification shall have a resistance value, (R-Value), not less than 76 as determined by ASTM D2844.

302.3.1.6 A job mix formula, certified by a Registered New Mexico Professional Engineer to comply with the requirements of this specification, shall be submitted to and authorized for use by the ENGINEER before the material may be incorporated in the construction. A submittal shall include, but not be limited to, the items in TABLE 302.C. Prior to delivery of the material, the CONTRACTOR may be required to furnish samples of the aggregates base course to the ENGINEER for testing. Gradations for the aggregate base course used in a particular day's placement shall be submitted to the ENGINEER upon request.

302.3.2 Prime coat for surface sealing of compacted aggregate base course shall comply with the requirements of CSS-1H Cationic Emulsified Asphalt as specified in Section 113.

302.4 TRANSPORTATION AND PLACEMENT

302.4.1 Aggregate base course shall be transported in suitable vehicles with a cover. A load shall be covered immediately after loading and remain covered until unloading.

302.4.2 The CONTRACTOR shall provide to the ENGINEER with each load of batched and/or delivered to the job site, before unloading at the site.

a copy of the delivery ticket on which is printed, stamped or written. the information defined in TABLE 302.D.

302.4.3 Aggregate base course shall be placed on prepared subgrade, prepared in accordance with the requirements of SECTION 301, the plans and specifications, and or as directed by the ENGINEER.

302.4.4 Aggregate base course shall be placed in lifts which will provide not less than four (4) inches and not more than 6 inches compacted thickness. The material shall be moisture conditioned within a range of optimum moisture plus or minus two percent (+/-2%), and compacted to a dry density greater than ninety-five (95) percent of maximum dry density as determined in accordance under the procedures specified in ASTM D1557.

302.4.5 The finish surface of the compacted aggregate base course shall not deviate from finish grade in excess of 1/2 inch in 10 feet when tested with a 10-foot straight edge in any direction. All deviations in excess of the specified shall be corrected by the CONTRACTOR prior to authorization for placement of the next life of material.

302.4.6 Immediately upon completion of compaction, the CONTRACTOR shall seal the surface of the compacted aggregate base course with a prime coat. The prime coat shall be applied as required to provide a uniform coverage of the surface. Application shall be between 0.05 and 0.15 gallons per square yard of surface. If final surfacing is to be placed within twenty four (24) hours after completion of compaction, the prime coat may be waived as authorized by the ENGINEER. The surface shall be kept at compaction moisture until the final surfacing is placed in the event the prime coat is waived.

302.4.7 Traffic on compacted aggregate base course shall be limited to moisture control application and final surfacing traffic only, as authorized by the ENGINEER.

302.5 TESTING

302.5.1 A sample of material delivered to the project shall be taken for each 300 tons placed or each days placement, whichever is greater, and tested for gradation and moisture density relationship. The average value of individual gradation tests, for all sieve size determinations, shall comply with the job mix formula within the tolerances specified in TABLE 302.B. Individual sample gradation test results, for all sieve size determinations, shall comply with the tolerance range plus two (2) percent. Non complying material shall be re-sampled and tested for compliance. Material not in compliance after the

initial and follow up testing shall be removed and replaced by the CONTRACTOR at no cost to the OWNER, as directed by the ENGINEER.

302.5.2 Compaction tests shall be taken at the rate of one test for each 500 sy/lift placed, or as directed by the ENGINEER, in accordance with the requirements of ASTM D 2922 and D 3017. Areas represented by non complying tests shall be reworked and retested for compliance.

302.5.4 Test reports shall include but not be limited to the requirements of TABLE 302.E.

302.5.5 Test Results shall be reported to the ENGINEER, CONTRACTOR, and OWNER in writing, within 4 working days of completion of the sampling and or field test. Non-complying test shall be reported within 1 working day of completion of the test.

302.6 MEASUREMENT AND PAYMENT

302.6.1 Measurement of aggregate base course shall be by the square yard per each thickness required, complete in place.

302.6.2 Payment shall be at the contract unit price per square yard per each thickness required, complete in place which shall include all material, labor and equipment required in placing, grading and compacting the aggregate base course.

**Table 302.A
ENGINEERING REQUIREMENTS**

CHARACTERISTIC Aggregate Type	SPECIFICATION LIMIT(S)	
	Fine	Course
Los Angeles Abrasion Wear (ASTM C 131)		40% max.
Soundness (5 cycles ASTM C 88)	15% max.	15% max.
Crushed Aggregate (% Material Retained on 3/8inch sieve by wt., having at least two (2) fractured faces)		50% max.
Maximum % passing No. 200	60% of -No.30	
Plasticity Index (Material finer than No.40 sieve)	4.0 max.	
Sand Equivalent Value	35 min.	

**TABLE 302.B
GRADATION RANGES AND TOLERANCES**

SIEVE SIZE/TYPE	PRODUCTION RANGE (% passing)		PRODUCTION TOLERANCES (+/-%)
	I	II	
1-1/2 inch	100	100	
1 inch	95-100	100	
¾ inch		90-100	8
½ inch	64-75		8
3/8 inch		65-80	8
No.4	35-46	48-55	8
No.30	12-18	18-25	5
No.200	5-12	6-15	3

**TABLE 302.C
SUBMITTAL REQUIREMENTS**

- A. Supplier
- B. Date
- C. Design Mix Identification Number
- D. Contractor
- E. Construction project number
- F. Construction Project Title (contract)
- G. Certification of compliance
- H. Target Gradation of Material
- I. Optimum moisture and maximum dry density relationship of material and graph

The submittal shall be rejected without review if the specified data is not included.

**TABLE 302.D
DELIVERY TICKET INFORMATION**

- A. Name of Supplier
- B. Date of Delivery
- C. Delivery Ticket Number
- D. Name of Contractor
- E. Project Name (optional)
- F. Job mix formula identification number
- G. Weight of load
- H. Time loaded

**TABLE 302.E
TEST REPORT INFORMATION**

A. Field Data

Date of Sampling/Field Test
Project Number or
Permit Number
Project Title
Location of sample/field test as defined by the project
plans and specifications
Time of Sampling/field testing
Field test results with reference specification limits

B. Laboratory Data

Base course classification
Gradation
Plasticity index
Liquid limit
Optimum moisture/maximum dry density relationship and graph
Estimated soil resistance R-Value

SECTION 340

PORTLAND CEMENT CONCRETE CURBS, GUTTERS, WALKS, DRIVEWAYS, ALLEY INTERSECTIONS, SLOPE PAVING, AND MEDIAN PAVING

340.1 GENERAL:

340.1.1 Portland cement concrete curbs, walks, gutters, cross gutters, valley gutters, driveways, alley intersections, slope paving and median paving constructed of concrete having a minimum compressive strength as specified in Section 101, unless otherwise noted on the plans or specified in the Supplementary Technical Specifications.

340.1.2 Subgrade preparation for concrete curbs, gutters, walks, driveways, alleys, intersections, and slope paving conform to the requirements of Section 301, unless otherwise noted on the plans or specified in the Supplementary Technical Specifications.

340.1.3 Unless otherwise specified or indicated on the plans and except as otherwise prescribed in Subsection 340.8, the minimum thickness of walks shall be 4 inches. The minimum thickness of gutters, driveway aprons, and alley intersections shall be 6 inches unless otherwise shown on the plans. The height and thickness of the curb section including other details of construction for items in Section 340 will be shown on the plans, or Standard Detail Drawings.

340.2 REFERENCES:

340.2.1 American Society for Testing and Materials (Latest Edition) (ASTM):

D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort

340.2.2 This Publication:

SECTION 101 PORTLAND CEMENT CONCRETE
SECTION 102 STEEL REINFORCEMENT
SECTION 105 CONCRETE CURING COMPOUND
SECTION 107 JOINT FILLER AND SEALANT MATERIAL
SECTION 301 SUBGRADE PREPARATION
SECTION 337 PORTLAND CEMENT CONCRETE PAVEMENT
SECTION 349 CONCRETE CURING

340.3 FORMS:

340.3.1 Form material shall be free from warp, with smooth and straight upper edges and, if used for the face of curb, shall be surfaced on the side against which the concrete is to be placed. Timber forms may be used for forming curved sections but shall not be

used for straight work unless authorized in writing by the ENGINEER. Metal forms for such work being of a gauge that will provide proper rigidity and strength for the purpose for which they are intended. Wood forms used on curb returns shall be not less than 3/4 of an inch in thickness, cut in the length and radius as shown on the plans and held rigidly in place by the use of metal stakes and clamps. The curb face forms shall be cut to conform exactly with the curb face batter, as well as being cut to the required length and radius. In every case, however, the forms shall be of sufficient rigidity and strength and shall be so supported as to adequately resist springing or deflection as a consequence of the placing and consolidation of the concrete.

340.3.2 All formed curb and combined curb and gutter shall be divided into blocks or stones in lengths not to exceed 12 feet long using metal templates' not less than 1/16 inch thick cut to the same cross section as the curb or curb and gutter being constructed. Templates shall be securely attached to forms to prevent movement during concrete placement.

340.3.3 Form material shall be thoroughly clean at the time it is used and shall be given a coating of light oil or other suitable material immediately prior to the placing of the concrete.

340.3.4 Forms, except curb back planks, shall be set with the upper edges thereof flush with the specified grade of the finished surface of the adjacent portion of the work and shall be not less than a depth equivalent to the full specified depth of thickness of the concrete to be supported thereby.

340.3.5 Back forms shall be held securely in place by means of stakes driven in pairs, one at the front form and one at the back, at intervals not to exceed 4 feet; clamps, spreaders, and braces being used in connection therewith to such extent as may be necessary to insure proper rigidity of the forms. Forms for walks, gutters, and similar work shall be firmly secured by means of stakes driven flush with the upper edge of the forms at intervals not to exceed 5 feet. The stakes shall be of sufficient size and shall be so driven as to properly and adequately support the forms.

340.3.6 Form clamps, specifically designed and manufactured for the curb and gutter to be constructed, may be used if, in the opinion of the ENGINEER, they fulfill the requirements above specified for curb and gutter forms.

340.4 PLACING CONCRETE:

340.4.1 The concrete shall be placed on a thoroughly dampened subgrade sufficiently moist to insure that no moisture will be absorbed from the fresh concrete.

340.4.2 Surfaces of structures in sidewalks, curbs, and gutters shall be adjusted as necessary prior to placing of concrete to meet the contiguous sidewalk surfaces.

340.4.3 Concrete shall be placed in horizontal layers not to exceed 6 inches each in thickness, each layer being spaded along the forms and thoroughly consolidated. However, if the section is more than 6 inches in depth, the concrete may be placed to provide the thickness shown or specified, if mechanical internal vibrators are used or if, in the opinion of the ENGINEER, the spading and tamping is sufficient to consolidate the concrete for its entire depth.

340.4.4 After the concrete has been placed between the side forms, a strike off shall be used to bring the surface to the proper section to be compacted. It shall then be spaded along the form faces.

340.4.5 After the concrete has been placed and consolidated, the upper surface shall be struck off uniformly smooth and true to the specified grade.

340.5 EXPANSION JOINTS:

340.5.1 Expansion joints shall be constructed in curbs, walks, and gutters as hereinafter specified, being filled with premolded joint filler strips conforming with the requirements prescribed therefor in Section 107. No such joints shall, however, be constructed in cross gutters, alleys, intersections, or driveway aprons.

340.5.2 Spacing: Unless otherwise shown on the plans or authorized by the ENGINEER, the location and spacing of expansion joints shall be as specified in the Standard Detail Drawings and herein.

340.5.2.1 Expansion joints in all types of curb and gutters shall be placed at both ends of returns except where cross gutters are being constructed, and at regular intervals not to exceed 200 feet between expansion joints. Expansion joints shall be placed at both ends of the cross gutter transitions.

340.5.2.2 Expansion joints in all types of sidewalk shall be placed where the sidewalk abuts Wheel Chair Ramps and driveways; at regular intervals not exceeding 18 feet between expansion joints; between the walk and any building or structure; around utility pads and light foundations; and between the walk and water meter areas.

340.5.2.3 Expansion joints at wheel chair ramps and

driveways shall be placed between these items of work and the back of the curb and gutters and the adjoining sidewalks.

340.5.2.4 Expansion joint filler strips shall be vertical and shall extend to the full depth and width of the work in which they are installed, being constructed at right angles or radially to the line of the curb or gutter as the case may be. The filler strips shall completely fill these joints at least to within 1/4 of an inch of any surface of the concrete that will be exposed upon completion of the work and must fully extend at least to those surfaces that will not be exposed. However, before the work will be accepted, any joint filler that protrudes beyond a surface that will not be exposed or beyond 1/4 of an inch below a surface that is exposed shall be trimmed off to the specified dimension in a neat and workmanlike manner. During the placing and consolidation of the concrete, the filler strip shall be held rigidly and securely in proper position.

340.5.3 CONTRACTION JOINTS

340.5.3.1 Contraction joints shall be constructed in slip formed curbs, curb and gutter, walks, and gutters as hereinafter specified. The joint shall be either cut or tooled to a minimum depth of 1 inch at curb, curb and gutter, and gutter, and the greater of either 1 inch or 1/4 the actual depth of the concrete at sidewalks and slabs on grade. The contraction joint shall be tooled at all exposed faces of the fresh placed concrete.

340.5.3.2 Spacing: Unless otherwise shown on the plans or authorized by the ENGINEER, the location and spacing of contraction joints shall be as specified in the Standard Detail Drawings and herein.

340.5.3.3 Contraction joints in extruded curb, curb and gutter, and gutters shall be placed at regular intervals not to exceed 12 feet.

340.5.3.4 Contraction joints shall be placed in all types of sidewalk at regular intervals not less than the width of the sidewalk nor greater than 6 feet.

340.6 FINISHING: Surfaces of the various items of work shall be finished as specified herein. Edges of concrete at expansion joints shall be rounded to 1/4 inch radius. Upon completion, the finished surface shall be true to line and grade and free from irregularities.

340.6.1 CURB:

340.6.1.1 The front forms may be stripped as soon as the concrete has set sufficiently but must be removed before the expiration of 6 hours after pouring. Immediately following the stripping of these forms, Class A mortar, as prescribed therefor in Section 106

thinned to the consistency of grout, shall be applied to the curb face. If monolithic curb and gutter is being constructed, this mortar shall be applied to the full exposed face; otherwise, it shall extend for an additional 2 inches below the gutter.

340.6.1.2 The face and top of the curb shall then be carefully troweled with a "steel mule" shaped to match the profile of the curb, curb and gutter, to a smooth and even finish, the top being finished to a transverse slope of 1/4 of an inch toward the front, with both edges rounded to a radius of 3/4 of an inch. Contraction joints, perpendicular to the flow line and in returns radial to the curve, shall be placed in the curb top and face and in the gutter. The surface shall be finished with a fine hair broom parallel with the line of the flow line.

340.6.2 SIDEWALK:

340.6.2.1 Following the placing of concrete, the surface shall be struck and floated to a true and even grade, free from waves and irregularities. After the floating contraction joints shall be made to a depth of 1 inch. The work shall then be carefully floated to a smooth and even finish, with the contraction joint and expansion joint edges rounded to a radius of 1/8 of an inch. The finished surface shall be given a fine hair broom finish, applied transverse the direction of travel of the sidewalk.

340.6.2.2 Contraction joints or block joints shall not exceed intervals of 6 feet. On straight work, the joints shall be parallel with and at right angles to the line of the work; at curves the joints shall, in general, be along lines concentric with the curve radius. The contraction joint shall be made with jointer tools that will round the edges to a radius of 1/8 of an inch, with a depth of not less than 1 inch. The finished joint opening, exclusive of radii, shall not be not less than 1/8 inch nor greater than 3/16 inch. The CONTRACTOR will be required to have a sufficient number of jointer tools on the job to accomplish the above specified requirements.

340.6.2.3 The concrete shall be cured in accordance with the requirements of SECTION 349.

340.6.3 GUTTER:

340.6.3.1 After the concrete has been thoroughly consolidated the surface shall be worked to a true and even grade by means of a float. Contraction joints shall be sawed or tooled at intervals not to exceed 6 feet, perpendicular to the flow line. The finished surface shall be textured longitudinally with a fine hair broom finish.

340.6.3.2 Side forms shall remain in place until the

concrete is sufficiently set, after completion of the gutter, but must be removed before the work will be accepted. The concrete shall be cured in accordance with the requirements of SECTION 349.

340.6.3.3 Valley gutter or cross gutter sections reinforcement steel and steel placement shall be constructed accordance with the plans and detail drawings. The reinforcement steel shall be in accordance with Section 102. The finished surface shall conform to the required roadway section as to both line and grade. The gutter sections will not be opened to traffic until specimen cylinders have attained a compressive strength of not less than 85% of its design strength or after 14 days or as authorized by the ENGINEER.

340.6.4 CONCRETE SLOPE PAVEMENT:

340.6.4.1 All subgrade preparation required for this item shall be done in accordance with applicable provisions of Section 301 with the exception that minimum density requirements will be 90% of maximum density as determined by ASTM D1557 or ASTM D698.

340.6.4.2 Reinforcement shall be included where shown on the plans or as specified.

340.6.4.3 Thickness of concrete shall be as specified or as shown on the plans. Concrete shall be screeded and finished with ten foot straight edge, lapped at 1/2 its length or equivalent, to a plane surface having no variation when measured with a 10 foot straight edge in excess of 1/4 inch, unless a curvilinear surface is designated for a particular job. All concrete work shall be in accordance with Sections 101 and 349.

340.7 CURING:

340.7.1 GENERAL: Immediately after the operations have been completed on all concrete, the CONTRACTOR shall initiate the curing of the concrete as specified in Section 349 and/or as approved by the ENGINEER.

340.8 DRIVEWAY ENTRANCES:

340.8.1 Driveway entrances shall be provided in new curbs at all existing driveways along the line of the work and at locations shown on the plans or as directed by the ENGINEER.

340.8.2 The location and construction details for driveways shall conform to the construction plans or Standard Detail Drawings, or as authorized by the ENGINEER.

340.8.3 Where walks are to be constructed across driveways, the thickness of the walk shall be not less

than 6 inches, unless otherwise specified or shown on the plans.

340.9 DRAINAGE OUTLETS THROUGH CURB: The CONTRACTOR will be required to construct suitable outlets through the new curb for all existing building drains along the line of the work, as per Standard Detail Drawings.

340.10 MISCELLANEOUS TYPES OF CURB, GUTTERS, SIDEWALKS: Extruded type concrete curb and gutter, precast curb and gutter sections, cut stone curbs, brick sidewalks, flagstone " sidewalks, etc., will be permitted where approved by the ENGINEER and in accordance with the plans and Supplementary Technical Specifications.

340.11 REPAIRS AND REPLACEMENTS:

340.11.1 New work that is found to be defective or damaged prior to acceptance and/or existing work damaged by the CONTRACTOR's operation shall be repaired or replaced by the CONTRACTOR at no expense to the OWNER. Defective or damaged concrete areas shall be repaired by neatly saw cutting at right angles to the face of curb and removing and replacing the effected area. Removals of defective concrete shall be either the entire area between existing joints or if a minimum of 6 feet can be maintained to an existing joint, an intermediate saw cut may be permitted when approved by the ENGINEER.

340.12 TESTS: Testing procedures shall be as provided for in SECTION 101.

340.13 BACKFILLING AND CLEANUP: Backfilling and compaction to the finished surface of the newly constructed improvement must be completed before acceptance of the work.

340.14 MEASUREMENT AND PAYMENT:

340.14.1 MEASUREMENT:

340.14.1.1 Concrete curbs and gutters shall be measured by the linear foot per each type of curb and gutter.

340.14.1.2 Concrete sidewalks, driveways, valley gutters, gutters alley intersections shall be measured by the square foot per each type of improvement.

340.14.2 PAYMENT:

340.14.2.1 The payment for concrete curb and gutter shall be at the contract unit price and SECTION 101 per linear foot per each type of curb and gutter, complete in place, which shall include all materials, equipment and labor required in the final grading,

subgrade preparation (subgrade compaction), placing, finishing, curing, backfilling and cleanup.

340.14.2.2 The payment for concrete sidewalks, drivepads, valley gutters, gutters and alley intersections shall be at the contract unit price and SECTION 101 per square foot per each type of improvement, complete in place, which shall include all materials, equipment and labor required in the final grading, subgrade preparation (subgrade compaction), steel reinforcement (when and where required), placing, finishing, curing, backfilling and cleanup.

SECTION 701

TRENCHING, EXCAVATION AND BACKFILL

701.1 GENERAL

Trench excavation and backfill for underground utilities, sanitary sewer, storm sewer, water lines, and appurtenances shall conform to these specifications or as specified in the Supplemental Technical Specifications or as authorized, in writing, by the ENGINEER.

701.2 REFERENCES

701.2.1 ASTM:

D-422 D-698
D-1557 D-2321
D-2487 D-2922
D-3017 D-4318

701.2.2 This Publication:

Section 207
Section 301
Section 302
Section 336
Section 337
Section 340

701.3 TERMINOLOGY

701.3.1 For the purpose of these specifications in this Section, the descriptive terms "flexible," "plastic" and "non-rigid" are similarly interchangeable as utilized in these specifications and appurtenant reference material.

701.3.2 Rigid pipe: shall be reinforced concrete, concrete cylinder, and vitrified clay pipes.

701.3.3 Flexible pipe shall be polyvinyl chloride, polyethylene, ductile iron, and corrugated metal pipes.

701.3.4 Standard Detail Drawings show the trench cross-sections which identify the meaning and limits of terminology used in these specifications for the terms "foundation, bedding, haunching, initial backfill, final backfill, embedment, pipe zone, cover, springline, and pipe width."

701.3.5 The Unified Soil Classification System in ASTM D2487 Shall be utilized for the purpose of

material classifications. See Table 701.3.A for a listing of referenced soil classes.

701.4 NOTIFICATION OF FORTHCOMING WORK

701.4.1 To assure that the construction work progresses in a timely manner and that good public relations are maintained with the property owners, the following actions are considered essential:

701.4.1.1 Prior to the start of construction the CONTRACTOR shall assist the ENGINEER in notifying the adjacent property owners as to when construction will start, the estimated completion date, anticipated access blockages.

TABLE 701.3.A
EMBEDMENT SOILS CLASSIFICATIONS

SOILS CLASS	SOIL TYPE	DESCRIPTION
CLASS I SOILS*		Manufactured angular, granular material, ¼ to 1-1/2 inches (6 to 40 mm) size, including materials having regional significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells, complying to the requirements of Class II soils.
CLASS II SOILS**	GW	Well-graded gravels and gravel-sand mixtures, little or no fines. 50% or more of coarse fraction retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS II SOILS**	GP	Poorly graded gravels and gravel-sand mixtures, little or no fines. 50% or more of coarse fraction retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS II SOILS**	SW	Well-graded sands and gravelly sands, little or no fines. More than 50% of coarse fraction passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS II SOILS**	SP	Poorly graded sands and gravelly sands, little or no fines. More than 50% of coarse fraction passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS III SOILS***	GM	Silty gravels, gravel-sand-silt mixtures. 50% or more of coarse fraction retained on No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS III SOILS***	GC	Clayey gravels, gravel-sand-clay mixtures. 50% or more of coarse fraction retained on No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS III SOILS***	SM	Silty sands, sand-silt mixtures. More than 50% of coarse fraction passes No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS III SOILS***	SC	Clayey sands, sand-clay mixtures. More than 50% of coarse fraction passes No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS IV SOILS	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
CLASS IV SOILS	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays, Liquid limit 50% or less. 50% or more passes No. 200 sieve.
CLASS IV SOILS	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
CLASS IV SOILS	CH	Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
CLASS V SOILS	OL	Organic silts and organic silty clays or low plasticity. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
CLASS V SOILS	OH	Organic clays of medium to high plasticity. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
CLASS V SOILS	PT	Peat, muck and other highly organic soils.

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- * Soils are as defined in ASTM D2487, except for Class I Soil which is defined in ASTM D2321
 - ** In accordance with ASTM D2487, less than 5% passes No. 200 sieve.
 - *** In accordance with ASTM D2487, soils with 5% to 12% passing No. 200 sieve fall in a borderline classification that is more characteristic of Class II than of Class III.

701.4.1.2 Prior to the start of trenching operations, including pavement cutting and removal, the CONTRACTOR should coordinate with the ENGINEER any problem areas and involving traffic control, access to private properties, stockpiling of excavated materials, and other utility conflicts.

701.4.1.3 The CONTRACTOR shall provide the ENGINEER with the name and telephone number of at least two contact persons during non-working hours.

701.5 TRENCH SAFETY

The CONTRACTOR shall be responsible for maintaining all trenches in a safe condition; thereby protecting the workers and the general public. Trench slopes and other protection shall be in accordance with applicable regulations such as the Department of Labor's Occupational Safety and Health Administration Standards 29CFR Part 1926, subpart P *or* any applicable amendments.

701.6 BRACING EXCAVATIONS

701.6.1 Excavation for pipe shall normally be by open unsupported trenches unless local conditions warrant trench bracing.

701.6.2 Excavations shall be braced and sheeted. to provide complete safety to persons working therein and bracing shall comply with applicable Federal (OSHA), State and local laws and ordinances. Support systems for trenches in excess of 20 feet deep and adjacent to existing improvement or subject to vibrations or ground water shall be in accordance with OSHA regulations. The CONTRACTOR shall be fully responsible for sufficiency and adequacy of bracing excavations with respect to work under construction and adjacent utility lines and private property.

701.6.3 If the soil conditions within the trench area require support, the CONTRACTOR may elect to use tight sheeting, skeleton sheeting, stay bracing, trench jacks, or movable trench shield to support the trench during pipe laying operations, such as: bedding preparation, pipe laying, backfilling of haunches and initial zone.

701.6.4 No sheeting shall be permitted to remain in the trench except when, in the opinion of the ENGINEER, field conditions or type of sheeting or methods of construction used by the CONTRACTOR, warrant the supports must remain. The ENGINEER may opt to have the lower portion (within the pipe zone) of the sheeting to remain. If the CONTRACTOR plans on removing the sheeting, he shall submit method to the ENGINEER for approval to treat the void created by the removal of the sheeting within the pipe zone and below.

701.6.5 When a movable trench shield is used, the trailing half of the shield should be notched to the height of the top of the pipe. This will allow the haunch area of the pipe to be compacted properly to the wall of the trench. If the trench shield is not notched, a subtrench shall be excavated for pipe installation such that the bottom of the trench shield does not enter the pipe zone.

701.7 DEWATERING

701.7.1 Trenching and pipe laying operations may encounter standing water or ground water which would preclude the proper placing of bedding, backfilling, and laying pipe. The water shall be removed by pumps and associated equipment, such as well points, to lower the water level. Dewatering shall continue for a minimum 24 hours after placement of any concrete.

701.7.2 Dewatering operations shall remove the water to achieve a stable foundation for pipe embedment and backfilling. The ENGINEER shall determine if adequate foundation has been attained. The ground water shall be lowered to a minimum depth of 6 inches below pipe grades. Should over excavation be necessary due to unsuitable foundation conditions, the ground water shall be additionally lowered as necessary.

701.7.3 The CONTRACTOR shall submit a plan for approval by the ENGINEER as to how and where the waste water will be disposed. Waste water will not be discharged into traffic and pedestrian lanes or onto private properties.

701.7.4 The CONTRACTOR shall obtain permit from the New Mexico State Engineer prior to commencing dewatering operations.

701.7.5 The CONTRACTOR shall also responsible for any adverse effect his dewatering operation has to private property, including providing temporary water to residences and/or business necessitated by the effect on private wells.

701.7.6 The CONTRACTOR shall arrange dewatering operation in a neat and orderly manner such that access to adjacent, properties is maintained, the discharge system does not leak and that any power generation complies with applicable noise limit regulations .

701.8 REMOVAL OF EXISTING PAVEMENT SIDEWALK, AND DRIVEWAY

701.8.1 Existing concrete pavement, sidewalk, or driveway removed in connection with construction shall be replaced , neatly sawed edges. Cuts shall be neat and to true straight lines with no shatter outside the removal area. If a saw cut would fall within 30 inches of a construction joint, cold joint, expansion joint, or edge, the concrete shall removed and replaced to the joint or edge. Concrete sidewalk and/or driveway may removed so that a minimum of 30-inch square is replaced. If the saw cut would fall within 12 inches of a score mark, the score mark.

701.8.2 Existing bituminous pavement removed in connection with construction shall be cut with a saw, pavement break cutting wheel, or other suitable tool approved by the ENGINEER. Care shall taken to assure that the edge of removed pavement does not vary from a straight line more than 2 inches from r mean.

701.8.3 Saw cutting shall be 1-1/2 inches in depth or 1/4 the thickness of the pavement, sidewalk, or driveway, whichever is greater. All saw cuts or other scoring shall be made perpendicular to the surface of the material to be cut.

701.8.4 Any unnecessarily irregular breakage or cracking caused by the CONTRACTOR shall be removed and replaced by the CONTRACTOR without added expense to the OWNER.

701.8.5 The CONTRACTOR shall be responsible for the disposal of removed materials.

701.8.6 Saw cutting is required on all concrete or asphalt paving on State maintained streets or roads.

701.8.7 Paving cuts for manholes and valve boxes and other utility appurtenances shall be square and at dimensions specified the Standard Detail Drawings or on the construction plans.

701.9 MAXIMUM LENGTH OF OPEN TRENCH

In developed areas, no more than 300 feet of trench shall be opened in advance of pipe laying operations. This distance may be reduced due to traffic control considerations. Backfilling shall begin as soon as pipe is laid and inspected and shall keep pace with the pipe laying. In advance of trenching operations in undeveloped areas, the CONTRACTOR shall submit in writing or on plans for the ENGINEER'S approval, the maximum length of trench that will be open at anyone time. Except by permission of the ENGINEER, the maximum length of open trench in anyone location where concrete structures are cast in -place will be that which is necessary to permit uninterrupted progress. Construction shall be pursued as follows: excavation, formwork, and setting of reinforcing steel, placing of floor slab, walls, and cover slab or arch shall follow each other without anyone of these operations preceding the next nearest operation by more than 200 feet. Failure by the CONTRACTOR to comply with the limitations specified herein or as may be specifically authorized by the ENGINEER may result in a written order from the ENGINEER to halt progress of the work until such time as compliance with this paragraph has been achieved and the work can be proceeded in an orderly sequence of operations.

701.10 WIDTH OF TRENCHES

Trench widths will vary according to the type of pipe used, size of pipe, depth of trench, and soil conditions, The minimum width requirements, indicated below, are for proper laying, aligning and jointing of pipe as well as trench grading, bedding preparation, and backfilling.

701.10.1 TRENCH WIDTH FOR RIGID PIPE MATERIALS: Trench widths from bottom of pipe to a point 12 inches above the top of the pipe shall be kept to the practical minimum required for properly laying, aligning, grading, jointing, and backfilling of the pipe, but no less width than pipe outside diameter plus 16 inches. For stable soils which will stand a vertical cut, the maximum trench width at a point 12 inches above the top of pipe or at a point 5 feet above the bottom of the trench, whichever is less, shall be as follows:

701.10.1.1 The pipe outside diameter plus 2 feet for pipes 27 inches in diameter and smaller.

701.10.1.2 1.6 times the nominal diameter for pipes 30 inches in diameter or larger.

701.10.1.3 When soil will not stand vertical. the trench sides shall be sloped to provide not less than the outside diameter plus 16 inches at the pipe invert.

701.10.2 TRENCH WIDTH FOR NON-RIGID PIPES: The minimum clear width of the trench measured at the springline of the pipe should be 1 foot greater than the outside diameter of the pipe. The maximum clear width of the trench at a point 1 foot above the top of the pipe is equal to the pipe outside diameter plus 2 feet. If the maximum recommended trench width must be exceeded *or* if the pipe is installed in a compacted embankment, then pipe embedment should be compacted to a point of at least 2-1/2 pipe diameters from the side of the pipe or to the trench walls.

701.11 ROCK EXCAVATION

701.11.1 Rock is defined as material which cannot be excavated without drilling and blasting. All stone or boulders less than 8 cubic feet in volume will be classified as earth; all larger boulders shall be classified as rock. If blasting is necessary to excavate such materials as shale, hardpan, soft sandstone, cemented gravel, or loose rock which normally can be classified as earth excavation, then this excavation shall be classified as rock excavation. Whenever a ledge of solid rock encountered with earth below it or where alternate layers of solid rock and earth occur, the earth shall be included in the allowance for rock when the thickness of the layer of earth is less than 12 inches, thus requiring it to be removed by blasting along with the ledges of rock. Blasting will be considered necessary when the soil and rock cannot be excavated at a rate of 50 cubic yards per hour by a competent operator with a back-hoe that has a minimum bucket curling force of 25,000 pounds (John Deere 690 or equivalent).

701.11.2 Whenever rock is encountered in the trench or elsewhere in any excavation required to be made, it shall be excavated to the line and grade as shown on the plans and within the limits described therein, unless otherwise authorized, in writing, by the ENGINEER.

701.11.3 For trenches, rock shall be excavated to a depth of 6 inches minimum below the outside bottom of the conduit except at points of rock and earth transitions at which points the rock shall be

excavated to a minimum of 12 inches below the outside bottom of the conduit as shown on the detail sheets for trench cuts and backfill of rock. Any depression in the bottom of the trench caused by overshoot and/or excavating and being 6 inches or greater in depth from a theoretical bottom of trench grade shall be filled to the theoretical bottom of the trench with select soils. The trench shall be backfilled with select backfill material to a point 1 foot above the top of the conduit. The remainder of the trench shall be backfilled as specified herein. The complete trench backfill from the bottom through to the top of the subgrade shall meet the compaction and/or moisture requirements as specified herein.

701.11.4 BLASTING: Suitable weighted covering or mats shall be provided to confine all materials lifted by the blasting within the limits of the trench and to prevent injury of persons or damage to property. Blasting shall be under the supervision of a person qualified and experienced in the use and handling of explosives. All blasting operations shall be done in accordance with applicable local, state, and federal laws, ordinances, and codes regulating the transportation, storage, and use of explosives. Forty-eight hours prior to blasting operations, the CONTRACTOR shall notify the local law enforcement agency.

701.12 FOUNDATION

701.12.1 All pipe shall be bedded on a stable foundation in a trench which is completely free of water. The ENGINEER shall determine the adequacy of the foundation. Class V soils shall not be used as a foundation. If Class V soils are encountered at the bottom of the trench it shall be removed to the depth authorized by the ENGINEER and replaced with Class I, II or III soils.

701.12.2 Where an unstable foundation condition is encountered, it must be stabilized before laying pipe or alternative foundation methods utilized. The CONTRACTOR will be paid for foundation stabilization when required by the ENGINEER. Failure to notify the ENGINEER of an obvious unstable foundation condition prior to proceeding with placement of the pipe shall result in complete removal of the affected pipe, foundation stabilization, and replacement of the pipe at the CONTRACTOR'S expense.

701.12.3 Should the trench be inadvertently over-excavated below the foundation, the area of over-excavation shall be filled with select material in 6 inch lifts and compacted to a density of not less than 95 percent of maximum density, as determined by ASTM D 1557.

701.12.4 Unless specifically approved in writing by the ENGINEER, the CONTRACTOR shall not proceed with pipe embedment in a trench where water is present or the foundation is saturated. Adequate dewatering, as specified in Section 701.7, shall be utilized.

701.13 PIPE EMBEDMENT

701.13.1 GENERAL:

701.13.1.1 The class of bedding used for each pipe shall be as shown on the plans or as specified in the Supplemental Technical Specifications.

701.13.1.2 The CONTRACTOR may request a change in the class of bedding required on a pipe, if authorized by the ENGINEER, all increase in the cost of labor and materials required to include upgrading of the pipe class will be at the CONTRACTOR'S expense with no additional cost to the OWNER.

701.13.2 RIGID PIPE EMBEDMENT:

701.13.2.1 The trenches shall be excavated in conformance with the trench width requirements in Section 701.10 and 701.5.

701.13.2.2 Embedment material shall be Class I, II, III, or IV soils, or lean fill as specified in Section 207.

701.13.2.3 All soil in the embedment zone shall be placed in lifts not exceeding 8 inches in uncompacted depth, except that material along the side of the pipe shall not be placed above the springline until the haunch area of the pipe is adequately filled and sliced such that no voids remain.

701.13.2.4 All soil shall be compacted to a density not less than 90 percent of maximum density, as determined by ASTM D 1557. The CONTRACTOR shall take care to assure that the pipe is not damaged or misaligned during compaction of the embedment.

701.13.3 FLEXIBLE PIPE EMBEDMENT:

701.13.3.1 Proper placement of soils in the embedment zone is extremely important in achieving a satisfactory installation of flexible pipe. The CONTRACTOR shall be aware that the soil classes have differing requirements relative to embedment. There are also differing requirements for embedment in dry and wet conditions (wet conditions meaning that the embedment zone will be subject to ground water).

701.13.3.2 Embedment material shall be Class I, II, or III soils, or lean fill as specified in Section 207.

701.13.3.3 Embedment soil shall be placed in lifts not exceeding 8 inches loose depth. The haunch shall be properly compacted by hand tampers utilizing due caution such that the pipe is not damaged or misaligned. Mechanical tampers shall not be utilized directly over the pipe in the embedment zone.

701.13.3.4 The CONTRACTOR may utilize acceptable on site soils in the embedment area which are in conformance with these specifications. The CONTRACTOR has the option of importing a different soil, however, additional compensation will only be allowed if the on site soils are Class IV or V.

701.13.3.5 Class I soil shall comply with the requirements of Section 302, AGGREGATE BASE COURSE.

701.13.3.6 Class II and III soils shall be compacted to a density of not less than 95 percent of maximum density in the embedment area, as determined by ASTM D 1557. The moisture content shall not exceed 5 percent above optimum.

701.14 FINAL BACKFILL

701.14.1 Final backfill shall consist of homogeneous soil except that boulders, frozen clumps, rubble, and Class V soils are excluded.

701.14.2 Final backfill shall be compacted to a density of not less than 90 percent of maximum density, as determined by ASTM D 1557 unless otherwise specified in the Contract Documents.

701.14.3 The upper portion of the final backfill may require specific soils and compaction in order to provide a suitable foundation for pavements, curb and gutter, sidewalk, or other type of structure.

701.15 COMPACTION METHODS

701.15.1 The CONTRACTOR shall be responsible for the compaction method utilized during foundation preparation, embedment placement, and final backfill except as otherwise specified herein or in the Supplemental Technical Specifications.

701.15.2 The use of mechanical vibratory compactors directly over the pipe is prohibited in the embedment area. Extreme care shall be taken when utilizing mechanical compactors in the haunch and initial backfill area in order to avoid damage to or misalignment of the pipe. The ENGINEER shall examine any damaged pipe and has the authority to

direct that it be replaced with new pipe at no additional cost to the OWNER.

701.15.3 Flooding or jetting shall be allowed if the subsurface soils are compatible to its usage, as authorized by the ENGINEER. It shall not be used for compaction of flexible pipe, when the soil has a plastic limit of 7 or greater, and in areas of collapsible soils. The CONTRACTOR shall take any necessary precautions to minimize to negligible flotation of the pipe.

701.15.4 The CONTRACTOR shall, at the direction of the ENGINEER, excavate the compacted fill as necessary for the purpose of determining the adequacy of the compaction.

701.16 PAVEMENT

701.16.1 Either new street construction or pavement replacements shall satisfy the following design and construction requirements:

701.16.1.1 Unless permanent pavement is specified to be placed immediately, a temporary dust-free patch shall be placed wherever excavation is made through existing pavements, sidewalks, or driveways. The patch shall be placed, rolled, and maintained by the CONTRACTOR to provide a smooth surface for traffic until a permanent pavement is constructed within the time frame specified by the ENGINEER.

701.16.1.2 The subgrade preparation of the area to be paved shall be in accordance with Section 301 of these specifications. The asphalt pavement placed shall be in accordance with Section 336 and the concrete pavement shall be in accordance with Section 337. The placement of the other roadway items shall be in accordance with Section 340.

701.16.1.3 Material thickness for all pavement replacements within residential or arterial streets shall conform to the plans or the Standard Detail Drawings or match the existing pavement as authorized by the ENGINEER.

701.16.1.4 Pavement cuts of 8 ft. or more in width and 100 ft. or more in length shall be paved with a laydown machine.

701.16.1.5 When authorized by the ENGINEER, asphalt concrete base course may be used to replace surface course thickness requirements on streets that are scheduled for overlay.

701.16.1.6 The edges of all trenches at the base course level shall be neatly trimmed before

beginning any paving replacement. All edges of the existing pavement adjacent to the trench cut shall be inspected. Undermined, broken, cracked, or unevenly cut portions shall be removed and the pavement edges retrimmed prior to pavement replacement. All vertical edges of the existing asphalt pavement adjacent to the trench cut and all surface areas for a width of at least 4 inches and no greater than 8 inches, shall be thoroughly cleaned and a tack coat applied prior to placing any hot mix asphalt. The finished surface of the pavement replacement shall be graded to conform to the existing contour both in cross section and profile.

701.16.1.7 Concrete pavement to replace cuts made in concrete paved streets, arterials, etc., shall conform to the Standard Detail Drawings for concrete pavement or in accordance with New Mexico Department of Transportation requirements where applicable.

701.16.1.8 When more than one-half of the surface area of a manhole, lamphole or valve box is found to extend into the area to receive a permanent asphaltic hot-mix surfacing and/or base pavement replacement, the existing pavement surrounding the manhole, lamphole, or valve box shall be removed to within those limits which will permit a permanent pavement replacement to be made in accordance with the approved plans.

701.16.1.9 Asphaltic hot mix shall not be placed upon the concrete collar, nor shall traffic be permitted upon the collar for at least 24 hours, or longer, if so directed by the ENGINEER. A tack coat of asphaltic emulsion may be applied after the concrete has taken its final set. During this time adequate barricading of the area shall be maintained by the CONTRACTOR.

701.16.1.10 If in the course of a pavement removal, a manhole, lamphole, and/or valve box is encountered and has a concrete collar about it and the collar is performing adequately, no special construction need be made in the permanent pavement replacement.

701.16.1.11 The CONTRACTOR shall make any small grade or alignment adjustment of the manhole, lamphole, and/or valve box encountered that is necessary to provide a smooth riding surface between the existing pavement and the patch and/or within the patch itself.

701.16.1.12 TESTING

701.16.1.12.1 A sample of each type of soil encountered shall be classified in accordance with

the requirements of ASTM D2487, and the moisture density relationship determined in accordance either ASTM D698 or D1557, whichever is applicable.

701.16.1.12.2 A compaction test shall be taken for each 2 feet depth per 200 feet trench length or less, as directed by the ENGINEER. Compaction tests shall be taken in accordance with ASTM D2922 and D3017. Areas represented by non-complying tests shall be reworked and re-tested for compliance.

701.17 MEASUREMENT AND PAYMENT

701.17.1 TRENCHING, BACKFILLING, AND COMPACTION:

701.17.1.1 Trenching, backfilling, and compaction shall be combined into one unit and shall be measured and paid for as follows:

701.17.1.2 Measurement shall be made along the centerline of the pipe.

701.17.1.3 The unit of measurement shall be by the linear foot *per* pipe diameter per specified increment of depth.

701.17.1.4 The following depth increments will apply:

701.17.1.4.1 For water line installations the costs for trenching, backfilling and compaction shall be included in the unit price per linear foot of pipe per pipe diameter for maximum depth, such as: 4 to 14 inch diameter at 6 feet, 16 to 24 inch diameter pipe at 7 feet and all pipe larger than 24 inch at 8 feet. Separate payment will be specified in the Bid Proposal when required depths exceed the above depths.

701.17.1.4.2 For sewer installations the increments shall be 8 feet or less, 8 feet to 12 feet, 12 feet to 16 feet, 16 feet to 20 feet and thereafter at 4 foot intervals.

701.17.1.4.3 All depths shall be measured to the nearest foot.

701.17.1.5 All depths shall be measured from the invert of the pipe to the top of existing ground elevation. The existing ground elevation shall be the elevation of the surface that exists along the centerline of the pipe at the time of construction staking for said trenching.

701.17.1.5.1 Whenever a special pipe embedment detail is specified, on the plans, the trench depth shall be measured from the bottom of the embedment to the top of existing ground elevation.

However, no additional trench depth shall be measured as a result of inadvertent over-excavation nor to accommodate trench dewatering.

701.17.1.6 Payment will be made at the unit price per linear foot per diameter of pipe per depth increment as specified in the Bid Proposal, and will include trenching, backfilling, and compaction for all trench zones. No additional payment will be made for compacted materials to bring trench backfill up to required depth.

701.17.2 OVER-EXCAVATION: Required over-excavation for foundation stabilization shall be measured by the cubic yard of material removed and replaced with compacted suitable material. Payment will be made at the unit price per cubic yard of compacted replacement material and shall include excavation, backfill material, and compaction.

701.17.3 ROCK EXCAVATION: Rock excavation will be measured by the cubic yard within the specified limits of the trench configuration. Blasting will be included in the rock excavation. Payment will be made at the unit price per cubic yard.

701.17.4 UNSUITABLE MATERIALS: Removal and disposal of unsuitable materials from the construction site shall be measured by the cubic yard of excavated material. Payment will be made at the unit price per cubic yard of excavated material.

701.17.5 PAVEMENT, SIDEWALK, AND DRIVEWAYS: Removal and disposal of existing pavement, sidewalks, and driveways will be measured by the square yard or square foot whichever is apropos. Payment will be made at the unit price per square yard or square foot as specified in the Bid Proposal.

701.17.6 SELECT MATERIALS: Where selected material is required in the backfilling operations, the quantity of material will be measured by the cubic yard of compacted material in place in the trench. Payment will be made at the unit price per cubic yard of select material as indicated above.

701.17.6.1 Whenever a special pipe embedment detail is specified, measurement and payment shall be as identified in the Bid Proposal.

701.17.7 DEWATERING: Dewatering operations for trench work shall be measured by the linear foot along the center-line of that portion of the trench which requires dewatering. Payment will be made at the unit price per linear foot of dewatered trench.

701.17.8 PAVEMENT:

701.17.8.1 Permanent or temporary pavement surfacing shall be measured and paid for in accordance with the paving section elements as defined under Section 300 for the specific item of work.

701.17.8.2 Permanent resurfacing or permanent surface patching will be measured on the basis of the square yard for new surfacing as provided in the applicable section of these specifications. For payment purposes, the normal maximum pavement cut width shall be as defined in the Table No. 701.17.8.2

TABLE No. 701.17.8.2

NORMAL MAXIMUM PAVEMENT CUT WIDTHS ALLOWED FOR PAYMENT PURPOSES

Soil Stability	Trench Depth (TD)	Pipe Size	Max. Pavement Cut Width
Stable. Soil stands in a vert. cut	Less than or equal to 5 feet	ND less than or equal to 27"	00 + 2 feet
"	Greater than 5'	ND less than or equal to 54"	TD + 2 feet
"	"	ND greater than 54"	1.6 X ND + TD + 3'
Unstable. Soil does not stand in vert. cut	Any	Any	2 X TD + OD

- NOTES: 1. TD is trench depth; ND is nominal pipe diameter; and OD is outside pipe diameter.
2. Individual locations or conditions may warrant greater cut widths than those specified above. The ENGINEER shall authorize in writing the increase in the above pavement cut widths.

SECTION 801

INSTALLATION OF WATER TRANSMISSION, COLLECTOR AND DISTRIBUTION LINES

801.1 GENERAL

The water facilities and materials, specified herein, are associated with water transmission, collector and distribution lines.

801.2 REFERENCES

801.2.1 American Water Works Association
(Latest Edition) (AWWA):

C110 American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids

C203 Coal-Tar Protective Coatings and Linings for Steel Water Pipelines -Enamel and Tape-Hot-Applied

C206 Field Welding of Steel Water Pipe

C207 Steel Pipe Flanges for Waterworks Service-Sizes 4 in. through 144 in.

C502 Dry Barrel Fire Hydrants

C504 Rubber-Seated Butterfly Valves

C509 Resilient-Seated Gate Valves for Water and Sewerage Systems

C600 Installation of Ductile-Iron Water Mains and Their Appurtenances

C651 Disinfecting Water Mains

C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution

C905 Polyvinyl Chloride (PVC) Water Transmission Pipe Nominal Diameter 14 in. through 36 in.

C909 Molecular Oriented Polyvinyl Chloride (PVCO), Pressure Pipe 4" - 12" for water distribution.

M9 Concrete Pressure Pipe

M23 PVC Pipe-Design and Installation

801.2.2 This Publication:

SECTION 121 PLASTIC PIPE

SECTION 127 STEEL WATER PIPE

SECTION 128 CONCRETE CYLINDER PIPE

SECTION 129 DUCTILE IRON PIPE

SECTION 130 GRAY IRON AND DUCTILE IRON FITTINGS

SECTION 340 PORTLAND CEMENT CONCRETE CURBS, GUTTERS, WALKS, DRIVEWAYS, ALLEY INTERSECTIONS, SLOPE PAVING, AND MEDIAN PAVING

SECTION 343 REMOVAL AND DISPOSAL OF EXISTING PAVEMENT, CURBS, GUTTERS, SIDEWALKS & DRIVEPADS

SECTION 701 TRENCHING, EXCAVATION AND

BACKFILL

SECTION 1502 SUBMITTALS

801.3 MATERIALS:

801.3.1 GENERAL:

801.3.1.1 The CONTRACTOR shall submit certification from the manufacturer of the pipe as specified in Section 1502 as to the pipe material and that the pipe meets or exceeds the required testing. Only pipe manufactured in the United States of America will be acceptable.

801.3.1.2 Main line pipe and fittings shall be as specified in the Reference Section in this publication as listed above or as specified in the Supplemental Technical Specifications and/or as authorized by the ENGINEER.

801.3.2 PIPE:

801.3.2.2 Limitations of pipe materials versus pipe sizes will be as follows, unless otherwise specified on the plans or Supplemental Technical Specifications:

<u>Pipe Type</u>	<u>Sizes</u>
Ductile Iron	3" thru 64"
Concrete Cylinder(AWWA C303)	16" and larger
Plastic (PVC)	4" thru 20"
Welded Steel Pipe (AWWA 200)	16" and larger

801.3.2.3 The type of pipe used shall be approved by the ENGINEER. Steel pipe will be used only where specified on the drawings. All pipe shall be of domestic manufacture and origin. Unless otherwise approved by the ENGINEER, all pipe installed shall be identical from valve to valve.

801.3.3 GATE VALVES:

801.3.3.1 Gate valves shall only be used for pipe sizes of 12 inches and smaller, unless otherwise noted on the plans or in the Supplemental Technical Specifications.

801.3.3.2 Resilient seat gate valve shall be used and shall conform to AWWA C 509. The gate valve shall be a non-rising stem type with inside screw and "O" ring seals. The valve shall have a standard hub which opens counter-clockwise. Type valve ends shall be mechanical joints, unless otherwise specified on the plans. "O" ring retainer shall be

secured with nuts and bolts.

801.3.3.3 The resilient seat shall be mechanically retained or bonded on the valve gate (wedge disc).

801.3.3.4 All brass or bronze parts used on gate valves shall comply with AWWA C 509.

801.3.3.5 The outside of the valve body shall be painted with coal tar enamel or corrosion-resistant coating. The inside shall be protected with corrosion resistant coating, approved for potable water.

801.3.3.6 The valve stem shall comply with AWWA C 509. The material for the valve stem shall be brass or bronze, and shall have a minimum yield strength of 20,000 psi and minimum tensile strength of 60,000 psi.

801.3.3.7 Gate valves shall have a 2 inch square operating hub nut. Gate valves in vaults with valve covers at ground level shall have a handwheel with the 2" nut welded to the center.

801.3.3.8 Maximum input torque to open and/or close the valve shall be 200 foot pounds for a 4-inch valve and 300 foot pounds for 6-inch under a working pressure of 200 psi.

801.3.3.9 No Project will be accepted by the OWNER until all valves are operational and accessible.

801.3.3.10 Before the Work will be accepted, the CONTRACTOR shall provide the ENGINEER with a completed "Water Valve Data Card", as shown on Pages 801-5 and 801-6. The ENGINEER shall forward the card to OWNER.

801.3.4 RUBBER SEATED BUTTERFLY VALVES:

801.3.4.1 Butterfly valves will be used for sizes of 14 inches and larger, and shall comply to AWWA C 504.

801.3.4.2 Only short body, Class 150B valves are acceptable. Wafer type valves are not acceptable. Valve ends may be either mechanical joint or flanged.

801.3.4.3 The rubber seat shall be field replaceable on valve sizes 24 inches and larger. The rubber seat may be mechanically retained or bonded on the disc or valve body.

801.3.4.4 Butterfly valves shall have a 3 inch square operating hub nut. Butterfly valves in vaults with valve covers at ground level shall have a handwheel with the 3" nut welded to the center.

801.3.4.5 The valve shaft and disc shall be installed horizontally. The valve disc shall pivot and rotate on the horizontal axis.

801.3.4.6 The maximum input torque to open and/or close the valve shall not exceed 150 foot pounds under a minimum working pressure of 150 psi, and the butterfly operator shall be compatible with this pressure. Maximum operating torques shall be in accordance with AWWA C 504, Table 1, Class 150B. The manufacturer of the valve shall be responsible for the operator.

801.3.4.7 No project will be accepted by the OWNER until all valves are operational and accessible.

801.3.4.8 Before the Work will be accepted, the CONTRACTOR shall provide the ENGINEER with a completed "Water Valve Data Card," as shown on pages 801-5 and 801-6. The ENGINEER shall forward the card to the OWNER.

801.3.5 VALVE BOXES: Valve boxes shall consist of Polyvinyl Chloride (PVC) C-900, or High Density Polyethylene Pipe, (HDPE), with corrugated exterior and smooth interior pipe cut to accommodate the required depth. No joints shall be allowed. Pipe diameter shall be 10 inches for valves in paved areas to accommodate the cover and lid specified here-in. The pipe shall be centered and placed true to vertical around the axis of the operating nut. Valve covers and lids for re-use water shall be different than those used for potable water, and shall be as shown on re-use project construction plans.

801.3.6 COMBINATION AIR AND VACUUM VALVES: Air and vacuum valves shall be the type and size shown on the plans.

801.3.7 FIRE HYDRANTS:

801.3.7.1 Fire hydrants and their extensions shall be in accordance with AWWA C 502, traffic type. Fire hydrants shall have one 5 1/4 inch diameter valve opening; 6 inch mechanical joint inlet connection; two 2 1/2 inch hose nozzle connections; and one 4 1/2 inch steamer nozzle with National Standard Fire Hose Coupling Screw Threads. Fire hydrants shall have a bronze or cast iron, pentagon, operating nut, be designed for 150 psi. working pressure service, and have a normal bury of 4 to 4 1/2 feet unless field conditions require a deeper bury, in which case extensions will be used so as to bring the bottom of the break-off flange 2 to 8 inches above the top of finish grade.

801.3.7.2 The pipe fittings and fire hydrants starting at the street main and ending at the fire hydrant itself shall be lying in a line perpendicular to the street's centerline or radially on a curvilinear installation. Fire hydrants shall have no more than 1/2 inch variation from a vertical line between the breakaway flange and the top of the fire hydrant.

801.3.7.4 Hydrants shall be dry barrel, post-type with compression main valve closing with pressure. They shall have a field lubrication capability. Hydrants shall have a bronze seat ring threaded into a bronze drain ring or bronze or cast iron bushing.

801.3.7.5 Exterior of hydrant, below the ground line, shall be coated with asphalt varnish, and the exterior painted from the top to a point one foot below the ground level flange, consisting of one coat rust inhibitive primer and one coat "chrome yellow" enamel. The bonnet shall then be painted with a reflectorized paint using a color as close to "chrome-yellow" as possible.

801.3.7.6 The bottom plate of the main valve shall be epoxy coated. The shoe of the fire hydrant shall have a 6-inch mechanical joint connection and the inside shall be epoxy coated to prevent corrosion. The nozzle shall be threaded in place and retained by stainless steel locks. Hydrant body shall be threaded to receive the threaded nozzle. Nozzle shall be secured by a stainless steel locking device.

801.3.7.7 Fire hydrant shall contain two drain outlets. The drain outlets shall be constructed of bronze. Hydrant shall be provided with a pentagon operating nut to open counter clockwise and shall have an anti-friction washer between the hold-down nut and the operating nut.

801.3.7.8 To prevent loss of brass operating nuts due to theft or vandalism, the following shall be included in or on the fire hydrant:

801.3.7.8.1 Attach OWNER approved anti-theft device to the hydrant; or

801.3.7.8.2 The bonnet must be removed in order to remove the operating nut; or

801.3.7.8.3 Use a cast iron operating nut.

801.3.7.9 Fire hydrants shall be installed at locations as shown on construction plans and in accordance with Standard Detail Drawings.

801.3.7.10 Fire hydrants shall be properly restrained in accordance with Section 130. If mechanical restraint is used, each joint on the hydrant leg shall also be restrained.

801.3.8 PRESSURE REDUCING VALVE (PRV): Pressure reducing valve shall be a globe pattern, flanged end, pressure Class 125. Submittals for approval shall be made to the ENGINEER and approval must be received before installation. The following items are required in the PRV:

801.3.8.1 Materials:

801.3.8.1.1 Main valve-cast iron with brass trim.

801.3.8.2 Pilot Control System:

801.3.8.2.1 Adjustment from 15 psi to 75 psi.

801.3.8.2.2 Shut-off cock on all pilot control system lines.

801.3.8.2.3 Inlet flow strainer.

801.3.8.2.4 Closing speed control.

801.3.8.2.5 Opening speed control.

801.3.8.2.6 Flow stabilizer.

801.3.8.2.7 Tubing shall be copper.

801.3.8.3 Installation shall be as per the construction plans. ENGINEER shall determine final settings on PRV.

801.3.8.4 Before the Work will be accepted, the CONTRACTOR shall provide the ENGINEER with a "Water Valve Data Card". The ENGINEER will forward the card to the OWNER.

801.3.9 TAPPING SLEEVES: (For other than Concrete Cylinder Pipe) For either taps greater than 2/3 line size, or size on size taps 12 inches or less, only approved, long body, fully gasketed tapping sleeves shall be allowed. During installation of the tapping sleeve, the pipe shall be fully supported to support the weight of the tapping sleeve and tapping machine.

801.3.9.1 Tapping sleeves of heavy welded steel bodies shall meet the following requirements:

801.3.9.1.1 Epoxy coated.

801.3.9.1.2 Bolts and nuts to be stainless steel.

801.3.9.1.3 Gaskets to be Buna-N rubber.

801.3.9.1.4 Flange to be flat face steel and comply with AWWA C-207.

801.3.9.1.5 Class D-ANSI 150 lbs. drilling.

801.3.9.1.6 Designed to sustain an operating pressure of 150 psi.

801.3.9.1.7 May be used on all water mains, 4" and larger.

801.3.9.2 Tapping sleeves of cast iron bodies shall meet the following requirements:

801.3.9.2.1 Mechanical joint type with a working pressure of 200 psi .

801.3.9.2.2 Outlet flange to be Class 125, ANSI B16.1.

801.3.9.2.3 Sleeves to include side and end gaskets of Buna-N rubber.

801.3.9.2.4 Eight high strength steel bolts and nuts to secure the halves of the sleeve to the pipe.

801.3.9.2.5 May be used on all water mains, 4" and larger.

801.3.9.3 Tapping sleeves of short sleeve cast iron shall meet the following requirements:

801.3.9.3.1 Working pressure of 150 psi.

801.3.9.3.2 Outlet flange to be Class 125, ANSI B16.1.

801.3.9.3.3 Outlet half to have an enclosed gasket in a groove for a pressure seal.

801.3.9.3.4 Four high strength steel bolts to secure halves of tapping sleeve to the pipe.

801.3.9.3.5 May be used on all water mains, 4" and larger.

801.4 WATER VALVE DATA CARD: Water Valve Data Card, as shown on pages 801-5 and 801-6 shall be prepared for all types of valves (Gate Valves, Butterfly Valves, Pressure Reducing Valves, Air Release Valves, etc.) according to the following instructions.

801.4.1 A Water Valve Data Card will be prepared for each valve installed.

801.4.2 The Valve Number will be assigned by the OWNER at a later date.

801.4.3 Valve Size is the nominal diameter of the valve, i.e., 6-inch, 14-inch or 48-inch. In the case of

compound valves give size of main valve and bypass valve, i.e., 24-inch and 4-inch, or 36-inch and 6-inch.

801.4.4 Valve Type is the general description of the valve, such as: Resilient-Seal Gate Valve, Butterfly Valve, Globe Valve, Check Valve, etc.

801.4.5 Make and Model refers to the manufacturer, make and model number to identify the valve for replacement parts. This information should be available from the shop drawings.

801.4.6 Number of Turns and Direction to Open is the number of revolutions of the operating nut to make the valve travel from fully closed to fully open, and the direction is either clockwise or counterclockwise, i.e., 54 turns counterclockwise. All standard valves shall open counterclockwise. Operation, turn count, and direction to open will be verified by the ENGINEER prior to installation.

801.4.7 Under Project Name is the assigned work order number.

801.4.8 Date Warranty Expires is the expiration date, under the contract, for requiring warranty repairs.

801.4.9 Street Location: Give both Block number and street name. For valves in intersections give both streets, i.e., 5200 San Mateo Blvd. NE and 3000 Candelaria NE.

801.4.10 The section on coordinate location shall be completed with information furnished by the ENGINEER.

801.4.11 All applicable items on the "Water Valve Data Card" should be filled in. However, accuracy is more unknown and cannot be determined, leave the space blank.

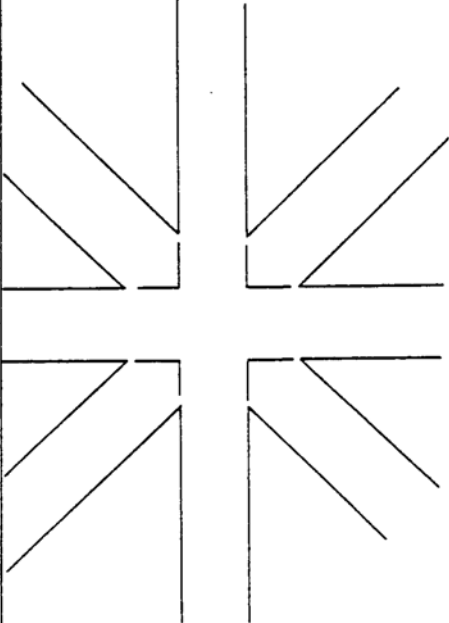
801.4.12 Depth to "Operator" is vertical distance from the top of actual valve operating nut to top of valve box cover.

801.5 FIRE HYDRANT DATA CARD
Fire Hydrant Data Card, as shown on page 801-8 shall be prepared for all installations of fire hydrants, according to the following instructions.

[illegible]

801-5

CARD NO. 801.4
 WATER VALVE DATA CARD
 (Reverse Side)

		REFERENCE SYMBOLS - SUBJECT VALVE - OTHER VALVE (S) - PRESSURE REDUCING VALVE - AIR RELIEF VALVE - FIRE HYDRANT - LINE VALVE IS FOR - OTHER WATER LINES
		COORDINATES OF LID X - Y - Z -

INDICATE NORTH
 BY ARROW



801.5.1 Fire hydrant number will be assigned by the OWNER at a later date.

801.5.2 Fire hydrant type refers to the manufacturer's make and model.

801.5.3 Location. Indicate both block number and street name. At intersections indicate both street names.

801.5.4 Date installed. Indicate actual date the hydrant was installed.

801.5.5 Depth. Indicate the actual depth in feet of the lower barrel of the fire hydrant. This depth is measured from the shoe to the break-away flanges of the hydrant.

801.5.6 On the reverse side of the card indicate the location of fire hydrant on the sketch.

801.6 WATER LINE CONNECTIONS

801.6.1 GENERAL : All new water line tie-ins to the existing water system shall be directly inspected and approved by the ENGINEER. This includes non-pressurized or pressurized connections that will result in extension of the existing system.

801.7 LOCATIONS OF WATER MAINS AND SEWER LINES

801.7.1 Unless otherwise authorized by the ENGINEER, parallel water and sewer lines shall be installed at least 10 feet apart horizontally, and the water line shall be at a higher elevation than the sewer. Separate trenches will be required in all cases (this shall be effective even though one line has been installed prior to the other), and the water line shall be at least 18 inches above the sewer; when water and sewer lines cross each other, the water line shall be at least 18 inches above the sewer; otherwise the sewer shall be of pressure class pipe extending between manholes, or concrete encased for 10 feet on each side of the water line as shown in the Standard Detail Drawings. The crossings shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints.

801.7.2 Water mains shall not be constructed under walkways, sidewalks, curbs and gutters, driveways, or similar concrete structures by tunneling underneath them. Trenchless technologies may be allowed with prior approval by the OWNER. The CONTRACTOR will cut these structures by using a concrete saw or, at his option, he may remove and replace the section of the concrete

structure to the nearest full expansion joint or edge.

801.8 TRENCHING AND BACKFILLING

801.8.1 All trenching and backfilling shall be in full accordance with Section 701. The minimum cover over distribution lines shall be 3 feet, and 4 feet of cover over transmission and collector lines.

801.9 GENERAL INSTALLATION ITEMS

801.9.1 Trenching, bedding, and backfilling shall comply with the requirements set forth in Section 701.

801.9.2 Pipe and accessories shall be new and unused and shall be handled in such a manner as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. No other pipe or material of any kind shall be placed inside of a pipe or fitting after the coating has been applied.

801.9.3 The interior of the pipe shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during operations by plugging or other approved methods. When work is not in progress, open ends of pipes and fittings shall be securely closed so that no other substances will enter the pipes or fittings. Any section of the pipe found to be defective before or after laying shall be replaced with sound pipe without additional expense to the OWNER.

801.9.4 All nuts and bolts utilized in underground pipe connections shall be stainless steel, high strength cast iron or high grade, high strength steel. The full length of each section of pipe shall rest solidly upon the bed, with recesses excavated to accommodate bells and joints. Any pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipes shall not be laid in water or when trench or weather conditions are unsuitable for the work except by as authorized by the ENGINEER. All unconnected ends of pipes shall have a valve, plug, or cap installed on it.

801.9.5 Pipe shall be laid to line and/or grade shown on the plans or as staked in the field. Changes in horizontal or vertical alignment of the pipe at a joint shall not exceed the manufacturer's recommended deflection for the type and size pipe being laid. When the change required is more than the recommended deflection, a fitting or several short joints of pipe shall be used. PVC pipe may not be deflected at the joints.

CARD NO. 801.5
FIRE HYDRANT DATA CARD

FIRE HYDRANT NUMBER																												
INSP.																												
REP.																												
CREW																												
DATE																												

TYPE	LOCATION
DATE INSTALLED	VALVES TO CLOSE FOR REPAIRS
DEPTH	REMARKS

FRONT SIDE

REVERSE SIDE

801.9.6 When new pipe is to be connected to an existing pipe or when crossing an existing pipe line, the CONTRACTOR shall excavate the existing lines well in advance of the laying of the new pipe line to enable the ENGINEER to verify their elevation and placement and to make any changes in grade and/or alignment of the new pipe line that may be required.

801.9.7 On all push-on-joints (bell and spigot, fluid-tite, and ring-tite) the rubber gasket shall be removed, cleaned, the groove cleaned, the gasket replaced, and the bell or plain end cleaned before jointing. The gasket and the bell or plain end of the pipe to be jointed shall both be lubricated with a suitable soft vegetable soap compound to facilitate jointing. Care shall be taken to insure that neither the bell or collar, or the pipe being jointed is damaged as it is being pushed home.

801.9.8 Flanged and mechanical joints shall be made with machine bolts and nuts of the proper size only. All components of these types of joints shall be cleaned before jointing. Only one (1) gasket will be permitted in a flange joint. In a mechanical joint the plain end pipe shall be fully seated before the gasket and gland is slipped up to the bell. Nuts on both types of joints shall be tightened by alternating nuts 180 degrees apart. The CONTRACTOR shall be responsible for assuring that proper torque is achieved and shall have a torque wrench available for verification by the ENGINEER.

801.9.9 When laying PVC pipe, a metalized detectable warning tape shall be installed a minimum of 1 foot above the top of pipe and 3 to 6 feet below the final surface. The tape shall be detectable with a standard metal pipe locator. The color of tape shall be safety precaution blue and will be inscribed at 10-foot intervals with the words, "CAUTION BURIED WATER LINE BELOW." Tape shall be 2 inches wide. The tape shall be constructed of material that is impervious to alkalis, acids, chemical reagents, and solvents found in the soils.

801.9.10 When laying pipe, Electronic Marker Disks (EMDs) shall be installed in accordance with Section 170.

801.10 SPECIFIC PIPE LAYING REQUIREMENTS

801.10.1 Ductile iron pipe shall be installed in accordance with AWWA C 600 and as herein specified.

801.10.2 Steel pipe shall be installed in accordance with AWWA C 206 for welded joint and as herein specified. All field welded joints shall have one coat of coal-tar enamel of 3/32 inch thickness.

801.10.3 Plastic pressure pipe shall be installed in accordance with AWWA M 23 and C 900 and/or manufacturer's printed recommendations, whichever is applicable. Where a conflict arises with this Specification, this Specification shall control. Trenching, embedment and backfill shall be specified in Section 701. A reference mark (a distinct circumferential line) is placed on the pipes spigot by the manufacturer to indicate the correct depth of the spigot penetration into the pipes gasket joint. If the pipe is seated too deep or too shallow, the pipe may buckle or separate due to thermal expansion/contraction, therefore particular attention must be exercised when jointing pipe. The reference mark must be showing and not farther than 1/2" from the leading edge of the bell. The CONTRACTOR shall verify that the manufacturer's reference mark is correct per manufacturer's literature.

801.10.4 All welded steel and concrete cylinder pipe shall have two small bond wires of low resistance, or other approved method, welded across the joint to make the joint electrically continuous. Where rigid joints are specified they shall be provided as specified herein. The outside joint recess shall be completely filled with a rich low shrinkage cement grout. The concrete surface in contact with the joint mortar shall be moistened with water just prior to pouring the joint recess. The mortar shall be poured into the joint recess against a waterproof paper or cloth diaper laid around and lapping the outside field joint. The diaper shall completely and snugly enclose the joint recess, being held in place by metal box strapping or wire. The mortar shall be poured into an opening slightly to one side on the top of the pipe and rodded by a flexible wire rod into place until it appears on the opposite side completely. After the joint recess has been filled with mortar, adjoining pipe sections shall not be disturbed. After the joint has been made, the concrete lining surfaces of the joint shall be moistened and the interior recess tightly jointed and troweled flush and smooth with the inside pipe surface. Grout for painting the interior joints shall be of a stiff consistency and shall have low shrinkage characteristics. In sizes of pipe smaller than 24", the mortar shall be buttered all around the shoulder inside the bell before the spigot is entered. A backing-up tool, such as an inflated rubber ball wrapped with burlap, shall be pulled through the joint to compact the mortar, completely fill the inside annular space and wipe off the excess mortar. Each joint will be inspected by the ENGINEER for proper and complete closure prior to final acceptance. Flanges shall be protected by "cocoon" type protection coating of coal-tar and felt in accordance with AWWA C 203. When moving individual pipe sections, the pipe shall be lifted using two web or belt type slings which support the pipe between the third and outside quarter points.

801.10.5 All fittings and valves shall be installed as per the type of joint as stated herein and/or as shown on the plans.

801.10.6 All couplings, clamps, sleeves, etc shall be installed as per the manufacturer's printed recommendations and as approved by the ENGINEER. The CONTRACTOR shall properly restrain all appurtenances as necessary.

801.10.7 All waterlines installed as part of a re-use system or other non-potable use shall be purple in color or shall be encased in purple PVC wrap.

801.11 CUTTING: The cutting of any type of pipe shall be done as per the manufacturer's printed recommendations, as approved by the ENGINEER. Care shall be taken in cutting any pipe that has an internal and/or external lining or coating.

801.12 BLOCKING AND RESTRAINED JOINTS

801.12.1 All restrained joints shall be by mechanical means unless directed or approved otherwise by the ENGINEER.

801.12.2 All tees, bends shall be restrained by mechanical means. Valves in runs need not be restrained, except that butterfly valves shall be flanged. Where rigid joints are called for on concrete cylinder pipe, the joints shall be flanged or field welded bell and spigot joints in accordance with the manufacturer's recommendation.

801.12.3 All caps and plugs on dead end lines will be mechanically restrained when feasible. Blocking may also be required when adequate restrain length is not available.

801.12.4 Where restrained joints on ductile iron pipe, or PVC pipe are called for on the plan, the mechanical restraining system employed shall conform to the recommendations of the pipe manufacturer. The restrained joint will be subject to the hydrostatic test specified herein.

801.13 RESTRAINING JOINTS FOR WELDED STEEL AND CONCRETE CYLINDER PIPE

801.13.1 Restrained joints in welded steel and concrete cylinder pipe for thrust restraint shall be produced by continuous welding the pipe joints and as shown on the plans.

801.13.2 Unless otherwise stated in the supplemental specifications the working pressure (operating plus transient) shall be 150 psi. The value for weight of overburden and the coefficient of friction

shall be stated in the supplemental specifications.

801.14 TAPS INTO EXISTING CONCRETE CYLINDER PIPE

801.14.1 OBJECTIVE: The intent of this Subsection is to establish procedural and design criteria for making taps into existing concrete cylinder pipe for water distribution line extensions, and will be applicable to 4-inch and larger size water taps.

801.14.2 NEW WATER LINES: No non-factory taps will be allowed on newly-installed concrete cylinder pipes.

801.14.3 EXISTING WATER LINES:

801.14.3.1 Taps to existing concrete cylinder pipe must be approved in writing by the OWNER. The requester shall provide the following information:

801.14.3.1.1 Justification for the tap,

801.14.3.1.2 Project name and number, if applicable,

801.14.3.1.3 Date tap required,

801.14.3.1.4 Name of the CONTRACTOR who will be making the tap.

801.14.3.2 The CONTRACTOR shall coordinate the work with the OWNER before commencing work. The OWNER shall inspect and approve the entire installation of the tap.

801.14.4 INSTALLATION OF FIELD TAP:

801.14.4.1 Installation of field taps on concrete cylinder pipe shall be no smaller than 4 in. and no larger than 2/3 diameter of pipe to be tapped. No "weld neck" or weld on outlets will be used.

801.14.4.2 For field taps larger than 2/3 of pipe diameter, a tee will be inserted into the line.

801.14.4.3 For field taps greater than 4 in. and less than 2/3 diameter of pipe to be tapped an approved tapping saddle will be used. Tapping saddles shall be approved by the ENGINEER

801.15 SALVAGED MATERIALS

All salvaged materials (pipe, fittings, valves and other water line appurtenances) shall be stockpiled on-site in a neat manner by the CONTRACTOR. The ENGINEER and a representative of OWNER will inspect the stockpiled materials for salvage fitness and direct the following disposition:

801.15.1 If the material is considered salvageable, the CONTRACTOR will be directed to deliver the material to the OWNER. The CONTRACTOR will be responsible for the loading, transportation and off-loading of the salvageable materials. When the materials are delivered, the CONTRACTOR shall obtain a signed receipt from the OWNER. Before final acceptance of the project, all signed receipts will be submitted to the ENGINEER for accounting purposes.

801.15.2 Materials that do not have salvageable value will be disposed of by the CONTRACTOR at no additional cost to the OWNER.

801.16 HYDROSTATIC TESTS:

801.16.1 The CONTRACTOR shall be required to perform hydrostatic tests in all water mains, laterals, dead ends, and service lines in accordance with AWWA C 600. The test shall be conducted in the presence of the ENGINEER or his authorized representative. The testing of the lines shall be done without being connected to existing lines unless approved by the ENGINEER. The CONTRACTOR shall provide all temporary plugs required. If connections to the existing lines are allowed by the ENGINEER, it is with the understanding that the CONTRACTOR assumes any and all responsibility in case of damage or failure of the existing system. Water used for disinfecting may be used for hydrostatic testing. Leakage through connections to the existing system, leaks in the existing lines, or leaking existing valves under the test pressure will invalidate the test. The lines shall be tested at 150 pounds, or 1.5 times the normal working pressure of the line, whichever is greater, for not less than two hours. All taps, gauges and necessary equipment shall be provided by the CONTRACTOR as approved by the ENGINEER, however, the ENGINEER may utilize gauges provided by himself if he so elects. Each section of the new line, between valves shall be tested to demonstrate that each valve will hold the test pressure. No installed pipe will be accepted if the leakage is greater than that determined by hydrostatic test sheet calculations in which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested; D is the nominal diameter of the pipe in inches; and P is the test pressure in pounds per square inch gauge. During the test the test pressure should not lose more than 10 psig without being pumped back up to test pressure. The totals of the gallons of water required to hold the test pressure during the two hours and the amount of water required to return the line to the test pressure at the end of the test period is the total leakage. If the total leakage is less than the allowable, the line can be accepted. All visible leaks will be repaired regardless of the amount of leakage.

801.16.2 CONTRACTOR shall submit a testing plan to the ENGINEER for approval. In cases where a new main is being connected to an existing main without the installation of a new valve, the end of the new main shall be temporarily capped and blocked and a hydro-static test performed. Hydro-static tests should not be made such that an existing valve or existing main is included in the test section. Test Sheet on page 801-12 is the standard form which must be completed at the time of the test, signed by the ENGINEER and delivered to the OWNER prior to acceptance of the Project

801.17 DISINFECTING, FLUSHING, AND BACTERIA TESTING OF WATER LINES: New water lines shall be installed in such a manner as to not require cleaning by flushing. This shall require capping of stockpiled line, capping of lines at night and any other time work is not in progress, visual inspection of interior of lines, and cleaning as necessary, prior to placing in the trench. Every effort shall be made to prevent the entry of dirt and debris into pipelines under construction.

801.17.1 Mains shall be disinfected in accordance with AWWA C 651 or as required below with chlorine liquid solution, which is added by an approved method at one end of the lines as water is drawn through the lines and service connections. The chlorine solution shall remain in the line for at least 24 hours. The lines shall then be flushed until the chlorine residual is equal to the normal residual in the existing system or at 0.5 parts per million for unchlorinated water. Dry chlorine will not be used for disinfection of water lines. The flushed water will be disposed of by the CONTRACTOR appropriately.

801.17.2. Prior to the line being placed into service, bacteria samples shall be taken by the OWNER. Should results of the bacteriological analysis be unsatisfactory, the disinfection procedure shall be repeated.

801.17.3 The CONTRACTOR will be granted two free volumes of water for testing, disinfecting and flushing the new installation. All water used for testing, disinfecting and flushing shall be metered. If additional water is needed for these purposes, the water will be paid for by the CONTRACTOR at the current water rates. An approved backflow preventor system shall be used when withdrawing water from any waterlines and hydrants. Direct connection to the water system shall not be used for providing water for disinfecting, testing or flushing.

801.17.4 OWNER or the ENGINEER will collect the water sample to test the water in the existing lines at

TEST SHEET 801.16.2
HYDROSTATIC TEST

Test No.: _____

PROJECT NAME: _____
DATE: _____

PROJECT _____ NUMBER: _____
CONTRACTOR: _____

LOCATION: _____

PIPE MATERIAL: _____ DIP _____ PVC _____ CCP _____ Fabricated Steel

Test: Length (S) = _____ ft.
Size (D) = _____ inches
Pressure (P) = _____ psi - gauge (average test pressure during the hydrostatic test)
Leakage Allowed (L_{ALL}) - _____ gal / hr ($L_{ALL} = SD \sqrt{P} / 133,200$ per AWWA C600-99)

Basis: Only resilient seated gate valves and/or rubber seated butterfly valves are used. No metal seated valves are allowed.

Total Leakage Allowed for 2 hour Test Period: $L_{ALL} * 2 \text{ hours} =$ _____ gallons

Actual Amount of Water ADDED to maintain 150 psi $\pm$ 5 psi for 2 hours = _____ gallons

If actual amount of water added is LESS THAN total leakage allowed, test PASSED

If actual amount of water added is GREATER THAN total leakage allowed, test FAILED

_____ Test Passed _____ Test Failed

Contractor _____ Date _____ Inspector _____ Date _____

Project Manager _____ Date _____

COMMENTS:

Note: See Section 801.16 for the Specification for test procedure. A0224B/D2376B
the point of delivery for assurance of clean and

potable water. The water in the existing lines will be used for testing and flushing.

801.18 INTERFERENCE WITH SERVICE AND SCHEDULE OR WORK

801.18.1 The CONTRACTOR shall obtain the permission of the ENGINEER before making any connections with existing mains. The required operation of existing valves will be performed by the OWNER as per Section 18.

801.18.2 Work shall be started after authorization of the ENGINEER and shall be completed in a prompt efficient manner in coordination and cooperation with other utilities concerned. 801.18.3 The CONTRACTOR will be required to arrange his construction program with a view of maintaining continuous service to water users, from existing facilities, to the fullest extent possible. He shall, at all times, withhold construction work, where any conflict in the service requirements occur.

801.19 NOTIFICATION OF COMPLETION

The CONTRACTOR shall notify the ENGINEER, in writing, when the CONTRACTOR has completed construction of a water line. This notification should be submitted immediately upon completion; the water line will not be placed in service by the OWNER before the sewer service and the street are in place and until the OWNER has received and accepted all adequate documentation submittals. OWNER shall consider, on a case by case basis, exceptions for fire protection purposes.

801.20 VALVE CAN REHABILITATION

801.20.1 The rehabilitation of existing valve cans as shown on the plans or as authorized by the ENGINEER shall include the following:

801.20.1.1 Removing the existing valve can and ring and cover and installing the new type can and cover.

801.20.1.2 Install a new concrete collar in paved and unpaved areas. Size and direction of the line should be noted on the collar.

801.20.1.3 The existing ring and cover shall be considered salvaged materials.

801.20.1.4 Removal and replacement of the pavement.

801.20.1.5 Excavation, backfill, and compaction.

801.20.1.6 All materials, labor, and equipment

necessary to do the work.

801.20.2 The work under this item shall be constructed per the Standard Detail Drawings.

801.21 DOCUMENTATION SUBMITTALS

801.21.1 At the time of the final inspection the following documentation will be submitted to the ENGINEER and OWNER:

801.21.1.1 Hydrostatic test data of the new water line system.

801.21.1.2 Microbiological test reports which were taken at representative locations along the system.

801.21.1.3 Fire hydrant and valve cards. All valves at that time shall be in the open position, unless otherwise authorized by the ENGINEER and OWNER.

801.21.1.4 A marked-up set of construction drawings reflecting as-built conditions. This does not supplant the requirements for record or as-built drawings.

801.22 MEASUREMENT AND PAYMENT

801.22.1 PIPE: Payment for all sizes and types of pipe shall be made on the basis of measurement per linear foot, including the length of fittings, valves, etc. The contract unit price of pipe shall include all jointing and coupling materials necessary for its installation and connections to other sections of pipe, except for fittings, valves or other appurtenances. The cost of hydrostatic testing, flushing and disinfecting of new water lines shall be included in the contract unit price for the item in place. Pipe locator tape for pipe shall be included in the contract unit price of the pipe.

801.22.2 DEPTH OF TRENCH:

801.22.2.1 The contract unit price for pipe and appurtenances in all cases shall include the trenching, installation, and compacted backfilling for trench cuts as specified in Section 701.

801.22.2.2 Payment for additional depth, below the specified limits shall be made on the contract unit price per vertical foot per linear foot, and shall include trenching, installation of pipe and appurtenances, and compacted backfilling in the deeper trench.

801.22.3 REMOVAL AND RELAY, RETURN, OR DISPOSAL OF PIPE:

801.22.3.1 The contract unit price for removal and relaying pipe shall include all labor and new gasket material necessary to remove and reinstall pipe in another location.

801.22.3.2 The payment for removing and the delivery 2-1/4 inch to 14 inch pipe to the Water Utility Division in the City Yard as salvage materials shall be made on the unit price per linear foot. Only cast iron or ductile iron pipe that is undamaged will be considered for salvage.

801.22.3.3 Where there is no salvage value of the pipe, the pipe shall be removed and disposed of by the CONTRACTOR. The payment for removal shall be made on a unit price per linear foot; there will be no additional cost to the OWNER for disposal.

801.22.3.4 The payments for removal and relaying, removal and return, or removal and disposal shall include trenching and compacted backfilling.

801.22.4 CAST IRON AND DUCTILE IRON FITTINGS:

801.22.4.1 All cast iron and ductile iron fittings shall be measured and paid for at the contract unit price per pound based on weights of an all mechanical joint ends fitting for the type and size of fitting used as specified in AWWA C 110, regardless of the type of ends on the fitting installed. The contract unit price per pound of fittings shall include all gaskets, glands, bolts and nuts required, no separate payment will be made for these items.

801.22.4.2 When the CONTRACTOR installs a OWNER-furnished fitting and replaces that fitting in the OWNER's inventory, the CONTRACTOR shall be paid the full contract unit price of that fitting as outlined above. If the CONTRACTOR does not replace the fitting in the OWNER's inventory the payment to the CONTRACTOR will be at the contract unit price of the fitting less the cost of the fitting itself.

801.22.4.3 Fitting insertion: The insertion of a fitting into an existing pipe line shall be measured and paid for at the contract unit price per pound based on weights of an all mechanical joint end fitting and if required an all mechanical joint connecting piece (coupling) of the type fitting and size used, as specified in AWWA C 110, regardless of the type of ends on the fitting and coupling installed. This payment shall include all compensation for the excavation, cutting and removal of the existing pipe, installation of the fitting and coupling, if required, the recutting of the existing pipe or new pipe installed between the fitting and coupling, and backfill and compaction complete in place. In addition to the

payment for the fitting insertion, the CONTRACTOR shall be paid for one each non-pressurized (wet) connection and if pavement, curb and gutter, sidewalk, drivepad, etc., are removed, these items will be paid for as part of the appropriate item.

801.22.5 REMOVAL AND RELAY, RETURN OR DISPOSAL OF PIPE APPURTENANCES:

801.22.5.1 The contract unit price for removal and relaying the appurtenances shall include all labor and new gasket material necessary to remove and reinstall the item in another location.

801.22.5.2 The payment for removing and returning 2 1/4 inch to 36 inch appurtenance to the OWNER as salvaged material shall be made on the contract unit price per each or unit price per pound. Only undamaged material will be considered for salvage.

801.22.5.3 Where there is no salvage value of the appurtenance, the item shall be removed and disposed of by the CONTRACTOR. The payment for removal shall be made on the contract unit price per each or contract unit price per pound; there will be no additional cost to the OWNER for disposal.

801.22.5.4 The payment for removal and relaying, removal and return, or removal and disposal shall include trenching and compacted backfilling.

801.22.5.5 Only cast iron or ductile iron appurtenances will be removed and relaid or removed and returned for salvage.

801.22.5.6 Fire hydrant relocation payment shall be the contract unit price per each for removal and reinstallation and shall include excavation, blocking, aggregate and compacted backfilling, as shown in the Standard Detail Drawings.

801.22.6 CONCRETE CYLINDER OR WELDED STEEL PIPE FITTINGS:

Concrete cylinder or welded steel pipe fittings, such as flanged outlets, bends, reducers, etc., shall be considered as incidental to the contract unit price for installation of the pipe, as shown on the construction plans.

801.22.7 COUPLINGS: The measurement for steel or cast iron couplings shall include payment for all gaskets, bolts, and incidental materials as may be needed for its complete installation. Payment shall be made on the contract unit price per each size of coupling required.

801.22.8 STEEL FITTINGS: Steel fittings shall only be used when authorized by the ENGINEER and

when needed to connect to an existing steel water line. Measurement and payment for steel fittings, when authorized, shall be made at the contract unit per pound based on weights of an all mechanical joint ends fitting of the type fitting and size used, as specified in AWWA C 110. This payment shall include all fabrication and welding required on the fitting.

801.22.9 VALVE AND VALVE CANS:

801.22.9.1 Valves shall be measured and paid for at the contract unit price per each size of valve. The contract unit price for valves 24-inch and larger shall include the bypass valve, fittings and piping, complete in place.

801.22.9.2 Valve boxes shall be measured and paid for at the contract unit price per each per type of valve boxes, which payment shall include the concrete pad with stem extension when required, complete in place.

801.22.10 FIRE HYDRANTS: Fire hydrants shall be measured and paid for at the contract unit price per each per depth of bury, which payment shall include excavation, gravel drain pocket, mechanical restraining system or blocking, backfilling, and compaction complete in place.

801.22.11 VALVE BOX ADJUSTMENTS:

801.22.11.1 Valve box adjustment using the adjustment collar and insert shall be measured and paid for per each complete in place including the concrete pad.

801.22.11.2 When the adjustment height required on a valve box exceeds the height of the adjustment collar or the valve box has been previously adjusted, the valve box will have to be rehabilitated. Measurement and payment shall be made as specified under Valve Box Rehabilitation.

801.22.12 WATER LINE CONNECTIONS:

801.22.12.1 Nonpressurized Connections: Nonpressurized connections shall be measured and paid for at the contract unit price per each for any size or type of pipe, complete in place, which shall include any extra excavation required, shut-off coordination, the removal of any caps or plugs or the cutting of the existing pipe any number of times required to make the connection, drainage plan (if required), pumping or handling of the water, backfilling and compaction. Fittings shall be measured and paid for per pound as specified herein, including all types of couplings.

801.22.12.2 Pressurized Connection: Pressurized connections shall be measured and paid for at the contract unit price per each per location shown on the plans, complete in place, which shall include excavation, the cleaning or removal of existing pipe coatings and coverings, air testing, the tapping, any grouting required, backfilling and compaction. The installation of the tapping sleeve and gate valve is to be paid under separate item or as indicated on the plans.

801.22.12.3 Connection to Steel Water Lines: All connections to existing steel water lines shall be made by using a transition coupling. The measurement and payment for this type of connection shall be made per pound of fitting for a Mechanical-Joint Connecting Piece of the size used based on the weights specified in AWWA C 110.

801.22.13 THRUST RESTRAINTS:

801.22.13.1 CONCRETE BLOCKING: When concrete blocking is used as a substitute for a mechanically restrained joint as authorized by the ENGINEER, the blocking shall be measured and paid for at the contract unit price per cubic yard placed to the neat lines shown on the plans or per the Standard Detail Drawings.

801.22.13.2 RESTRAINING JOINTS FOR WELDED STEEL OR CONCRETE CYLINDER PIPE: Measurement and payment for this item shall be at the contract unit price per linear inch of circumferential weld, complete in place, including protective coating of the weld.

801.22.13.3 MECHANICALLY RESTRAINED JOINTS: Mechanically restrained joint assemblies shall be measured and paid for at the contract unit price per each assembly per size of the pipe per each type (pipe to pipe, pipe to mechanical joint, pipe to fitting, etc.) complete in place.

801.22.13.4 VALVE ANCHORAGE: No separate measurement nor payment shall be made for valve anchorage as per Standard Detail Drawing. The cost of this work shall be included with the cost of the valve.

801.22.14 PRESSURE REDUCING VALVE (PRV): Measurement and payment for furnishing and installing a PRV shall be made at the contract unit price per each per size, complete in place as shown on the plans or in the Standard Detail Drawings. The payment shall include all labor, equipment and material required for the excavation, the PRV, all bypass piping, fittings and valves both inside and outside the structure, the structure, backfilling and compaction.

801.22.15 AIR RELEASE VALVE (ARV): Measurement and payment for furnishing and installing an ARV shall be made at the contract unit price per each per size of ARV, complete in place as shown on the plans or in the Standard Detail Drawings. The payment shall include all labor, equipment and materials required for the excavation, ARV, piping, fittings, gate valve, can or structure, backfilling, and compaction.

801.22.16 VALVE BOX REHABILITATION: Valve box rehabilitation shall be measured and paid for at the contract unit price per each, complete in place which shall include the removal of the existing valve box, excavation, the new valve box installed, backfilling, compaction and the installation of the concrete collar.

801.22.17 CONCRETE STRUCTURES: The removal and replacement of concrete structures such as sidewalks, drive pads, and curb and gutters etc., required for the installation of water lines shall be measured and paid for as specified in Section 340 and 343.

801.22.18 BEDDING MATERIAL: No separate measurement nor payment shall be made for bedding material required when shown on the plans or when required due to the type of pipe supplied by the CONTRACTOR. The cost of the bedding material shall be included in the unit price of the pipe. If bedding material is not required by the conditions above but is required due to the conditions encountered during construction then the bedding material shall be measured and paid for as specified in Section 701.

801.22.19 SURPLUS MATERIALS: No separate measure nor payment will be made for the removal and disposal of surplus material generated by the pipe, bedding material or the use of lean fill.

SECTION 1012

NATIVE GRASS SEEDING

1012.1 GENERAL:

Work under this section consists of preparing all area indicated on the plans for native grass seeding, furnishing and installing all seed, fertilizer and soil amendments as specified herein and on the plans, or as authorized by the ENGINEER.

1012.2 REFERENCES:

1012.2.1 This Publication:

Section 1011

1012.3 WORK AREA/TIMING:

1012.3.1 Areas that are disturbed by the CONTRACTOR that are outside the construction limits shown on the plans or authorized by the ENGINEER shall be seeded with native grasses as specified herein at no cost to the OWNER.

1012.3.2 The seeding of disturbed areas shall commence upon completion of the other work in the area.

1012.4 MATERIALS:

1012.4.1 Native Seed: The native seed species and rate of application shall be as shown below and shall be used based on the type of soil or as specified on the plans or in the Supplemental Technical Specification.

1012.4.1.1 Sandy Soils. Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

<u>Variety/ Common Name</u>	<u>Genus/ Species</u>	<u>P.L.S./Acre</u>
"Paloma"Indian Rice grass	Oryzopsis hymenoides	5.0
"Viva" Galleta grass	Hilaria jamesii	1.0
"Niner" Side oats grama	Bouteloua curtipendula	3.0
"Hatchita" Blue grama	Bouteloua gracilis	1.0
Sand dropseed (NM Region)	Sporobolus cryptandrus	1.0
Fourwing saltbush (NM Region)	Atriplex canescens (de-winged)	<u>1.0</u>
Total rate		12.0 lbs/ acre

1012.4.1.2 Clay, Clay Loam, and Sandy gravelly clay loam soils. Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

<u>Common Name</u>	<u>Genus/species</u>	<u>PLS/acre</u>
"Paloma" Indian rice grass	Oryzopsis hymenoides	2.0
"Viva" Galleta grass	Hilaria jamesii	2.0
"Niner" Sideoats grama	Bouteloua curti pendula	2.0
"Hatchita" Blue grama	Bouteloua gracilis	3.0
Sand dropseed (NM Region)	Sporobolus cryptandrus	1.0
Four-wing Saltbush (NM Region)	Atriplex canescens (de-winged)	1.0 1.0
Total rate		11.0 lbs/ac

NOTE: If the area to be seeded is along a recreational trail of any type the seed mixes for either type of soil listed above shall exclude the one (1) pound per acre of Four-wing saltbush. The seeding rate shall be lowered by one (1) pound per acre.

1012.4.1.3 Seeds may be pre-mixed by a seed dealer. Each bag of seed shall be sealed and labeled by the seed dealer in accordance with Federal Seed Laws and New Mexico Department of Agriculture Labeling Laws. This includes: variety, kind of seed, lot number, purity, germination, percent crop, percent inert, percent weed (including noxious weeds), origin, test data and net weight. Federal Seed Laws require that analysis shall be no older than 5 months for seed shipped interstate and no older than 9 months for seed shipped intra-state. The ENGINEER shall receive all labels from all bags of seed used for verification.

1012.4.2 Fertilizer and Soil Amendments: Unless otherwise specified on the plans or in the Supplemental Technical Specification, no fertilizer or other soil amendments are required on areas specified to receive native seeding. If fertilizer and/or other soil amendments are required they shall be in accordance with Section 1011 of these specifications.

1012.4.3 MULCH:

1012.4.3.1 Hay Mulch: Perennial native or introduced grasses of fine-stemmed varieties shall be used unless otherwise specified on the plans. At least 65 percent of the herbage by weight of each bale of hay shall be 10 inches in length or longer. Hay with noxious seed or plants will not be acceptable. Rotted, brittle, or moldy hay will not be acceptable. Marsh grass or prairie hay composed of native grass of species to be seeded will be acceptable. Tall wheat grass, intermediate wheat grass, switch grass, or orchard hay will be acceptable if cut prior to seed formation. Marsh grass hay shall be composed of mid and tall native, usually tough and wiry grass and grass-like plants found in the lowland areas within the Rocky Mountain region. Hay shall be properly cured prior to use. Hay which is brittle, short fibered or improperly cured is not acceptable.

1012.5.2 Straw Mulch: Small grain such as wheat, barley, rye, or oats will not be allowed except by prior approval of the ENGINEER and with the concurrence of the Air Division, Environmental Health Department. Alfalfa or the stalks of corn, maize or sorghum is not acceptable. Material which is brittle, shorter than 10 inches or which breaks or fragments during the crimping operation will not be acceptable.

1012.4.3.3 Gravel Mulch: Gravel mulch shall be crushed or screened gravel 3/4" to 1" maximum size with a minimum of one fractured face unless otherwise specified.

1012.4.3.4 Erosion Control Matts, Fabric or Blankets: The type of erosion control mats, fabric or blankets used shall be as specified or allowed on the plans or in the Supplemental Technical Specifications.

1012.5 SEED BED PREPARATION:

1012.5.1 General:

1012.5.1.1 Prior to the starting of any seed bed preparation the final grades of all earth work shall be inspected and approved by the ENGINEER.

1012.5.1.2 No preparation shall be performed when the surface is wet or muddy or when the soil moisture content is such that the soil is not fully loosened by the discing operation.

1012.5.1.3 The extent of seed bed preparation shall not exceed the area on which seeding, mulching and crimping operations can be completed prior to crusting or wind or water erosion of the prepared surface. If erosion, crusting or re-compaction

occurs, the affected area shall be re-worked beginning with seed bed preparation. Depth of preparation must be approved by the ENGINEER prior to the seeding and mulching operations.

1012.5.2 Mechanical Preparation: The seed bed shall be loosened to a minimum depth of 6" (six inches) by means of disc or harrow. Area of heavy or compacted soil may require additional preparation such as chiseling or ripping if discing alone does not result in preparation to the full minimum depth of 6". The soil shall be worked to a smooth surface free of clods, stones 4" and larger or any other debris or foreign material that could interfere with seeding or crimping equipment operations.

1012.5.3 Hand Preparation: Areas which cannot be prepared with mechanized equipment because of small size irregular shape or slope angle may be prepared to a minimum depth of 2" using hand tools or a rototiller. Any such areas will be specified on the plans.

1012.6 SEEDING:

1012.6.1 General:

1012.6.1.1 Seeding shall not start until the seed bed preparation has been inspected and approved by the ENGINEER.

1012.6.1.2 No more area may be seeded than can be covered with mulch and crimped, or covered with gravel mulch or erosion control mats by the end of the work day. No seeding operations may be conducted when steady wind speed exceeds 10 miles per hour. If winds exceed 10 mph while seeding is underway, seeding operations will be halted and any areas seeded to that point completed.

1012.6.2 Seed Application:

1012.6.2.1 Drill Seeding: Drill seeding is required unless otherwise specified on the plans or in the Supplemental Technical Specifications. Seed shall be applied with a "rangeland" type seed drill equipped with packer wheels. Seed shall be drilled to a maximum depth of 1/2" unless otherwise specified. Direction of seeding shall be across slopes and on the contour whenever possible.

1012.6.2.2 Broadcast Seeding: Seed may be applied using the broadcast method when size, irregular shape or slope angle exceeding 3.1 prevents the use of a seed drill. Seed may be broadcast by hand or by means of a mechanical seeder provided that the seed is evenly distributed over the seeding area. Areas of broadcast seeding

will be hand raked to cover seed. Areas which are broadcast seeded shall be seeded at rate which is double that used for drill seeding.

1012.6.2.3 Seeding With Gravel Mulch: Areas to receive gravel mulch will be seeded at the broadcast seed rate with 1/2 the seed applied prior to application of gravel and 1/2 the seed applied on the surface of the gravel. Water shall be applied in quantity sufficient to wash seed from the surface and into the gravel.

1012.6.2.4 Hydro Seeding: Hydro seeding will not be allowed on areas of non-irrigated native grass seeding unless specified on the plans or in the Supplemental Technical Specifications or authorized by the ENGINEER.

1012.7 MULCHING:

1012.7.1 General:

1012.7.1.1 All seeded areas shall be mulched unless otherwise specified on the plans or in the Supplemental Technical Specifications.

1012.7.1.2 On seeded areas that are level or have slopes 3:1 or less, any of the four (4) types of mulching or erosion control specified herein may be used. On seeded areas that have slopes steeper than 3:1 only gravel mulch or erosion control materials may be used as specified on the plans and in the Supplemental Technical Specifications.

1012.7.2 Hay Mulch: Hay mulch shall be applied at a minimum rate of 1.5 tons per acre of air dry hay.

1012.7.3 Straw Mulch: Straw mulch shall be applied at a minimum rate of 2.5 tons per acre of air dry straw.

1012.7.4 Crimping: Hay and/or Straw mulch shall be crimped into the soil. The mulch shall be spread uniformly over the area either by hand or with a mechanical mulch spreader. When spread by hand, the bales of mulch shall be torn apart and fluffed before spreading. Mulching will not be permitted when wind velocity exceeds 15 miles per hour. The mulch shall be wetted down and allowed to soften for 15 to 20 minutes prior to crimping. A heavy disc such as a mulch-tiller, with flat serrated discs at least 1/4 inch in thickness, having dull edges and the disc spaced 6 inches to 8 inches apart shall be used to crimp (or anchor) the mulch into the soil to a minimum depth of 2 inches or as specified on the plans or the Supplemental Technical Specifications. The discs shall be of sufficient diameter to prevent the frame of the equipment from dragging the mulch.

The crimping operations shall be across the slope where practical but not be parallel to prevailing winds or by tight interlocking "S" curves to avoid straight crimp lines.

If small grain straw mulch is used it shall be crimped in two (2) directions in a cross-hatch pattern.

1012.7.5 Gravel Mulch: Gravel mulch shall be placed by hand or by mechanized equipment that provides full coverage at a uniform thickness of 2 inches in depth.

1012.7.6 Erosion Control Mats, Fabric or Blankets: the type of erosion control mats, fabric or blankets used shall be as specified on the plans or the Supplemental Technical Specifications or as approved by the ENGINEER. The anchoring of the erosion control items shall be as per the manufacturer's recommendations.

1012.8 PROTECTION OF NATIVE GRASS SEEDED AREA:

1012.8.1 GENERAL: The CONTRACTOR shall be responsible for protecting and caring for seeded areas until final acceptance of the work and shall repair at his expense any damage to seeded areas caused by pedestrian or vehicular traffic or vandalism.

1012.9 INSPECTION FOR NATIVE GRASS AREA:

1012.9.1 The following inspection shall be the minimum required inspections to native grass during the course of construction. Additional inspections shall be made at any time at the discretion of the ENGINEER.

1012.9.2 It shall be the responsibility of the CONTRACTOR to notify the ENGINEER, in writing, 48 hours in advance of each required inspection.

1012.9.3 The sequence of required inspections shall not be changed from the sequence listed below. The CONTRACTOR shall not proceed with work of the next sequence without written approval of the work of the previous sequence. Payment will not be approved for items which have not been inspected and approved in writing.

1012.9.3.1 Each phase of soil preparation shall be inspected in process.

1012.9.3.2 Finish grade shall be inspected.

1012.9.3.3 Seed shall be inspected prior to seeding.

1012.9.3.4 Seeded area shall be inspected after completion.

1012.9.3.5 Final inspection of the project and acceptance.

1012.10 MEASUREMENT AND PAYMENT

1012.10.1 MEASUREMENT: The measurement of native grass seeding shall be by the acre.

1012.10.2 Payment: Payment shall be made at the contract unit price per acre of native grass seeding complete in place, which shall include the seed, fertilizer, (if required) area preparation, seeding, soil amendments, (if required) and mulching.

SUPPLEMENTAL TECHNICAL SPECIFICATION

APWA (2006) SECTION 1012

NATIVE GRASS SEEDING

Revised 07/24/2020

1. In subsection 1012.4 MATERIALS delete paragraphs 1012.4.1.1 and 1012.4.1.2 in their entirety and replace with the following:
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Grass Seed Mix shall include the following species and rates:

Indian Rice Grass	5 lb/ac
Galleta	5 lb/ac
Sideoats Gramma	5 lb/ac
Blue Gramma	5 lb/ac
Sand Dropseed	5 lb/ac

Total Grass Seed Mix application rate = 25.0 lbs / acre

Wildflower Seed Mix shall include the following species and rates:

Globemallow	1 lb/ac
Purple Aster	1 lb/ac
Blue Flax	1 lb/ac
Mexican Hat	1 lb/ac
Blanket Flower	1 lb/ac

Total wildflower seed mix application rate = 5.0 lbs / acre

Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

END OF SECTION

SECTION 1200

BARRICADING AND TEMPORARY TRAFFIC CONTROL

1200.1 GENERAL: The work under this section includes, but is not limited to, traffic control standards needed to ensure safety to motorists, the public, construction workers, and special event participants when City roadways are temporarily disrupted due to construction efforts or special events.

1200.2 REFERENCES

1200.2.1 Manual on Uniform Traffic Control Devices, (MUTCD), Part VI, FHWA.

1200.2.3 The American Traffic Safety Services Association (ATSSA), Quality Standards for Work Zone Traffic Control Devices.

1200.2.3 This Publication, Latest Edition

SECTION 19 CONSTRUCTION TRAFFIC CONTROL SECTION 400 TRAFFIC CONTROL

1200.3 BARRICADING STANDARDS

1200.3.1 Before construction begins all traffic control signs and barricades must be installed in accordance with the approved traffic control plan, construction plans, barricading detour plan or as directed by the OWNER. No construction signing and barricading shall commence until CONTRACTOR is assured that all equipment, manpower, and resources are available to start and complete the work. Where applicable, all signs, barricades, and/or barrels will be moved forward as the construction progresses.

1200.3.2 The name and telephone number of the owner shall be permanently stenciled on all barricades and traffic control equipment. The name and telephone number shall be a non-retroreflective color not over 2 inches in height, and be placed on a non-retroreflective surface of all equipment. Graffiti shall be promptly removed from any all barricades and traffic control equipment. If notified by the OWNER or the ENGINEER, graffiti shall be removed, or the equipment replaced with clean equipment, within four hours or the barricade permit is subject to revocation.

1200.3.3 All advance warning signs approaching a construction zone shall be double indicated (one sign each on left and right sides of approaching traffic) for all multiple-lane roadways with painted or raised medians and where adequate space is available. All double indicated signs shall be the same size. When a sign is placed in a painted median, especially a two-way continuous left-turn lane, a reflectorized barricade must be placed on the back side of the sign to alert

motorists approaching from the opposite direction.

1200.3.4 It shall be the responsibility of the CONTRACTOR to remove all construction barricades, signing, and traffic control devices not required at the end of the working day.

1200.3.5 All advance warning signs shall be a minimum of thirty-six inches by thirty-six inches in size with super engineering grade sheeting or better. On high-speed (posted 45mph and above), rural section roadways where adequate pedestrian space is available, forty-eight inch by forty-eight inch signs is preferred. The use of forty-eight inch signs shall be required at locations as published on a list by the ENGINEER. All advance-warning signs not directly applicable shall be removed when not needed, and shall not be left in public right-of-way. All construction signing shall be black on a reflectorized orange field unless otherwise specified.

1200.3.6 Existing posts may be used at some locations, with approval of the ENGINEER. Portable sign supports will be acceptable as an alternate for signs which are to be in place for less than three (3) weeks. The bottom of advance warning signs mounted on barricades or temporary sign supports shall be no less than one foot above the traveled way. All regulatory and advisory signs shall be mounted on sign stands or as otherwise approved by ENGINEER. The placement of portable sign supports shall not block or impede pedestrian access. All signs ground mounted on single or double posts shall have the bottom of the sign seven (7) feet above pavement level.

1200.3.7 Barrels and different types of barricades are generally not intended to be intermixed in the same series of channelization. All barrels may have sand or water ballast limited to one hundred (100) pounds. All barricades shall be placed correctly with diagonal stripes sloping downwards in the direction traffic is to pass. Where barricades extend entirely across a roadway, the stripes must slope downward in the direction toward which traffic must turn. Where both right and left turns are provided, the stripes must slope downward in both directions from the center of the barricade or barricades. Where no turns are intended, the stripes must slope downward toward the center of the barricade or barricades.

1200.3.8 The CONTRACTOR shall inspect and maintain all barricades at least once each day except for barricades on or adjacent to arterial and collector streets which shall be checked twice daily, including inspection during hours of darkness. A log of these

inspections showing project, location, date, and time shall be kept and a copy sent to the Construction Coordination Division upon request. Upon request, the CONTRACTOR shall immediately produce current traffic control logs. Failure to do so may result in suspension of work or revocation of barricade permit.

1200.3.9 All traffic control devices required within traveled lanes after dark are to be equipped with warning lights. Type (A) flashing warning lights shall be used on all devices which are intended to warn motorists or pedestrians of hazards or obstructions in or near the travel path. Type © steady burn lights shall be used on all devices which are intended to define the travel path. All lights shall be operational. Traffic control devices that are damaged, dirty or have substandard reflectorization shall be immediately brought up to standard. Reflectorized sheeted panels shall not be considered as a replacement for a required warning light. Warning lights shall be incidental to payment for traffic control.

1200.3.10 Equipment and materials are not to be stored within fifteen (15) feet of a traveled lane during non-working hours, unless approved by the ENGINEER, which approval cannot be unreasonably withheld.

1200.3.11 CONTRACTOR shall provide and maintain a safe and adequate means of channelizing pedestrian traffic around all work areas throughout the periods of construction. All such channelization shall be arranged to prevent pedestrians from having to enter the roadway in order to pass around the work area. Where required, pedestrian detour signs will be installed by the CONTRACTOR. Where construction impedes or obstructs sidewalk access, CONTRACTOR shall barricade sidewalks and place "Sidewalk Closed" signs accompanied with the appropriate pedestrian detour signing. Pedestrian detour signs shall be incidental to payment for traffic control.

1200.3.12 CONTRACTOR shall provide and maintain a safe and adequate means of channelizing bicycle traffic around all work area throughout the periods of construction when existing bicycle trails, lanes, or routes are designated. Where possible, adequate space for bicyclists must be provided, and bicycle detour signs, including "Share the Road" signs shall be installed. When adequate space is not available to provide for bicycle access, the bicycle facilities shall be adequately detoured around the construction site. The detour route shall minimize out-of-direction travel distance, and shall be adequately signed and directed. Bicycle detour signs shall be incidental to payment for traffic control.

1200.3.13 All barricades, signs, and traffic control equipment shall be properly and adequately ballasted

for normal wind loads. For equipment placed for extended periods (seven days or more), or during the months of February through May, additional ballast shall be required.

1200.3.14 The use of roll-up advance warning signs is allowed, so long as the reflectivity required in the MUTCD is provided. Such signs shall be adequately braced to resist rotation under normal wind loads.

1200.3.15 The use of orange warning flags mounted atop construction warning signs is encouraged and is required in certain instances. Flags mounted atop construction signs is required on all "Reduced Speed Ahead (R2-5a)" signs, "Reduced Speed (R2-5b and R2-1)" signs, all "Double Fine Zone" signs, "Road Closed Ahead (W20-3)" signs, "Detour Ahead (W20-2)" signs, "Flagger Ahead (W20-7)" signs, "Flagger Symbol (W20-7a)" signs, and "Be Prepared to Stop (W20-7b)" signs.

1200.3.16 Cones are an acceptable traffic control device under certain situations. Traffic cones are not to be used to separate traffic traveling in different directions. All cones must be a minimum of 28 inches tall. The use of cones as traffic control devices is not allowed during nighttime hours; however if used, all cones used at night must include white, reflectorized bands per MUTCD standards. The use of cones is encouraged for daytime moving closure operations, projects in duration of two hours or less, and special events.

1200.3.17 Type III barricades must be used at all road closures. Multiple type III barricades of the same configuration placed next to each other in the same direction is allowed. A type III barricade or illuminated arrow panel must be used for each lane closure. A minimum of two feet of exposed railing is required on the traveled side (open lanes) of type III barricades. The minimum length of type III barricade for each lane closure is eight (8) feet per lane twelve (12) feet or less in width, and the minimum length of type III barricade required for a sidewalk closure is four (4) feet. The minimum length of type III barricades for a double lane closure is sixteen (16) feet. Additional barricades above the minimum required may be required to fill in gaps for wide lanes, multiple lane closures, or shoulder areas.

1200.3.18 Road closures shall be pre-warned by the use of a "Road Closed to Through Traffic" (R11-4) sign, where appropriate. These signs shall be placed at intersections approaching the road closure with appropriate detour signing. When mounted on a three rail barricade support, the maximum width of sign support shall be six feet. If the detour route is more than one intersection before the road closure, then additional R11-4 signs shall be placed at each

intersection between the detour route and the road closure. "Road Closed to Through Traffic" signs are encouraged to be placed on or near the center of the roadway, but R11-4 signs shall not be placed in an area that block sight distance for motorists and pedestrians. Where sight distance becomes a problem, low-volume intersections may be temporarily converted to a four-way Stop condition, with the approval of the ENGINEER.

1200.3.19 Illuminated arrow panels with a minimum size of 32 square feet may be used in lieu of type III barricades for lane and roadway closures. Arrow panels must be battery or solar powered. The use of diesel, or other noise generating power sources, is not allowed. For roadways with a previously posted speed limit of 35 mph or higher, the use of arrow panels is required for all lane closures. An arrow panel is required for each lane reduction, but is not required for shifting tapers. In residential areas where the arrow panel will be used at night, directional lighting limited to 30 degrees or less must be used to reduce glare into nearby properties. When illuminated arrow panels are used for a lane closure, then the use of vertical panels at the regular MUTCD minimum spacing for the lane reduction taper is allowed.

1200.3.20 For work expected to last one hour or less and for moving closures, reduced barricading may be allowed as approved by the ENGINEER. Reduced barricading on arterial or collector roads shall consist of a minimum of one advance warning sign, a minimum of a three barricade or cone taper, and an illuminated arrow panel.

1200.3.21 For emergency utility work on arterial or collector roadways, the CONTRACTOR must notify the traveling public. If a variable message board is not required by the ENGINEER, a "Utility Emergency Ahead" sign must be installed for each direction of arterial / collector traffic approaching the work site. The "Utility Emergency Ahead" sign must be placed in addition to, and preceding, the three normally required advance warning signs at the same spacing required in the MUTCD for advance warning signs.

1200.3.2 Double fine zones shall be delineated by the use of "Double Fine Zone" signs as outlined in this section. Double fine zones shall be delineated for construction zones and construction curtilage zones at the request of either the OWNER or ENGINEER. In addition, double fine zones are required on all arterial / collector roadways where there is a: 1.) reduced speed limit; 2.) lane reduction; 3.) reduced design speed; or 4.) traffic hazard. Double fine zones are required for all flagging operations, and work zones with an imminent danger to workers, regardless of the roadway classification. The beginning of the double

fine zone shall be clearly marked with a sign stating: "*Construction* - Begin Double Fine Zone". The end of the double fine zone shall be clearly marked with a sign stating: "*Construction* - End Double Fine Zone". If the double fine zone extends beyond one-half mile in length, intermittent signs must be placed no more than one-half mile apart stating: "*Construction* - Double Fine Zone". Additional intermittent signs are needed following side street entrances. Details for the double fine zone signs are on file with the ENGINEER. Placement of the Begin Double Fine Zone sign shall be immediately following the "Road Work Ahead" sign. Placement of the End Double Fine Zone sign shall be immediately preceding the "End Road Work" sign.

1200.3.23 On arterial or collector roadways with multiple lane closures, the advance warning signs shall indicate the correct number of lanes closed. Arrow panels are required for each lane closure of multiple lane closures on arterial or collector roadways, regardless of the previously posted speed limit.

1200.4 CONFLICTS WITH EXISTING SIGNING, STRIPING, AND SIGNALS

1200.4.1 CONTRACTOR shall not remove, realign, or adjust any official OWNER traffic control device including stop signs, warning signs, or any other traffic or parking control signs, unless approved by the OWNER. CONTRACTOR shall give the OWNER three (3) working day's prior notice of any official OWNER traffic control device that needs to be moved. The OWNER shall take all appropriate actions as soon as practical thereafter. When CONTRACTOR places regulatory signing reducing the posted speed limit as approved by the OWNER, the CONTRACTOR must temporarily cover any and all conflicting speed limit signs. Such covers must be immediately removed once the temporary speed limit reductions are removed.

1200.4.2 The CONTRACTOR is responsible for obliteration of any conflicting striping and responsible for all temporary striping. For temporary situations lasting seven days or less, conflicting pavement markings may be addressed with the proper use of channelization devices and signing, unless otherwise approved or required by the ENGINEER.

1200.4.3 When the construction activity or traffic detouring plans result in less than two signals being visible in any direction at a signalized intersection, additional temporary traffic signals shall be required. A minimum of two signals must be visible within a twenty degree horizontal and vertical cone of vision, as measured from the stop bar for each lane approaching a signalized intersection.

1200.5 STREET AND LANE CLOSURES

1200.5.1 CONTRACTOR shall maintain access to all public and private facilities adjacent to the construction area at all times, including businesses and/or residents. When denying access is unavoidable, CONTRACTOR must coordinate access restriction to times and locations that are reasonably convenient to the property owners and/or residents affected. CONTRACTOR shall construct and maintain access roads, including paved ramps, where deemed necessary by ENGINEER to maintain traffic flow. Business access signs may be required to direct traffic to existing businesses, as directed by ENGINEER or OWNER. No more than three businesses shall be placed on a single sign. In areas of multiple adjacent businesses, only generic "Business Access Only (arrow)" signs are required. For shopping centers with multiple business tenants, the name of the shopping center shall be placed on a sign at each access location. Access signs shall have 5 inch high, white letters with a directional arrow on a reflectorized blue background. Business access shall be rectangular in shape, no taller than wide, and shall be no larger than four feet wide by three feet tall. Business access signs shall not be placed where they block sight distance for either motorists or pedestrians.

1200.5.2 CONTRACTOR shall notify the following services forty-eight (48) hours in advance of any complete street or access closures: Police Department, Fire Department, U.S. Postal Service, Solid Waste Department, Ambulance Services, local schools, and the Transit Department. The CONTRACTOR shall also notify all businesses and residents directly affected by the road closure. For the total closure of arterial or collector roadways, a variable message board must be installed for a minimum of two days prior to the road closure notifying motorists of the dates and times for the closure. A minimum of one variable message board is required for each direction of closure. For the total closure of a local roadway, a sign must be installed for a minimum of two days prior to the road closure notifying motorists and residents of the dates and times of the closure. A minimum of one sign is required for each direction of closure.

1200.5.3 The CONTRACTOR shall be responsible, and shall make appropriate accommodation, for garbage and trash collection, mail delivery, and other essential services needed by residents and businesses affected by CONTRACTOR operations. This effort shall include coordination with U.S. Post Office, Solid Waste Department, and other agencies. Where required, CONTRACTOR shall notify all residents in writing at least two days prior. Such notice shall include at a minimum: dates and times of construction activities and the name and telephone number of the CONTRACTORS contact person. CONTRACTOR

shall collect all trash and garbage in the project area and deliver to an accessible location for collection by 7:00 a.m. on the designated trash collection day. Such trash and garbage cannot be deposited onto private property, must not block access, and shall be immediately cleaned up by CONTRACTOR upon pick up by the Solid Waste Department or private trash collection company.

1200.5.4 Total or partial closure of some streets may be restricted to certain hours of the day by the OWNER. Streets having working hour limitations may be noted on the approved construction plans. In cases of emergency work or permit work, streets having working hour limitations will be designated by the ENGINEER. Waivers of the working hour limitations can be obtained from the ENGINEER.

1200.5.5 If construction on streets with working hour limitations is expected to extend past the allowed working hours, plating of the trench and/or temporary asphalt concrete pavement shall be provided so that the roadway is opened to traffic within the allowable work hours. Such excavations must be plated, temporarily patched or resurfaced prior to opening to traffic. A minimum width of 11 feet for each lane of traffic shall be provided, unless otherwise directed by the ENGINEER.

1200.5.6 When detouring low and moderate-volume traffic onto a previously unpaved area, see Table 1200.1 for surfacing requirements.

Table 1200.1

Time	Shoulder Residential	Shoulder (Other)	Local Residential /	Major Local	Collector	Arterial
Under one day	Compacted Subgrade	Compacted Subgrade	Compacted Subgrade	Compacted Subgrade	Gravel or millings	Gravel or millings
1-3 days	Compacted Subgrade	Gravel or millings	Gravel or millings	Gravel or millings	Treated Millings	2" Asphalt
4-7 days	Gravel or millings	2" Asphalt	Gravel or millings	Treated Millings	2" Asphalt	2" Asphalt
8-30 days	Treated Millings	2" Asphalt	Treated Millings	2" Asphalt	4" Asphalt	4" Asphalt

Table Notes:

The contractor shall be responsible to continually maintain all detours, providing a smooth, drained, and safe roadway surface. All compacted subgrade areas shall be graded regularly to provide a smooth driving surface, and must be treated regularly with water or other approved dust control palliative. During periods of dry and/or windy weather, a water truck must be on-site at all times, and frequent watering may be necessary.

Gravel, millings, or treated millings must be bladed and compacted to provide a stable, smooth driving surface prior to opening to traffic. Such surfacing shall be regularly maintained to provide a smooth and stable driving surface. All temporary asphalt pavement shall be placed upon a compacted subgrade which shall be graded to drain. Treated millings includes millings stabilized with an applied emulsive asphalt.

1200.6 MEASUREMENT AND PAYMENT

1200.6.1 Measurement and payment for barricading and temporary traffic control shall be per lump sum per project except for the items listed below. Payment of additional items will only be made if such traffic control device or services is either approved in the construction plan set or requested by the OWNER in writing. Payment shall include the cost of obtaining all permits and approvals; preparation of traffic control plans; working restricted or extended hours when required; notification to all affected residents, businesses, agencies, or other public contacts; setting and resetting barricades, maintaining barricades, daily removal of barricades when required, flagman operations when required, installation of temporary traffic signals when not required by the OWNER or in the construction plans; coordination with ENGINEER on traffic signal re-timing; hiring of off-duty Police Department Officers; and any and all other costs associated with temporary traffic control except the following:

1200.6.1.1 Measurement and payment of the installation of temporary striping shall be made per lineal foot of striping installed per four inch wide.

1200.6.1.2 Measurement and payment of business access and special signs shall be made on a per square foot basis project duration.

1200.6.1.3 Measurement and payment of Variable Message Boards shall be made per each on a per day (24-hour period) basis.

1200.6.1.4 Measurement and payment of illuminated arrow boards required by the OWNER, or required in the construction plans, shall be made per each on a per day (24-hour) basis.

1200.6.1.5 Measurement and payment of temporary wall barrier shall be made per lineal foot of wall barrier installed and removed at each location per project.

1200.6.1.6 Measurement and payment for temporary traffic signals required by the OWNER, or required in the construction plans, shall be made per each per project duration at each location.

NMDOT SPECIFICATIONS

SECTION 450: PORTLAND CEMENT CONCRETE PAVEMENT (PCCP) (QLA)

450.1 DESCRIPTION

This Work consists of constructing Portland Cement Concrete Pavement (PCCP) on a prepared Subgrade, Base Course or HMA/WMA.

450.2 MATERIALS

Portland cement, air-entraining admixtures, chemical admixtures, mineral pozzolans, water, and aggregate will meet the requirements of Section 509, "Portland Cement Concrete."

450.2.1 Dowels and Tie Bars

Dowels and tie bars will meet the applicable requirements of Section 540.2, "Steel Reinforcement Materials."

450.2.2 Joint Sealing Material

Joint sealing Material will meet the requirements of Section 452, "Sealing and Resealing Concrete Pavement Joints."

450.2.3 Curing Compound

The Contractor shall use curing compound that complies with the requirements of ASTM C309 for Type 1-D or Type 2.

450.3 CONSTRUCTION REQUIREMENTS

450.3.1 Proportioning

The Contractor shall use a Class P concrete mix that has been reviewed and approved in accordance with Section 509, "Portland Cement Concrete Mix Designs" by the State Concrete Engineer. If the concrete is not slip-formed, an approved Class HPD concrete mix shall be used instead of Class P.

The Contractor shall mix and place all concrete in accordance with Section 510.3, "Construction Requirements" except for Subsection 510.3.5.5, "Price Adjustments." The Contractor shall use a concrete mix that has been approved for use in the Freeze-Thaw zone, as defined in Section 509.2.7.4, "Freeze-Thaw Risk Zones" in which the Project is located.

The Contractor shall keep a copy of the approved mix design available on the jobsite when using the concrete mix.

450.3.2 EQUIPMENT

450.3.2.1 Batching Plant

The Contractor shall Use batching plants and Equipment that meet the requirements of Section 510.3.2.1, "Batching Plant."

450.3.2.2 Mixers

The Contractor shall use mixers that meet the requirements of Section 510.3.2.6, "Mixing."

450.3.2.3 Transporting

The Contractor shall use truck mixers, truck agitators or non-agitating trucks that comply with Section 510.3.2, "Transporting."

450.3.2.4 Slip-Form Paver

The Contractor shall place the concrete with an approved slip-form paver designed to spread, consolidate screed, float, and finish the concrete in one (1) complete pass to create a dense and homogeneous pavement. Minimize the use of hand finishing.

The vibrators of the slip-form paver must be located behind the auger. The Contractor shall not use pavers with vibrators in front of the auger.

The Contractor shall equip slip-form pavers with internal vibrators that meet or exceed the following Specifications at 8,000 cycles per minute (cpm) under no-load conditions:

1. Amplitude (peak to peak) = 0.070 inch; and
2. Centrifugal force = 1,200 lb.

The Contractor shall equip the slip-form paver with an electronic monitoring device capable of the following:

1. Displaying the operating frequency of each internal vibrator; and
2. Continuously recording at a minimum the following:
 - a. Time of Day,
 - b. Station location,
 - c. Paver track speed, and
 - d. Operating frequency of each vibrator.

The Contractor shall store all information captured by the electronic monitoring system throughout the Project. This information is to be used only for Project information by the Department and will be provided to the Project Manager at his request during the course of the Project and at the completion of the Project.

The Contractor shall position the vibrators no further apart than the manufacturer's recommendations for horizontal spacing of the vibrators; but do not exceed 18 inches, center-to-center. The Contractor shall ensure that the space from the outer edge of the pavement to the center of the outside vibrator does not exceed nine (9) inches, or $\frac{1}{2}$ the maximum recommended spacing, whichever is less.

450.3.2.5 Concrete Jointing Equipment

The Contractor shall provide enough sawing Equipment to complete the Work within the allotted time. The Contractor may use a water-cooled diamond edge saw blade, or an "early entry dry cut" type with a skid plate, as defined by ACI 302. The Contractor shall provide at least one (1) additional saw in good working order. The Contractor shall keep an ample supply of saw blades (and skid plates, if the "early entry dry cut" saws are used) at the Work site during sawing operations.

450.3.2.6 Curing Compound Application Equipment

The Contractor shall apply curing compounds with Equipment that uses a pressure tank or pump. The Contractor shall ensure that the Equipment has a feed tank agitator that provides continuous agitation of the compound during spraying operations. The Contractor shall use a nozzle that contains enough air to thoroughly atomize the compound.

450.3.3 Operations

For slip-form paving, the Contractor shall construct a padline of sufficient width and stability to accommodate the slip-form paving Equipment.

The Contractor shall provide enough lateral support to construct the section in accordance with the Contract. The Contractor shall maintain the smoothness and compaction of the Base Course in the specified condition until the concrete placement is completed. The Contractor shall moisten untreated aggregate base layer, if used, before paving standing water will not be allowed.

The Contractor shall control the paver alignment and grade by using a string line pulled from pin to pin in front of the paver at intervals not greater than 25 feet, or by automatic machine control (stringless system).

450.3.3.1 Handling, Measuring, Batching, and Mixing Materials

The Contractor shall handle, measure, batch, and mix the Materials in accordance with Section 510, "Portland Cement Concrete." The maximum mixing time for either truck mixers or non-agitating mixers is specified in Section 510.3.4.2, "Mixing Time."

450.3.3.2 Placing, Spreading, and Consolidating Concrete

The Contractor shall place concrete with the specified thickness along the full width of the lane or area being paved. The Contractor shall prevent segregation and minimize redistribution. The Contractor shall place the concrete continuously between transverse joints without using intermediate bulkheads.

When using dowel baskets, the Contractor shall not end-dump the concrete directly onto the dowel baskets. The Contractor may use end-dumps to transfer the concrete to the Equipment designed to place it completely across the grade. The Contractor shall not windrow the concrete.

When placing concrete adjacent to a newly constructed PCCP lane, the Contractor shall not operate Equipment or traffic on the lane until the concrete has achieved a compressive strength of at least 3,000 psi, as determined by the Maturity Method, as described in Section 510.3.5.2, "In-Place Concrete Strength Measurements."

When working on existing pavement, the Contractor shall use Equipment with protective pads on crawler tracks or rubber-tire wheels. The Contractor shall set the crawler tracks or rubber-tire wheels far enough from the pavement edge to prevent damage to the pavement.

The Contractor shall receive delivery tickets, monitor and maintain yield to achieve the minimum required thickness. Copy of tickets shall be delivered to NMDOT at the end of each Days paving.

Additional concrete Material shall be placed at locations of grade adjustments and irregularities as approved by NMDOT.

450.3.3.2.1 Slip-Form Paving

The Contractor shall use a slip-form paver that complies with Section 450.3.2.4, "Slip-Form Paver" to distribute the concrete uniformly. The Contractor shall vibrate the full width and depth of the concrete to consolidate the concrete without causing segregation. The Contractor shall ensure that the vibration produces uniform concrete that will stand normal to the surface with sharp well-defined edges.

The Contractor shall coordinate concrete mixing, delivering, and spreading operations in order to provide uniform progress and to minimize stopping and starting of the paver. If it is necessary to stop the paver, the Contractor shall also stop the vibratory and tamping elements immediately. The Contractor shall not apply external tractive force to the machine; the machine must be propelled only by its own mechanisms.

450.3.3.2.2 Other Paving

For paving operations that are not slip-formed, the Contractor will place Class HPD concrete between stationary side forms. The Contractor shall consolidate the concrete by internal vibration and finish it to the required surface smoothness using the hand-float method or other suitable means. The Contractor shall cure the concrete with approved methods.

The Contractor shall leave wood or metal forms in place at least 12 hours after placing the concrete. If necessary, the Contractor shall take additional efforts to prevent thermal cracking of the concrete. The Contractor shall clean and oil the forms each time they are used. The Contractor shall apply a curing compound to the concrete surfaces exposed by removal of the forms immediately after removing the forms.

The Contractor shall check the form's alignment and grade elevations and make the necessary corrections before placing the concrete. If a form is disturbed or if the Base Course under a form becomes unstable, the Contractor shall reset and recheck the form, as directed by the Project Manager.

450.3.3.3 Temperature and Weather Limitations

Temperature and weather limitations are defined in Section 511.3.4, "Temperature and Weather Limitations." The Contractor shall keep the concrete temperature between 50 °F to 90 °F at the time of placement. For cold weather placement refer to Section 511.3.3.1, "Cold Weather Concrete." The Contractor shall provide the Project Manager with Hot Weather and Cold Weather Concrete Placement and Curing Plan(s) in accordance with Section 51.3.4, "Temperature and Weather Limitations" for review and approval by the State Concrete Engineer.

450.3.3.4 Rate of Evaporation Limitations

The Contractor shall continuously monitor the evaporation potential at a height not to exceed five (5) ft above the surface of the concrete as determined from Figure 511.3.4.3:1, "Surface Evaporation from Concrete" at the actual placement location. Computerized Equipment furnished by the Contractor must have the capability to automatically take the required readings. Readings shall be taken at least once every five (5) minutes beginning at least 15 minutes before the placement begins and continuing until the final application of the curing compound has been completed. All readings shall be graphically plotted on a continuous time scale.

The Contractor shall not place (or continue to place) PCCP if the average evaporation potential over any ten (10) minute period of time is greater than 0.2 lb per square ft per hour.

If the evaporation exceeds the 0.15 lb per square foot per hour, one (1) or more of the following actions shall be implemented to reduce the rate of evaporation, as approved by the Project Manager:

1. The Contractor shall use an evaporation retarder (If used, this cannot be used as a finishing aid).
2. The Contractor shall erect windbreaks to reduce the wind velocity over the concrete surface.
3. The Contractor shall place concrete during nighttime or early morning hours.
4. The Contractor shall lower the fresh concrete temperature during hot weather. This can be accomplished by using cool aggregate and chilled water, by adding ice as part of the mixing water, or by adding liquid nitrogen to the concrete mix after all mix ingredients have been placed into the ready mix truck.
5. The Contractor shall increase the relative humidity at the site with a fog spray maintained over the entire concrete surface until the final finish has been achieved and the curing system has been applied.

450.3.3.5 Change in Atmospheric Conditions

Placement of any PCCP by the Contractor during marginal weather placement is at the Contractor's risk. The Contractor shall repair or replace at no additional cost to the Department any concrete that is determined by the Assistant District Engineer (Construction) to be damaged due to weather conditions.

450.3.4 Joints

The Contractor shall submit the proposed joint layout plan in .pdf format to the Project Manager, State Pavement Engineer, and the State Materials Bureau for review and approval at least four (4) weeks before starting concrete slab construction. The proposed joint layout plan shall have the lane markings clearly depicted. Attempts shall be made in the submitted jointing plan for mainline paving not to place longitudinal joints in the wheel path. After receiving the recommendations and/or responses from the State Pavement Engineer and from the State Materials Bureau the Project Manager will either approve or reject the submittal within ten (10) Working Days from the date of submittal.

The Contractor shall construct joints at the locations, intervals, and dimensions shown in the approved joint layout Plan, and seal them in accordance with Section 452, "Sealing and Resealing Concrete Pavement Joints." The Contractor shall ensure no re-entrant corners. For typical slabs, the longitudinal joint spacing shall not exceed 12 feet and the transverse joint spacing shall not exceed 15 feet.

The Contractor shall avoid taper joints if possible. If a tapered joint is formed, the Contractor shall place a control joint at:

1. One-half the distance between the end of the taper and the opposite end, if the baseleg is less than or equal to ten (10) ft and longer than five (5) ft; or
2. Third points along the base leg, if the base leg is longer than ten (10) ft.

Additional Jointing Guidance:

1. No slabs will have angles less than 60 degrees.
2. Joints shall be "dog-legged" through curve radius points. Dog leg should be at least 24 inches in length to the radius point.
3. The Contractor shall construct joint faces perpendicular to the PCCP surface.

The Contractor shall install dowels at any joints added to control cracking in exactly the same way as the standard joints.

The Contractor shall construct transverse and longitudinal contraction joints by inserting control joints while the concrete is still plastic or by sawing the freshly hardened concrete as soon as possible after placing it. The Contractor shall make the initial sawcut at least one third the pavement depth. The Contractor shall not allow the saw to cut so deep that any reinforcement is damaged.

The Contractor shall saw joints in a sequence and with a timing that will eliminate the possibility of uncontrolled cracking.

Time to cut longitudinal and transverse joints is to be determined by the Contractor. Approval of jointing Plan by NMDOT does not absolve the Contractor from responsibility of PCCP panels containing uncontrolled cracks. The Project shall not be granted Substantial Completion until all panels containing cracks have been removed and replaced.

The Contractor shall make transverse contraction and longitudinal joints in two (2) phases. The Contractor shall make the initial saw cut or inserted joint wide enough and deep enough to ensure that a sufficiently weakened cross-section exists, but not less than 1/3 the thickness of the concrete. The Contractor shall make the second sealant reservoir-shaping saw cut in accordance with the details shown in the Plans. The Contractor shall not damage the steel reinforcement with any saw cut.

The Contractor shall saw joints sequentially. However, the Contractor may saw control transverse joints at intervals shown in the Contract, or at intervals that will most effectively minimize the possibility of uncontrolled cracking.

If necessary, the Contractor shall perform the sawing operations day and night, regardless of weather conditions. The Contractor shall not saw a joint if a crack occurs at or near the joint location before sawing. The Contractor shall immediately discontinue sawing of a joint when a crack develops ahead of the saw.

The Contractor shall install dowels at transverse construction joints.

The Contractor shall construct transverse contraction joints by sawing the freshly hardened concrete as soon as possible after placement. The Contractor shall make the saw cut at least one third (1/3) the pavement depth as shown on the typical drawing included in the Project documents, or 1 1/4 inch depth for early entry sawing. The Contractor shall not allow the saw to cut so deep as to damage any reinforcement.

All PCCP panels containing full-depth uncontrolled cracks shall be removed and replaced at no additional cost or time to the Department. The Project shall not be granted Substantial Completion until all panels containing full-depth cracks have been removed and replaced.

The Contractor shall change saw blades (and skid plates, when using the early entry dry cut saws) as often as required to control and minimize spalling. The Contractor shall maintain a sufficient supply of replacement saw blades and skid plates at the Project site to insure that the sawing operations will proceed without interruption until completed.

450.3.4.1 Longitudinal Joints

The Contractor shall place tie bars in accordance with the current NMDOT Standard Drawings, perpendicular to the longitudinal joints using approved Equipment, or secure the

joints with chairs or baskets. The Contractor shall not place tie bars within 15 inches of transverse joints.

The combined width of all concrete slabs tied together in any one (1) placement shall not be more than 40 feet.

The Contractor shall use straight full-length tie bars, a two (2) part threaded tie bar and splice coupler system, or bent tie bars. The Contractor shall only bend tie bars made of Grade 420 steel. The Contractor shall bend tie bars at right angles against the form of the first lane constructed and then straighten them into final position before placing the concrete of the adjacent lane.

If construction of PCCP abuts existing pavement, the Contractor shall drill the holes at mid-depth of the thinner slab. The Contractor shall drill the face of the existing PCCP to accept half of the tie bar length. The Contractor shall ensure that the drill holes are a diameter that allows easy insertion of the tie bar but minimizes the requirement for grout or epoxy anchor Materials. The Contractor shall construct joints with tie bars as shown on the Plans.

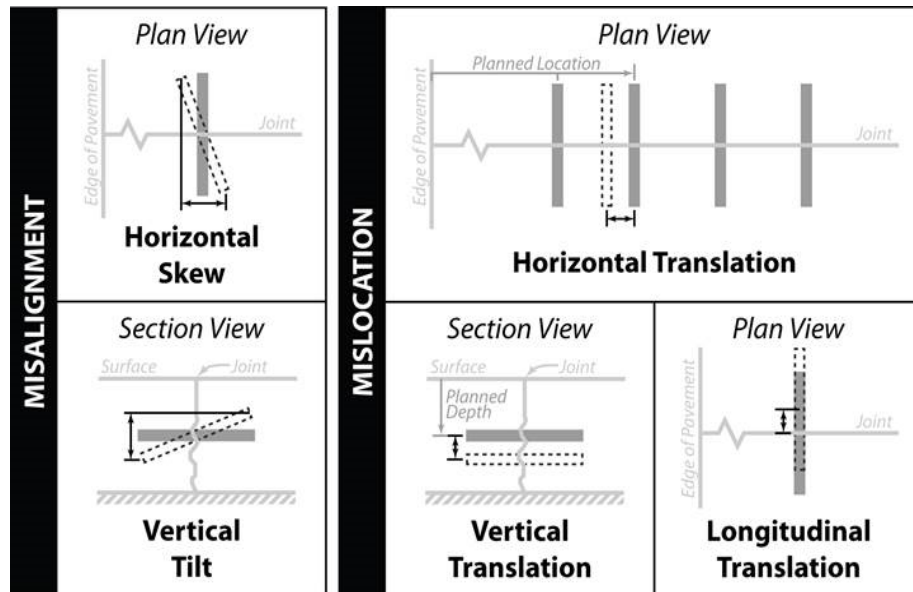
450.3.4.2 Transverse Joints

The Contractor shall construct transverse contraction joints with load transfer devices (dowels). The Contractor shall hold dowels in position parallel to the surface and centerline of the slab with chairs or other approved supports as approved by the Project Manager. The Contractor shall submit shop drawings of the welded dowel assemblies to the Project Manager for approval by State Pavement Engineer. The Contractor shall not place concrete until the Department approves the welded dowel assemblies.

Dowel bars shall be installed within the tolerances and of the size, grade and spacing specified. Horizontal support wires or shipping braces shall be non-deformed bars or wires with a diameter less than or equal to 0.307 inches (gauge 0 wire). The number of horizontal support wires or shipping braces shall be limited to a maximum of five (5) per assembly. The center of the dowel assembly or insertion location shall be marked on both sides of the pavement slab for reference in sawing the joint. Dowel bars shall be furnished in a rigid welded assembly or, when the Contractor demonstrates that the placement can be made within required tolerances, placed by a dowel insertion machine. Assembly should be securely fastened to the Base/Subbase and constructed to firmly hold all the centerline of all dowel bars at T/2 depth with a minimum of three (3) inches cover, parallel to each other and to the pavement grade and alignment. See Detail indicated in the Contract Plans or standard Plan serials for the applicable section.

450.3.4.2.1 Individual Dowel Placement Tolerances

- Horizontal Skew (Rotational Alignment) = 1 ½" inches
- Vertical Tilt (Rotational Alignment) = 1 ½" inches
- Horizontal Translation = Two (2) inches
- Vertical Translation (Depth) = One (1) inch
- Longitudinal Translation = Three (3) inches



- **Horizontal Skew** – The deviation of the dowel bar from true parallel alignment from the edge of the pavement, measured over the entire length of the dowel bar.
- **Vertical Tilt** – The deviation of the dowel bar from true parallel alignment from the surface of the pavement, measured over the entire length of the dowel bar.
- **Alignment** – The degree to which a dowel bar aligns true (e.g., parallel) to the horizontal and vertical planes of the pavement.
- **Misalignment** – Any deviation in either the horizontal or vertical plane from a true alignment condition (e.g., horizontal skew or vertical tilt).
- **Mislocation** – Any deviation of the dowel bar from its planned location other than misalignment.

The Contractor is responsible for ensuring that the dowels remain properly aligned and in the proper locations before and during the placing procedure. The Contractor shall not cut the tie wires holding the baskets together before placing the concrete.

The Contractor shall thoroughly and uniformly coat each dowel and each tie wire along its full length with an approved form release agent not more than twelve (12) hours before concrete placement. The Contractor shall not use grease to lubricate the dowels. If the concrete placement is postponed or Delayed; the dowels will be re-coated.

Ground Penetrating Radar equipped with dual side-by-side antennas or approved equal by the Project Manager and State Concrete Engineer can be used for all embedded steel reinforcement. Magnetic Tomography (i.e. MIT Scan 2) may be utilized. Regardless of the equipment used, the results from the nondestructive testing shall be confirmed by drilling or coring for at least three (3) dowel bars within the first 120 linear feet of paving.

450.3.4.2.2 Joint Score

The Joint Score is the means of assessing locking potential. The Joint Score is evaluated for a single transverse joint between adjacent longitudinal joints and/or pavement edges.

**Table 450.3.4.2.2:1
WEIGHTING FACTORS USED TO DETERMINE JOINT SCORE**

Range of Rotational Misalignment	Weight
< 0.6 in.	0
≥ 0.6 in and < 0.8 in.	2
≥ 0.8 in and < 1 in.	4
≥ 1 in	5
Joint Rejection Criteria: 1. Any joint with a Joint Score greater than ten (10) is considered rejected. An individual joint may be allowed if the two (2) longitudinally adjacent joints each have a joint score less than or equal to ten (10). 2. Any joint that does not have at least three (3) acceptable dowel bars in each wheel path.	

450.3.4.2.3 Individual Dowel Bar Rejection Criteria

Rotational Alignment (Vertical Tilt and Horizontal Skew):

- Any bar with a misalignment greater than 1.5 inches.

Longitudinal Translation:

- Any bar with a mislocation greater than three (3) inches.
- Any bar that is not embedded at least six (6) inches on each side of the joint.

Vertical Translation (Depth):

- Any bar within the top three (3) inches of the pavement or at a depth less than the saw-cut depth.
- Any bar within the bottom three (3) inches of the pavement.
- Any bar with a mislocation of greater than one (1) inch.

Horizontal Translation:

- Any bar with a mislocation of greater than two (2) inches.

When rigid assemblies are used to install dowel bars and the bars are rejected for depth, the Contractor may core the pavement to verify the MIT 2 Scan depth results.

450.3.4.2.4 Dowel Bar Corrective Measures

The following corrective measures will be allowed for the bars or joints that are rejected:

- Rotational Misalignment:
 - o Saw-cut the misaligned bars. Joints with less than three (3) un-cut bars in each wheel path will require the addition of dowel bars using an approved dowel bar retrofit method.

- Longitudinal and Horizontal Mislocation:
 - o Addition of dowel bars using an approved dowel bar retrofit method.
- Depth:
 - o Inadequate cover above the bar - Remove the bar and install a replacement bar using an approved dowel bar retrofit method.
 - o Inadequate cover below the bar - Addition of dowel bars using an approved dowel bar retrofit method.
- Missing Dowel Bars:
 - o Addition of dowel bars using an approved dowel bar retrofit method.

Retrofitting dowel bars shall not exceed the dowel bar rejection criteria.

In addition to the above procedures, the Contractor may propose removal and replacement of the affected slabs.

The Contractor shall submit the method of repair to the Project Manager for approval.

The Contractor shall demonstrate his ability to place dowel bars in conformance with the specifications by placement of a test section.

The test section shall be a minimum of 120 feet in length. Upon completion of the test section, the Contractor shall shut down paving operations. During the shutdown period, the Contractor shall evaluate all joints in the test section using the Ground Penetrating Radar, analyze the results and submit the results to the Project Manager. Paving operations shall not be restarted until the Project Manager approves the test section results. The test section will be found acceptable if 85% of the dowel bars placed are found to be within the acceptable tolerances stated in the rejection criteria. All dowel bars exceeding the Rejection Criteria must be addressed using the above corrective measures.

If the Project has less than 500 linear feet of pavement, the test section will not be required. If a Project does not have sections of continuous pavement greater than 45 linear feet, the test section will not be required.

Upon completion of the test section(s) and for each week of production, the Contractor shall prepare an electronic report generated using MagnoProof or equivalent software and submit it to the Project Manager at the start of each working week during production for the previous week's Work. All data shall be submitted in the manufacturer's native file format, along with the calibration files.

The electronic report shall include the following:

1. Control number, date, highway number and direction of traffic.
2. Joint number, lane number and station.
3. Bar number and x-location of dowel bar.
4. Horizontal and vertical misalignment of each bar in inches.
5. Overall misalignment of each bar in inches of each bar.
6. Side shift of each bar in inches.
7. Depth to center of each bar in inches.
8. Joint Score.

9. All measurements exceeding the rejection criteria shall be highlighted in red.

In addition to the electronic report provide all information required in the report as listed above on the final joint layout plan and provide to the Project Manager for Final Acceptance of the PCCP.

Due to potential magnetic interference from tie bars, dowel bars located within 15 inches of a tied joint shall not be included in the evaluation.

When the test section is found to be unacceptable, the Contractor shall perform corrective actions and place a second test section. If the second test section is found to be unacceptable, the Contractor shall pave no more than 500 feet per day until an acceptable test section has been achieved.

Once a test section is successfully completed, Dowel Bar Placement testing frequency shall be a minimum of one (1) location per 1,250 linear feet of each continuous lane including climbing lanes, passing lanes, acceleration and deceleration lanes and ramps or at the discretion of the Project Manager. Sections greater than 45 linear feet and less than 1,250 linear feet require a minimum of one (1) test location. Testing locations shall be determined by a random procedure so that each area has a randomly selected transverse joint location. At each location, five (5) consecutive joints shall be tested.

Sections of continuous pavement constructed less than 45 linear feet will not require Dowel Bar Placement Testing.

When any joint score is greater than ten (10) or any one (1) bar in a single joint exceeds the rejection criteria, joints shall be tested in each direction from the rejected joint, until two (2) consecutive joints in each direction are found to be within the rejection criteria.

All Delays or costs associated with dowel bar rejection will not be paid for by the Department.

The Contractor will be responsible for providing the appropriate equipment and qualified personnel to provide the specified tests and reports to the Project Manager. This work will be incidental to concrete pavement.

450.3.5 Finishing

After the concrete has been discharged from the truck, no additional water will be added to the concrete.

The Contractor shall provide a final surface finish that complies with the Project requirements for MRI, measured in accordance with Section 401, "Pavement Smoothness Measurement."

The Contractor shall correct pavement edge slumping (exclusive of specified edging) in excess of ¼ inch before the concrete hardens. If edge slump exceeds ¼ inch within ten (10) ft, or less, of hardened concrete, replace the entire panel between the transverse and longitudinal joints.

Before the concrete's initial set, the Contractor shall work the edges and joints with the appropriate tools to produce a well-defined and continuous radius with a smooth and dense mortar finish that is not segregated nor prematurely sealed. The Contractor shall minimize disturbance of the slab surface during finishing operations. It is the Contractor's responsibility not to over-work the surface of the fresh concrete. Any plastic shrinkage cracks that occur

shall be repaired or replaced at the discretion of the Project Manager at no cost in time or money to the Department.

The Contractor shall thoroughly clean the sawed area and, after completion of the sawing process. The Contractor shall seal the joint immediately, if required by the Project Manager.

The Contractor shall give the pavement a final wearing surface by tining or grooving as required in Section 450.3.5.1, "Texturing of PCCP."

450.3.5.1 Texturing of PCCP

Texturing of PCCP will be longitudinal tining.

When tining, the Contractor shall use a mechanical device such as a wire broom or comb having a single row of tines 1/8 inch +/- 1/64 inch width. The depth of groove in the plastic concrete shall be 1/8 inch +/- 1/16 inch. Tining will be Longitudinal unless otherwise specified in the Contract.

Longitudinal Tining: The tines shall be uniformly spaced at 3/4-inch intervals. The Contractor shall use Equipment with horizontal and vertical controls to ensure straight, uniform depth grooves. A two (2) inch to three (3) inch wide strip of pavement surface shall be protected from longitudinal surface grooving for the length of and centered over the longitudinal joints.

Transverse Tining: The tines shall be randomly spaced from 3/8 inch to 1 5/8 inch with no more than 50% of the spacing exceeding one (1) inch. The Contractor shall leave a four (4) inch to six (6) inch wide un-tined strip of pavement surface centered over each transverse joint.

The Contractor shall perform the tining operation at such time and manner that the desired surface texture will be achieved while minimizing displacement of the larger aggregate particles and before the surface permanently sets. Where abutting pavement is to be placed, the texturing shall extend as close to the edge as possible without damaging the edge. If abutting pavement is not to be placed, the six (6) inch area nearest the edge or one (1) foot from the face of the curb shall not be textured. All uniform width slabs of 20 feet or narrower and less than 600 feet in length, as well as mainline and ramp pavement during Equipment breakdowns, may be textured by hand methods.

When diamond grooving is specified or allowed in the Contract Plans, the Contractor shall allow concrete to cure, but no sooner than 48 hours groove the surface of the concrete in accordance with Section 455, "Diamond Grinding and Grooving of Portland Concrete Cement Pavement." Unless otherwise approved by the Project Manager, make grooves as required by the Project Specifications.

The Contractor shall stamp the concrete surface near the right hand edge of the panel at the start and end of paving each Day, indicating the date, month, and year of placement.

The Contractor shall stamp the concrete surface at 500-foot intervals near the right-hand edge of the pavement indicating the Roadway station.

450.3.5.2 Protection of Fresh Concrete

To protect the fresh concrete from unanticipated storm events, the Contractor shall keep enough waterproof sheeting at the placement location to cover the maximum anticipated

amount of pavement that can be placed in a three (3) hour period. The Contractor shall reserve this sheeting exclusively to protect the pavement.

450.3.5.3 Surfacing Smoothness Requirements

The Contractor shall test the longitudinal smoothness of the PCCP finished surface in each through traffic lane and passing lane with an approved Profile, in accordance with Section 401, "Pavement Smoothness Measurement."

The Department will exclude the following locations from the Profiler measurement (The Contractor shall evaluate them using a straightedge in accordance with Section 401, "Pavement Smoothness Measurement."):

1. Shoulders, ramps, tapers, holding lanes, turn-outs, Medians, concrete pavement slab removal and replacement Projects, intersections not paved integrally with the mainline, and other non-mainline pavement.

450.3.5.4 Straightedge Measurements

The Contractor shall measure the surface of PCCP not subject to Profiler measurements using an approved ten (10) foot straightedge at both right angles and parallel to the centerline. The Contractor shall correct surface deviations greater than ¼ inch within ten (10) feet.

450.3.6 Curing

For Curing, the Contractor Shall use Method 2 as described in Section 511.3.10.2, "Method 2, Curing Compound" except as amended here.

The Contractor shall apply curing compound in accordance with the Manufacturer's instructions. If the Manufacturer does not specify when application should begin, the Contractor shall apply the curing compound immediately after finishing and texturing but no later than 30 minutes. The Contractor shall maintain curing compounds in place as specified below until such time as the pavement is to be opened for traffic or until the concrete has reached 3,000 psi compressive strength, whichever occurs first. The Contractor shall not apply the curing compound in rainy conditions.

450.3.6.1 Application of Curing Compound

The Contractor shall thoroughly mix the membrane forming curing compound within an hour of use and agitate it during spraying operations. Before placing the curing compound in the spray tank, the Contractor shall thoroughly agitate it with compressed air, or other approved means, until the pigments in the original container are uniformly suspended. The Contractor shall not dilute or alter the curing compound in any way. The Contractor shall not use a curing compound that exhibits separation, segregation, or skinning.

The Contractor shall apply curing compound to the entire area of the exposed concrete surface with an approved mechanical spray machine. The Contractor shall protect the fog spray from the wind with an adequate shield and apply uniformly until it completely covers the entire surface without gaps or openings in the coverage. The Contractor shall spray the concrete surface uniformly with two (2) coats of approved curing compound at an individual application rate of not more than 180 sq. ft. per gallon. The Contractor shall apply the first coat within ten (10) minutes after completing texturing operations. The Contractor shall apply the second coat within 30 minutes after completing texturing operations. The Contractor shall immediately reapply the curing compound over any control joints that were cut through previously applied coatings of curing compound.

The Contractor shall protect all surfaces covered with curing compound for three (3) Days after application. The Contractor shall re-apply curing compound in areas damaged by subsequent work activities.

The Contractor shall place the curing compound directly into the spray tanks from the manufacturer's original containers bearing the manufacturer's name, brand, and lot number.

If, because of cold temperature, the curing compound becomes too viscous for proper stiffening or application, or if portions of the curing compound have been precipitated from solution, the Contractor shall follow the manufacturer's recommendations to restore proper fluidity and dispersion.

If rain falls on freshly applied curing compound before it has dried enough to resist damage, or if the surface is otherwise damaged, the Contractor shall apply an additional coat of curing compound.

450.3.7—Reserved

450.3.8 Protections from and Opening to Traffic

The Contractor shall protect new pavement against public traffic and operational and employee traffic. The Contractor shall provide personnel to direct traffic. The Contractor shall erect and maintain warning signs, lights, pavement Bridges, or crossovers in accordance with the Contract's traffic control requirements.

The Contractor shall not open to traffic for a least three (3) Calendar Days or until the concrete has reached a compressive strength of 3,000 psi as determined by the Maturity Method, in accordance with Section 510.3.4.2.2, "In-Place Concrete Strength Measurements," unless the Project Manager directs otherwise.

The Contractor shall clean the pavement of loose Materials and debris before opening to traffic.

450.3.9 Test Strip

The Contractor shall construct a test strip a minimum of 0.1 mile, but not more than 0.2 mile in length for each CPPC mix design with a minimum of three (3) Contractor and three (3) agency samples to evaluate the process control, and placement operations. The Contractor shall construct test strip on shoulder, low volume segments of the pavement, or area approved by the Project Manager. The Contractor shall correct and modify non-complying placement operations and produce necessary process control adjustments. The Contractor shall develop a revised placement method if necessary based on the results of the test strip. Production and placement operations prior to approval of the revised placement operations are at the Contractor's risk.

The test strip will be evaluated in conformance in accordance with this Section. If accepted, the test strip will have a pay factor of one (1.0). If rejected, said Material shall be handled in accordance with Table 450.3.10.2.1:1, "Acceptance Limits." The Contractor shall remove unaccepted test strip Material placed within the Roadway Prism at no cost to the Department. If the Contractor disagrees with removing and replacing unacceptable Material placed in test strips outside the Roadway Prism, the Assistant District Engineer for Construction, based on his or her engineering judgment, will decide if the Material can remain in place with a maximum pay factor of 50%, or shall be removed and replaced at no cost to the

Department. If the test strip is rejected, the Contractor shall construct a subsequent test strip. The Contractor shall not proceed to full production until an Accepted test strip is produced.

450.3.10 Sampling and Testing

The Contractor shall sample and test the aggregate production and PCC mixture in accordance with Section 902, "Quality Control;" Section 903, "Quality Assurance;" and Section 906, "Minimum Testing Requirements." Department personnel may test locations other than the random locations generated for statistical analysis. These tests will not be used for pay factor determination, but may be used to determine Acceptance or rejection of localized Material.

450.3.10.1 Contractor Quality Control

The Contractor shall administer a Quality Control Plan, referred to hereafter as "the Plan" to provide a product in accordance with the Contract. The Contractor shall ensure the Plan conforms to Section 902, "Quality Control." The Contractor shall submit the Plan a minimum of two (2) weeks prior to PCCP pre-placement meeting. No PCCP operations are allowed until the Plan has been approved by the Project Manager and District Lab Supervisor.

The Contractor shall ensure the plan addresses all elements that affect the quality of the Portland cement concrete paving, including but not limited to:

1. Mix designs;
2. Aggregate production;
3. Quality of components;
4. Stockpile management;
5. Batching;
6. Mixing;
7. Transporting;
8. Placing;
9. Vibration and consolidation;
10. Finishing;
11. Joints;
12. Smoothness;
13. Hot/Cold Weather Placement and Curing Plan(s);
14. Curing method;
15. Thickness;
16. Placement phasing;
17. Rumble strips if required; and
18. Non Destructive Testing Methods (including Project calibration process).

The Contractor shall make sure the Plan identifies personnel responsible for sampling and testing of PCCP, and how to contact them at any time. The Contractor shall make sure that qualified sampling and testing personnel perform PCCP sampling and testing in accordance with Section 906, "Minimum Testing Requirements." The Contractor shall provide at least two (2) qualified technicians, as follows:

1. The Process Control Technician (PCT) is responsible for performing inspection, sampling, and testing at the concrete batching facility and at the Contractor's field

Laboratory. The PCT shall use Laboratory test results and other Quality Control practices to assure the quality of aggregate sources and other mix components, and adjust and control mix proportioning to meet the mix designs. The PCT shall periodically inspect Equipment used in proportioning and mixing to assure its proper operating condition and to assure that the Contractor performs proportioning and mixing in accordance with the mix design and other requirements.

2. The Quality Control Technician (QCT) is responsible for inspection, sampling, and testing at the paving site. The QCT shall assure that the delivered Materials comply with the requirements of the Contract. The QCT shall periodically inspect Equipment used to transport, place, and finish the concrete to assure its proper operating condition, and to assure that the Contractor provides a final constructed product in accordance with the Contract.

The Plan must coordinate and document the activities of the PCT and QCT. This includes the frequencies for each test, the criteria to reject or correct unsatisfactory Materials, and a description of what corrective actions can be taken, and how and when the actions will be initiated.

The Plan will detail the sampling and testing programs, including methods to determine and apply random sampling locations. The Contractor shall perform sampling and testing in accordance with Section 906, "Minimum Testing Requirements."

450.3.10.2 Department Quality Assurance

The Department will sample and test the Material on a statistically random basis in accordance with Section 903, "Quality Assurance" and Section 906, "Minimum Testing Requirements."

450.3.10.2.1 Acceptance

The Department will evaluate and Accept Materials using Contractor and Department test data in accordance with Section 904, "Quality Level Analysis" and Section 906, "Minimum Testing Requirements."

In addition to as indicated above, the thickness of the plastic concrete shall be determined by the Contractor by taking stab depth measurements during paving at intervals not greater than 100 feet intervals. The recorded depth shall be the average of three (3) depths taken per location and the three (3) locations shall be within 18 inches of one another. The Contractor shall stab and measure at the lane lines. When the edge of the concrete being placed falls at a lane line; the measurement shall be offset two (2) ft from that line. The Contractor shall keep a log (date, before or behind paver, depth station and offset) of these measurements and provide the NMDOT a copy every week, unless otherwise requested.

**Table 450.3.10.2.1:1
Acceptance Limits**

Characteristic	Specification limits, from TV
Entrained air (from the appropriate Freeze/Thaw Risk Zone)	± 1.5%
*Target Compressive Strength (From approved mix design)	± 1,000 psi
Thickness (From Project Specifications)	+ 1 inch/-1/4 inch
Unless otherwise provided in the Contract, target values for Acceptance shall be as follows:	

Table 450.3.10.2.1:1
Acceptance Limits

Entrained air	Target Air Content for the Freeze/Thaw Risk Zone in which the Project is located
Compressive strength	Target strength from mix design
Thickness	Nominal plan thickness +1 inch/-1/4 inch
*Target Compressive Strength will be the average compressive strength of the first thirty (30) tests from the Contractor's QLA testing program. If the Contractor's data does not validate with the departments data, the Target Compressive Strength will be the average of the first ten (10) Department tests.	

450.3.10.3 Independent Assurance Testing

The Department will perform Independent Assurance sampling and testing in accordance with Section 906, "Minimum Testing Requirements."

450.4 METHOD OF MEASUREMENT

The Department will only pay for the average thickness of pavement in accordance with the Plans.

The Department considers dowels, tie bars, joint Materials, and required coring, including the filling of core holes with concrete, Incidental to the Work in accordance with section 450, "Portland Cement Concrete Pavement ."

The quantities for PCCP will be measured in square yards (Sq Yd) completed and Accepted. The width for measurement will be the width of the pavement shown on the typical cross section of the Plans, including additional widening where called for, or as otherwise directed by the Project Manager in writing. The length will be measured horizontally along the centerline of each roadway and ramp.

450.5 BASIS OF PAYMENT

The Department will adjust the PCCP unit bid price in accordance with Section 904, "Quality Level Analysis." The Department will pay for PCCP on a lot-by-lot basis at a price determined by multiplying the unit bid price by the composite pay factor. The Department will use Table 450.5:1, "Composite Pay Factor," to calculate the composite pay factor. Composite Pay factors greater than one (1.0) will be paid for as one (1.0).

Table 450.5:1
Composite Pay Factors

Measured characteristic	Factor "f"
Entrained air	25
Compressive strength	25
Thickness	25
Dowel bar tolerances	25

Pay Item

Concrete Pavement

Pay Unit

Square Yard

450.5.1 Work Included in Payment

The Department will consider as included in the payment for pay item(s) listed in this section and will not measure or pay separately for the following Work:

1. Dowels, tie bars, and joint Materials.
2. Mixing, hauling, placement, jointing, texturing, finishing, and curing of concrete pavement.
3. Quality Control in accordance with Section 902, "Quality Control."
4. Required coring and filling core holes with concrete.
5. Providing Mix Design in accordance with Section 509, "Portland Cement Concrete Mix Designs."

SECTION 509: PORTLAND CEMENT CONCRETE MIX DESIGNS

509.1 DESCRIPTION

This Work consists of developing, submitting and receiving approval to use Portland Cement Concrete (PCC) mix designs for use on Department Projects.

For the purposes of this Section, the following definitions are used:

1. Supplier: Any individual, partnership, company, firm, corporation, or joint venture that owns the Approved Concrete Mix Design, for concrete that is incorporated into a Department construction Project(s).
2. The terms "mix" and "mixture" are used interchangeably.

509.2 MATERIALS

All Materials shall be in accordance with AASHTO and ASTM methods or other test procedures designated by the Department. The State Materials Bureau is the final authority regarding the interpretation of test procedures.

The certifying laboratory or Private Testing Laboratory (PTL) performing the physical and chemical tests for the Supplier is required to participate in the Cement and Concrete Reference Laboratory (CCRL) proficiency sample and the pozzolan inspection programs.

509.2.1 Reserved

509.2.2 Cementitious Materials

Unless otherwise specified, the Supplier shall use; (1) a combination of Type II, III, or V Portland cement and supplemental cementitious Materials (SCM), (2) Blended cement, or (3) a combination of blended cement and SCM. Supplemental cementitious Materials used in blended cements shall not be used as a replacement of portland cement for mix design purposes.

509.2.2.1 Portland and Blended Cements

Portland cement shall comply with ASTM C150. Types II, III, and V portland cement shall have an alkali content less than 0.60% by mass of alkalis as $\text{Na}_2\text{O} + 0.658 \text{ K}_2\text{O}$ when determined under AASHTO T 105. Types III and V portland cements shall only be used if specified or authorized by the State Concrete Engineer.

Blended cements shall comply with Type IS (S) – portland blast-furnace slag cement, Type IP (MS) – portland-pozzolan cement, or Type IT – Ternary blended cement as specified in ASTM C595, except:

1. Portland cement used in blended cements shall comply with the requirements listed in 509.2.2.1;
2. Class C fly ash shall not be used in blended cements, unless otherwise approved by the State Concrete Engineer;
3. SCM used in blended cements shall meet the requirements of Section 509.2.2.2, "Supplementary Cementitious Materials;"
4. Maximum SCM content shall not exceed 50%; and
5. Blended cement shall be composed of Type II or V portland cement and SCM produced by one of the following methods:

- 5.1. Intergrinding of portland cement clinker and SCM;
- 5.2. Blending of portland cement and SCM; and
- 5.3. Combination of intergrinding and blending of portland cement and SCM.

509.2.2.2 Supplementary Cementitious Materials

Each SCM shall be in accordance with the following standards and as modified in Table 509.2.2.2:1, "Supplementary Cementitious Material Requirements:"

1. Portland cement used in blended cements shall comply with the requirements listed in Section 509.2.2.1, "Portland and Blended Cements;"
2. Class C and F fly ashes shall comply with the requirements of ASTM C618:
 - 2.1. Class C fly ash shall not be used in concrete exposed to sulfate environments or with "potentially reactive," or "reactive" aggregate;
3. Ultrafine fly ash (UFFA) shall comply with ASTM C618, Class F;
4. Natural or calcined natural pozzolans shall comply with ASTM C618, Class N;
5. Metakaolin shall comply with ASTM C618, Class N;
6. Ground granulated blast furnace slag (GGBFS) shall comply with ASTM C989, Grade 100 or 120; and
7. Silica fume shall comply with ASTM C1240.

**Table 509.2.2.2:1
Supplementary Cementitious Material Requirements**

SCM Type	Material Standard	Properties	Limits		
Coal Fly Ash, and Raw or Calcined Natural Pozzolans	ASTM C618	Class	N	F	C
		Sum of Al_2O_3 , SiO_2 , and Fe_2O_4 , min	75%	85%	50%
		Loss on ignition, max	5.0%	3.0%	3.0%
		Magnesium Oxide (MgO), max	5.0%	5.0%	5.0%
		Sulfur Trioxide (SO_3), max	3.0%	3.0%	3.0%
		Available alkalis as $\text{Na}_2\text{O} + 0.658 \text{ K}_2\text{O}$, max	1.50%	1.50%	1.50%
		Calcium Oxide (CaO), max	As Approved	8.0%	50%

Table 509.2.2.2:1
Supplementary Cementitious Material Requirements

SCM Type	Material Standard	Properties	Limits
Ultra Fine Fly Ash in addition to the requirements for Class F fly ash	AASHTO M 321	Accelerated Pozzolonic Activity Index,	
		7 day 28 day	85% 100%
		Particle size distribution	
		- less than 2.25 μm - less than 8.50 μm	50% 90%
		Fineness, retained on 45 μm wet sieve, max	5.0%
		Moisture content, max	1.0%
Metakaolin	ASTM C618	Silicon dioxide (SiO_2) + aluminum oxide (Al_2O_3), min	92%
		Calcium oxide (CaO), max	1.0%
		Sulfur trioxide (SO_3) max	1.0%
		Loss on ignition, max	1.2%
		Available alkalis as $\text{Na}_2\text{O} + 0.658 \text{ K}_2\text{O}$, max)	1.5%
		Accelerated Pozzolonic Activity	

**Table 509.2.2.2:1
Supplementary Cementitious Material Requirements**

SCM Type	Material Standard	Properties	Limits
		Index, • 7 day • 28 day Fineness, retained on 45 μ m wet sieve, max	85% 95% 5.0%
Silica Fume	ASTM 1240	Reduction in mortar bar expansion when used with cement in the proposed mix design, min	80%

509.2.2.3 Cementitious Materials Source Approval and Acceptance

The Department will approve individual cementitious Materials based upon compliance with the respective ASTM or AASHTO Standard Specifications and the requirements listed in this Section. The following information shall be included with each cementitious Material approval request submittal:

1. Supplier name and address;
2. Manufacturer name and address;
3. Production facility physical address;
4. Material type;
5. Material source/origin;
6. Raw Material source(s);
7. Production procedures;
8. Description of storage facilities;
9. Quality Control program documentation including the following:
 - 9.1. Certifying Laboratory's accreditation and current participation in the ASTM Cement and Concrete Reference Laboratory Program (CCRL);
 - 9.2. Routine sampling and testing frequency; and
 - 9.3. QC program test reports (mill certs) for each lot tested from the previous six (6) months shall be provided upon request from the Department;
10. Cementitious Materials shall be tested and certified for conformance with the respective Material Specifications below:
 - 10.1. Portland cements: ASTM C150 – Standard Specification for Portland Cement; and

- 10.2. Blended cements: ASTM C595 – Standard Specification for Blended Hydraulic Cements;
 - 10.2.1. Portland cements used in manufacturing blended cements: ASTM C150 – Standard Specification for Portland Cement; and
 - 10.2.2. SCM used in manufacturing blended cements: ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; and
- 11. Supplementary Cementitious Materials shall be tested and certified monthly for conformance with the respective Material Specifications listed below:
 - 11.1. Pozzolans: ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete;
 - 11.2. Metakaolins: ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete;
 - 11.3. GGBFS: ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars; and
 - 11.4. Silica fume: ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.

509.2.2.4 Withdrawal of Source Approval

The State Materials Bureau may withdraw cementitious Material source approval for any of the following reasons:

- 1. A change in Material source or production procedure from that on the original request for approval;
- 2. Failure to comply with Specification requirements;
- 3. The source becomes inactive for a period of three (3) months; or
- 4. The appropriate cementitious Material mill certificates are not received monthly.

509.2.2.5 Packaging

Cementitious Materials shall be packaged with the name brand, the source manufacturing facility, Material type, date of production and lot number. The Supplier shall provide the same information, as well as quantities, on the shipping documents for bulk cementitious Materials deliveries.

509.2.2.6 Storage

Different brands of SCM or cements from different production facilities shall be stored in separate, identifiable storage units provided at the production facilities. Each cementitious Material shall be stored separately.

509.2.3 Aggregates

509.2.3.1 Aggregates Testing

Coarse and fine aggregate shall be tested in accordance with the methods shown in Table 509.2.3.1:1, "Aggregates Test Methods." Concrete mix design approval involving a designated source will remain in effect as long as annual test results for specific gravity, absorption, gradation, and sand equivalent (for fine aggregate only) and annual tests for other requirements (except ASR) demonstrate Material compliance.

**Table 509.2.3.1:1
Aggregates Test Methods**

Method	Aggregate test	Coarse	
		Aggregates	Fine Aggregates
AASHTO T 2	Sampling	Note ^A	Note ^A
AASHTO T 112	Clay lumps, max	2.5%	3.0%
	Soft fragments, max	2.0%	2.0%
	Coal & lignite, max	0.25%	1.0%
AASHTO T 27	Sieve analysis	Note ^B	Note ^{C, D}
AASHTO T 11	Passing No. 200, max	2.0% ^E	3.0% ^E
AASHTO M 6	Fineness modulus	NA	2.3 to 3.1 ^F
AASHTO T 85	Coarse aggregate absorption & specific gravity	Report	NA
AASHTO T 84	Absorption & Specific Gravity of Fine Aggregate	NA	Report
AASHTO T 104	Magnesium sulfate soundness, max	15%	12%
ASTM C131	L.A. Abrasion	40%	NA
ASTM D3744	Aggregate Index, min	25	NA
ASTM D4791 TTCP Modified	Flat and elongated pieces, max	15% ^G	NA
ASTM D5821	Fractured faces, min	Report	NA
AASHTO T 176	Sand equivalent, min	NA	75
ASTM C295	Petrographic analysis	Report	Report
AASHTO T303 or ASTM C1293	Alkali-Silica Reactivity	Report	Report

Notes:

1. Coarse and fine aggregates shall be sampled in accordance with AASTO T 2.
2. See Table 509.2.3.2.3:1 – Coarse Aggregate Gradation Requirements.
3. See Table 509.2.3.3.3:1 – Fine Aggregate Gradation Requirements.
4. The Department will not approve fine aggregate that has more than 45% passing any sieve and retained on the next finer sieve.
5. The Department may Accept coarse and fine aggregates with more than the maximum percent passing the No. 200 sieve if the combined gradation of the coarse and fine aggregate percent passing the No. 200 sieve does not exceed three percent (3.0%).
6. Ensure that Material larger than 3/8 inch contains no more than 15% flat or elongated particles with a 3:1 or greater dimensional ratio in accordance with TTCP. Add the percentage of flat pieces to the percentage of elongated pieces to determine specification compliance. Count pieces that are both flat and elongated only once.

509.2.3.2 Coarse Aggregate

Coarse aggregate shall consist of clean crushed stone, crushed gravel, or natural washed gravel free of trash, debris, organics, and other Deleterious Materials.

509.2.3.2.1 Coarse Aggregate Gradation Requirements

When using the combined gradation procedure in Section 509.2.7.5.1, "Combined Gradation;" coarse aggregate gradation requirements are not required with the exception of tolerance for Material passing the No. 200 sieve found in Table 509.2.3.2.1:1, "Coarse Aggregate Gradation Requirements." Coarse aggregate gradations shall be in accordance with Table 509.2.3.2.1:1, "Coarse Aggregate Gradation Requirements."

Table 509.2.3.2.1:1
Coarse Aggregate Gradation Requirements

Sieve size	% of aggregate passing sieve			
	1.5 in	1.0 in	3/4 in ^A	1/2 in
2.0 inch	100	—	—	—
1.5 inch	95–100	100	—	—
1.0 inch	—	95–100	100	—
3/4 inch	35–70	—	90–100	100
1/2 inch	—	25–60	—	90–100
3/8 inch	10–30	—	20–55	40–70
No. 4	0–5	0–10	0–10	0–15
No. 8	—	0–5	0–5	0–5
No. 200	0.0–2.0	0.0–2.0	0.0–2.0	0.0–2.0

A. Required for Class G gradation.

509.2.3.3 Fine Aggregate

Fine aggregate shall consist of clean and well-graded natural sand, manufactured sand, or combination of both, and free of trash, debris, organics, and other Deleterious Materials.

509.2.3.3.1 Fine Aggregate

When using the combined gradation procedure detailed in Section 509.2.7.5.1, "Combined Gradation;" fine aggregate gradation requirements are not required except for the amount of Material passing the No. 200 sieve which shall be within the tolerance listed within Table 509.2.3.3.1:1, "Fine Aggregate Gradation Requirements."

Fine aggregate shall meet the gradation requirements listed in Table 509.2.3.3.1:1, "Fine Aggregate Gradation Requirements." The gradation requirements represent the limits that the Department will use to determine source Acceptability.

The Supplier shall use a fineness modulus, calculated in accordance with AASHTO M 6, to determine the degree of uniformity between representative samples. If the combined gradation procedure has not been chosen, the Department may reject fine aggregate from designated sources with variation in fineness modulus greater than 0.20 above or below the fineness modulus shown on the approved concrete mix designs. Variations in excess of these tolerances may be cause for rejection.

Table 509.2.3.3.1:1
Fine Aggregate Gradation Requirements

Sieve size	% Passing
3/8 inch	100
No. 4	90–100
No. 8	70–95
No. 16	45–80
No. 30	25–60
No. 50	5–30
No. 100	0–8
No. 200	0.0–3.0

509.2.3.4 Aggregate Alkali-Silica Reactivity

The Supplier shall perform the initial proof-of-reactivity-potential test using standard GCC Type I-II low alkali cement from the GCC Cement plant located at Tijeras, New Mexico. The Department considers aggregates with mean mortar bar expansions of greater than 0.10% at 14 Days when tested in accordance with AASHTO T 303 or ASTM C1260 potentially reactive and those less than 0.10% as non-reactive. Expansions greater than 0.20% are considered "Reactive." If tested using ASTM C1293, the Department will consider aggregate non-reactive if the average expansion at the end of one (1) year is less than 0.04%. Once the State Materials Bureau approved a particular aggregate source is non-reactive, it will not require the source to reevaluate for five (5) years unless concerns arise from possible aggregate source changes.

509.2.3.4.1 ASR Mitigation Evaluation Criteria

If the results of the initial proof-of-potential-reactivity test show the aggregate to be "potentially reactive" or "reactive," the Contractor shall repeat the test procedure using the actual cement, and, if desired, any of the ASR inhibiting SCM and admixtures listed in Table 509.2.3.4.1:1, "Option 2 Mix Designs - ASR Mitigation Requirements." The Department will consider an admixture effective if the mean mortar bar expansion at 14 Days is less than or equal to 0.10%, when tested in accordance with AASHTO T 303 (modified to include SCM) or ASTM C1567. The Supplier shall retest aggregates classified as "potential reactive" or "reactive" for ASR mitigation each time the comprehensive mix evaluation is performed. The Contractor shall report the minimum amount of Class F fly ash, and the minimum amount of ASR inhibiting admixture required to provide a maximum expansion at 14 Days that is less than 0.10%. The SCM required for mitigation shall be reported as a percentage of the cement weight. For Option 2 mix designs, the Contractor shall use ASR inhibiting SCMs or admixtures in accordance with Table 509.2.3.4:1, "Option 2 Mix Designs - ASR Mitigation Requirements," unless it is determined that larger dosages are required to control the expansion.

Table 509.2.3.4:1
Option 2 Mix Designs - ASR Mitigation Requirements

SCM	Minimum SCM Content^{A, B}
Class F	
Binary Blends	20%
Ternary Blends ^C	12%
Blended cement	20%
GGBFS	20%
Silica fume	10%
Lithium nitrate	0.55 gal/yd ³ of solution for each pound of cement sodium equivalent

Table 509.2.3.4:1
Option 2 Mix Designs - ASR Mitigation Requirements

Notes:

1. By total cementitious content.
 2. Or minimum amount required to mitigate ASR expansion, whichever is greater.
 3. 20% combined SCM content or minimum amount required to mitigate ASR expansion, whichever is greater.
-

509.2.4 Admixtures

Admixtures types and brands are required to be on the Department's APL at the time of mix design submission. Air entraining, and chemical, and lithium nitrate admixtures shall not contain more than 0.1% of soluble and insoluble chlorides. Individual admixtures shall be compatible with each other when multiple admixtures are used in a concrete mixture. Admixtures shall be used in compliance with the manufacturer's written instructions.

509.2.4.1 Air Entraining Admixtures

Air-entraining admixtures shall be provided in accordance with ASTM C260.

509.2.4.2 Chemical Admixtures

Any of the following chemical admixtures types as defined by and meeting the requirements of ASTM C494 may be used to facilitate concrete mix design:

1. Type A – Water Reducing;
2. Type B – Retarding;
3. Type D – Water Reducing and Retarding;
4. Type F – Water Reducing, High Range; or
5. Type G – Water Reducing, High Range, and Retarding.

The following admixtures may be used if approved by the State Concrete Engineer:

1. Type C – Accelerating;
2. Type E – Water Reducing and Accelerating; or
3. Type S – Specific Performance.

Any of the following chemical admixtures types as defined by and meeting the requirements of ASTM C1017 may be used to facilitate concrete mix design:

1. Type I – Plasticizing; or
2. Type 2 – Plasticizing and Retarding.

509.2.4.3 Lithium Nitrate Chemical Admixture

Lithium nitrate shall be in an aqueous solution meeting the following:

1. Lithium nitrate as LiNO_3 shall be 30% by weight;
2. Sulfate as SO_4 shall be less than 0.1% (1,000 PPM); and
3. Alkalis as $\text{Na}_2\text{O} + 0.658 \text{ K}_2\text{O}$ shall be less than 0.1%.

509.2.4.4 Pigment Admixtures for Integrally Colored Concrete

Pigments shall conform to ASTM C979. Pigments shall be lightfast, alkali-resistant, weather resistant, and formulated to give long lasting color to concrete.

509.2.5 Water

Water shall conform to ASTM C1602. Water shall have a pH between 6.0 and 8.5; sulfate or chloride contents shall not exceed 1,000 ppm, and shall be free of oil, silt, clay, organic matter, or other Deleterious Material.

509.2.6 Fiber Reinforcement

If specified, steel fibers shall conform to ASTM A820, and synthetic fibers conform to ASTM C1116.

509.2.7 Portland Cement Concrete Mix Design

Concrete mixtures shall be designed in a PTL approved by the Department, by a Professional Engineer registered in the State of New Mexico with a minimum of three (3) year of experience in testing, proportioning and designing of concrete and is directly responsible for all test results used for design purposes. The laboratory mix design shall only be developed using the proposed Materials.

Only technicians who are currently certified by TTCP - Concrete or ACI Concrete Field Technician, Level I shall determine concrete fresh properties in accordance with the appropriate AASHTO procedures. Laboratories approved by the Department's State Materials Bureau shall determine hardened properties. Technicians performing tests on aggregates and aggregate gradations shall be certified by TTCP or ACI Concrete Laboratory Level I. Those technicians performing strength tests on hardened concrete must be certified as an ACI Level I Laboratory Technician or by TTCP for Compressive Strength Testing of Concrete.

509.2.7.1 Concrete Classifications

The concrete classes listed below shall be used when specified in the Contract:

1. Class A: Structural, cast-in-place sidewalks, curb/gutter, concrete wall barrier, Bridge Substructures;
2. Class AA: Structural, used for cast-in-place structural, Bridge Superstructure, approach slabs, abutments;
3. Class HPD: Structural, used for Bridge decks, concrete paving, concrete paving repair. Additional requirements: combined gradation protocol, shrinkage ASTM C157 less than 0.04% at 28 days;
4. Class F: Slip formed concrete wall barrier, curb/gutter; compressive strength measured at 14 days;
5. Class G: Below grade applications, caissons, drilled piers (part of Bridge Substructure);
6. Class HES (formerly rapid set): High early strength concrete used for rapid repair applications. Early compressive strengths will be determined on a per Project basis. Cement content will be determined by lab trials. Allowable cements: Type II, III and rapid strength cements;
7. Class P (formerly class F-LS): Concrete paving. Mix design shall include compressive strengths in addition to flexural beams in order to develop a correlation curve. Other additional requirements: combined gradation protocol, shrinkage

ASTM C157 less than 0.04% at 28 days; and

8. Special: The Contract Requirements for the individual Project will address mix design and testing requirements.

509.2.7.2 Concrete Class Requirements

Option 1 or Option 2 may be used for mix design development of the Concrete Classes listed in Table 509.2.7.2:1, "Option 1: Concrete Requirements." Mix designs developed using Option 1 shall be approved by the State Concrete Engineer for estimated Project quantities less than those provided in the table below. The Department may consider requests to increase the maximum estimated quantity on a Project specific basis. Mix designs developed using Option 1 do not require ASTM C666 testing, and ASTM C457 hardened air void characteristics.

For Projects with anticipated concrete quantities of 150 CY or less of an individual concrete class, a written request may be submitted to the State Concrete Engineer to issue the a mix design under Section 509.2.7.6.12, "Mixture Design Submittals," bullet 13.3, "Incidental Concrete."

**Table 509.2.7.2:1
Option 1: Concrete Requirements**

Class	Strength ^A , psi	W:CM Ratio, max	Minimum Cementitious Content, lbs/CY	Maximum Estimated Project, Quantity	Slump ^B , Inches	Air Content ^C , %
A	3,000	0.45	560	1,000 CY	3 - 5"	-
F	3,000 ^D	0.45	575		0.5 - 2"	-
G	3,000	0.44	611		6 - 9"	< 3% ^G
HES	4,000 ^F	0.40	NA	500 CY	Note H	-
P	3,000 ^D and 650 ^E flex	0.35	600	10,000 SY	0.5 - 2"	-
Special	The Contract Requirements for the individual Project will address special mix requirements.					
Notes: 1. Specified strength shall be achieved by 28 days unless otherwise noted. 2. As determined by AASHTO T 119. 3. Project risk zone requirements apply; see Section 509.2.7.4, "Freeze-Thaw Risk Zones." 4. Specified strength shall be achieved by 14 days. 5. Specified flexural strength shall be achieved by 28 days. 6. Specified strength shall be achieved in 24 hours, and 75% of the specified strength shall be achieved in five (5) hours, unless otherwise stated in the Contract. 7. Air entraining admixtures are not allowed. 8. Mix design specific for Project specific requirements.						

For Option 1 mix design development, the minimum SCM in concrete shall comply with one of the following:

- Any combination of cement and a minimum of one (1) SCM satisfying Equation 1:

Equation 1:

$$\frac{(25 \times UF) + (12 \times FA) + (6 \times SL)}{MC} \geq X$$

Where:

- UF = silica fume, metakaolin, or UFFA, including the quantity in blended cement, lb/CY.
 FA = Class N natural pozzolan, or Class F fly ash including quantity in blended cement, lb/CY.
 SL = GGBFS, including the quantity in blended cement, lb/CY.
 MC = minimum cementitious content, lb/CY.
 X = 1.8 innocuous aggregate, 3.0 for reactive or potentially reactive aggregates.
- Or
- 25 % Class F fly ash by total weight of cementitious Material.

Option 2 mix designs are required for Project quantities in excess of the maximum quantities provided in Table 509.2.7.2:2, "Option 2: Concrete Requirements."

Table 509.2.7.2:2
Option 2: Concrete Requirements

Class	Compressive Strength ^A , psi	Slump ^B , Inches	Air Content ^C , %
A	3,000	4.5" – 5.5"	-
AA	4,000	4.5" – 5.5"	-
F	3,000 ^D	0.5 - 2"	-
HES	4,000 ^F	-	-
HPD	4,000	4.5" – 5.5"	-
P	3,000 ^D and 650 ^E flex	0.5 - 2"	-
G	3,000	6-9"	< 3% ^G
Special	The Contract Requirements for the individual Project will address special mix requirements.		
Notes:			
1. Min specified strength shall be achieved by 28 days unless otherwise noted.			
2. As determined by AASHTO T 119.			
3. Project risk zone requirements apply; see Section 509.2.7.4, "Freeze-Thaw Risk Zones."			
4. Min specified strength shall be achieved by 14 days.			
5. Min specified average flexural strength shall be achieved by 28 days when tested in accordance with AASHTO T 97.			
6. Min specified strength shall be achieved in 24 hours, and 75% of the specified strength shall be achieved in five (5) hours, unless otherwise stated in the Contract.			
7. Air entraining admixtures are not allowed.			

For both Options 1 and 2, Class G concrete shall have the following characteristics:

1. Minimum cementitious content of at least 611 lb;
2. Maximum water/cementitious ratio no greater than 0.44;
3. Combined gradation;
4. Maximum sized aggregate no greater than 0.75 in;
5. Class G mix designs using aggregates with fractured faces shall include a viscosity modifying admixture.
6. Sand/aggregate ratio between 40% and 42% by total aggregate volume;
7. Maximum air content no greater than three percent (3.0%);
8. No air entrainment agent;
9. Slump range of seven (7.0) inches $\pm$ one (1.0) inch, except when placing under a drilling fluid;
10. Slump range of eight (8.0) inches $\pm$ one (1.0) inch for placement under a drilling fluid; and
11. Adjust admixtures for the job site conditions encountered so that the concrete remains workable and plastic for the two (2) h placement limit.

509.2.7.3 Details for Tables 509.2.7.2:1 & 2, "Concrete Classes for Laboratory Design of Concrete Mixtures"

Tables 509.2.7.2:1 & 2, "Concrete Classes for Laboratory Design of Concrete Mixtures" shall be used for designing concrete mixes. Section 510.3.1.4, "Plastic Properties" shall be used to evaluate concrete delivered to Department Projects.

The Contractor shall use the minimum air content shown below in the Laboratory mix:

1. High Risk Zones: 7.0%
2. Medium Risk Zones: 6.5%
3. Low Risk Zones: 6.0%

All new mix designs shall have a minimum over-design compressive strength of 1,200 psi greater than the specified compressive strength. For Class F and Class P the minimum over-design compressive strength shall be 800 psi greater than the specified design strength unless a lower value is calculated using the greater value from either Equation (1) or Equation (2). Class P over-design flexural strength shall be 15% greater than the specified flexural design strength. For Class P, the minimum average flexural strength for three (3) beams cast in the Laboratory shall be 650 psi at 28 Days, when tested in accordance with AASHTO T 97. Option 1 mix designs shall not be adjust based compressive strength statistical analysis.

For Option 2 mix designs, annually the Supplier shall determine the minimum allowable average compressive strength for approved mix designs with 15 or more compressive strength tests, or for similar mix designs mixing from the same facility with the similar air content and compressive strength, and 15 or more compressive strength tests using one (1) of the following equations. The equation that produces the largest value shall be used to determine the minimum allowable compressive strength.

$$f'_{cr} = f'_c + (1.34 \times k \times s) \quad (1)$$

$$f'_{cr} = f'_c + (2.33 \times k \times s) - 500 \quad (2)$$

Where,

- f'_{cr} Minimum Laboratory compressive strength at the specified age.
- f'_c Specified compressive strength.
- k KK-factor from Table 509.2.7.3:1, "k-Factor for Increasing Standard Deviation," for standard deviation increase if the total number of tests is less than 30, but equal to or greater than 15.
- S Standard deviation for the compressive strength tests submitted of the same specified strength.

Table 509.2.7.3:1
k-Factor for Increasing Standard Deviation

Total number of tests	k-Factor
15	1.16
20	1.08
25	1.03
≥30	1.00

The Department will allow linear interpolation for an intermediate number of tests. A mix that was developed from a history of 15 or more test results from the preceding 24 month period is considered an existing mix. A mix developed without historical test results is considered a new mix.

509.2.7.4 Freeze-Thaw Risk Zones

The concrete mixture shall be designed for use in the freeze-thaw zone in which the Project is located. One (1) freeze/thaw cycle is defined as a Day in which the lowest recorded temperature is equal to or less than 25 °F as recorded on the Western Regional Climate Center database. The web address is www.wrcc.dri.edu. The risk levels are defined as follows:

1. **Low-Risk.** The annual average number of freeze/thaw cycles is equal to or less than 30 cycles per year;
2. **Medium-Risk.** The annual average number of freeze/thaw cycles is greater than 30 but less than or equal to 130 cycles per year; and
3. **High-Risk.** The annual average number of freeze/thaw cycles is greater than 130 cycles per year.

Table 509.2.7.4:1, "Statewide Concrete Risk Zones," shall be used to determine the required risk zone.

Table 509.2.7.4:1
Statewide Concrete Risk Zones

District no.	County name	Station name	Concrete risk zone
1	Dona Ana	(County wide)	Low
1	Grant	(County wide)	Low
1	Hidalgo	(County wide)	Low
1	Luna	(County wide)	Low
1	Sierra	(County wide)	Low
1	Socorro	(County wide)	Medium
2	Chaves	(County wide)	Low

**Table 509.2.7.4:1
Statewide Concrete Risk Zones**

District no.	County name	Station name	Concrete risk zone
2	Curry	(County wide)	Medium
2	De Baca	(County wide)	Medium
2	Eddy	(County wide)	Low
2	Lea	(County wide)	Low
2	Lincoln	(County wide) ^a	Medium
2	Lincoln	Ruidoso	High
2	Otero	(County wide)	Medium
2	Roosevelt	(County wide)	Medium
3	Bernalillo	(County wide) ^a	Medium
3	Bernalillo	Sandia Crest	High
3	Sandoval	(County wide)	Medium
3	Valencia	(County wide)	Medium
4	Colfax	(County wide)	High
4	Guadalupe	(County wide)	Medium
4	Harding	(County wide)	Medium
4	Mora	(County wide)	High
4	Quay	(County wide)	Medium
4	San Miguel	(County wide)	Medium
4	Union	(County wide)	Medium
5	Los Alamos	(County wide)	Medium
5	Rio Arriba	(County wide)	High
5	San Juan	(County wide)	Medium
5	Santa Fe	(County wide)	Medium
5	Taos	(County wide)	High
5	Torrance	(County wide)	Medium
6	Catron	(County wide)	High
6	Cibola	(County wide)	High
6	McKinley	(County wide) ^a	High
6	Sandoval	(County wide)	High

^aExcept as otherwise listed

The minimum allowable air content for mix design submittal purposes is:

1. Six percent (6.0%) for low-risk zones;
2. 6.5% for medium-risk zones; and
3. Seven percent (7.0%) for high-risk zones.

The air content shall be confirmed by the pressure method and the volumetric method in accordance with Section 509.2.7.6, "Mix Design Submittal."

509.2.7.5 PCC Mixture Development

509.2.7.5.1 Combined Gradation

The combined gradation procedure is required for Class F, Class P and Class HPD, and is optional for all other concrete mixes. The aggregates shall be evaluated for concrete mixtures prepared for the combined gradation procedures in accordance with the following:

1. **Coarseness Factor.** Determine the Coarseness Factor in accordance with the following equation:

$$CF = \frac{Q}{Q+I} \times 100 \quad (3)$$

Where,

CF Coarseness Factor.

Q Weight of the aggregate retained on or above the 3/8-inch sieve.

I Weight of the aggregate passing the 3/8 inch sieve, but retained on the No. 8 sieve

2. **Workability Factor.** The weight of the aggregate passing the No. 8 sieve divided by the weight of the combined gradation, represented as a percent.
3. **Mortar Factor.** The volume of the cement, SCMSCM, water, air, other pozzolans, and aggregate passing the No. 8 sieve divided by the volume of the entire concrete mixture, represented as a percent.
4. **Paste Factor.** The volume of the cement, fly ash, water, air, and other pozzolans divided by the volume of the entire concrete mixture, represented as a percent.

When using the combined gradation protocol, aggregates shall be proportioned using a 0.45 power curve to achieve a dense and uniform gradation. Coarse and fine aggregate gradation requirements do not apply. The suggested targets for the Coarseness and Workability Factors for concrete mixtures designed using combined gradation are provided in Table 509.2.7.5.1:1, "Recommended Workability Factor and Coarseness Factor Targets."

Table 509.2.7.5.1:1 Recommended Workability Factor and Coarseness Factor Targets		
Nominal Maximum Aggregate Size	Workability Factor	Coarseness Factor
3/4 inch	32 - 36	65 - 75
1/2 inch	40-42	10-20

509.2.7.5.2 Concrete Mix Design Requirements

The concrete mix design shall be proportioned and designed to meet the following requirements:

1. All concrete mix design submittals shall include compressive strengths for the following specified ages:
 - 1.1 3 days;
 - 1.2 7 days;
 - 1.3 14 days; and
 - 1.4 28 days;
2. For concrete classes developed using Option 2, when examined in accordance with

the ASTM C457 linear traverse method, hardened air void system characteristics with the exception of Class G and Class HES, shall meet the following criteria:

- 2.1 A minimum air content of five percent (5.0%);
- 2.2 A specific surface greater than 600 inches⁻¹; and
- 2.3 A spacing factor less than 0.008 inch;
3. Ensure that concrete complies with Section 509.2.3.4, "Alkali-Silica Reactivity," and Section 509.2.3.4.1, "ASR Mitigation Evaluation Criteria," as determined by the State Materials Bureau;
4. For all concrete classes, chloride ion permeability at 28 Days tested in accordance with ASTM C1202 shall meet the following:
 - 4.1 Less than or equal to 3,000 coulombs for Low-Risk Zones;
 - 4.2 Less than 2,500 coulombs for Medium-Risk Zones; or
 - 4.3 Less than 2,000 coulombs for High-Risk Zones;
5. For structural concrete classes developed using Option 2, the durability index shall be determined from at least one (1) prism tested at 28 Days for 300 cycles, in accordance with ASTM C666, Method A. The mix designs shall have a minimum durability index of:
 - 5.1 80 for Low-Risk Zones;
 - 5.2 85 for Medium-Risk Zones; and
 - 5.3 90 for High-Risk Zones;
6. Cure prisms tested for durability index and chloride ion permeability by bathing in lime saturated water at a temperature of 73.3 °F ± 3.0 °F for the first seven (7) Days followed by 21 Days in lime saturated water at a temperature of 100.0 °F ± 3.0 °F; and
7. The maximum shrinkage value for Class P and HPD concrete mixtures is 0.04% at 28 Days when tested with three (3) inch x four (4) inch x 16 inch prism or three (3) inch x three (3) inch x ten (10) inch prism and cured in a standard cure for the first seven (7) Days. Following the seven (7) Day initial cure, cure in a relative humidity of 50% and test in accordance with AASHTO T 160. The results shall be reported in the "comments" field of the mix design submittal form.

509.2.7.6 Mixture Design Submittals

For standard concrete mix designs, complete electronic copy of the NMDOT *Concrete Mix Design Submittal Form* shall be submitted to the Concrete Unit of the State Materials Bureau for review and approval. Special mix designs and mix designs with Project specific shall be submitted to the Project Manager for review and approval by the State Concrete Engineer.

The following information shall be included in the mix design submittal:

1. Mix design Option;
2. Supplier name;
3. Production facility physical address, telephone number and e-mail address;
4. Production facility NRMCA Certification # and expiration date;
5. PTL's name;
6. The New Mexico registration number of the professional Engineer who is responsible for the concrete mixture design Work;
7. A comprehensive Materials list and the properties of each component, including:

- 7.1. Aggregates:
 - 7.1.1. Source names;
 - 7.1.2. Specific source locations;
 - 7.1.3. For new aggregate sources, a complete ASTM C295 "Petrographic Examination of Aggregates for Concrete" and an ASTM C294, *Constituents of Natural Mineral Aggregates* for both the coarse and fine aggregates after completing processing and manufacturing procedures and the aggregate is ready for use shall be submitted. Include the geologic origin of the Material; perform and certify the analysis using a petrographer previously approved by the Department;
 - 7.1.4. AASHTO T 11 - Soundness loss;
 - 7.1.5. AASHTO T 335 - Percent of Fractured Faces for the coarse aggregate;
 - 7.1.6. Gradations, including AASHTO T 11;
 - 7.1.7. AASHTO T 85 - Bulk saturated surface dry specific gravities;
 - 7.1.8. AASHTO T 96 - Los Angeles wear abrasion;
 - 7.1.9. AASHTO M 6 - Fineness modulus;
 - 7.1.10. AASHTO T 84 - Aggregate absorption;
 - 7.1.11. AASHTO T 152 - Aggregate correction factor;
 - 7.1.12. AASHTO T 176 - Sand equivalent of fine aggregate;
 - 7.1.13. AASHTO T 112 - Clay lumps content; and
 - 7.1.14. AASHTO T 21 - Organic impurity content, including soft fragments, coal and lignite, flat or elongated pieces, and other Deleterious substances;
- 7.2. Cement:
 - 7.2.1. Supplier name;
 - 7.2.2. Specific source name; and
 - 7.2.3. Specific cement type;
- 7.3. SCMSCM:
 - 7.3.1. Supplier name;
 - 7.3.2. Specific source name; and
 - 7.3.3. Specific SCM type;
- 7.4. Blended Cement:
 - 7.4.1. Cement supplier name;
 - 7.4.2. Specific cement source name;
 - 7.4.3. Cement type;
 - 7.4.4. SCM supplier name if different than the cement supplier name;
 - 7.4.5. Specific SCM source name;
 - 7.4.6. Specific SCM type; and
 - 7.4.7. Percent SCM;
8. Concrete mixture proportions; state clearly if submitting request under the combined gradation provisions;
9. Water/cementitious ratios;
10. Type and amount of admixtures; use admixtures on the Department's *Approved Products List*;
11. Water source and location; include pH, available alkalis, and a full chemical

- analysis, if the water source is not a certified NMED public potable water supply;
12. Plastic Concrete Properties:
 - 12.1. Air temperature;
 - 12.2. Concrete temperature;
 - 12.3. Slump; when using super-plasticizer, document the slump before and after addition of the super-plasticizer;
 - 12.4. Unit weight;
 - 12.5. Air content measured in accordance with AASHTO T 152 or AASHTO T 121; and
 - 12.6. When using super-plasticizer, document the measured air content before and after adding the super-plasticizer);
 13. Hardened Concrete Properties:
 - 13.1. New Concrete Mixtures:
 - 13.1.1. Compressive strength tests (the average of three (3) cylinders tested at three (3) Days, seven (7) Days, 14 Days and 28 Days);
 - 13.1.2. Type of fracture of each cylinder;
 - 13.1.3. Flexural strength test results for Class P (average of three (3) beams)
 - 13.1.4. Durability index (for structural mixes only);
 - 13.1.5. Hardened air void analysis (for structural mixes only);
 - 13.1.6. Rapid Chloride Permeability (for structural mixes only); and
 - 13.1.7. Expansion data from AASHTO T 303 or ASTM C1260 or C1567;
 - 13.2. Existing Concrete Mixtures:
 - 13.2.1. Resubmit original mix design, updated aggregate properties, and compressive strength statistical data when available in accordance with Section 509.2.7.6, "Mixture Design Submittals;"
 - 13.3. Incidental Concrete Mix Designs (Only for specific Projects) are concrete mixes intended for Projects that anticipate less than 150 CY of each concrete class. Incidental Mix Designs shall be proportioned in accordance with the Section and shall be approved based on the following:
 - 13.3.1. Compressive strength data (field performance data if using the mix within the previous 24 months, or Laboratory mix performance data not using it in the field); and
 - 13.3.2. Air content, as measured by the pressure method or the volumetric method; when using superplasticizer, show the air content before and after adding superplasticizer.

509.2.7.7 Mixture Design Approval

The Department will require 14 Days to review the submittal packages after receipt by the State Materials Bureau of all required information.

The Department will approve Option 1 mix designs for a period of one (1) year from the date of issuance upon verification of compliance with all requirements. Option 1 designs are required to be fully renewed each year prior to use on NMDOT Projects, or may be resubmitted under Option 2 with the additional testing required for Option 2.

The Department will approve Option 2 mix designs for a period of one (1) year from the date of issuance upon verification of compliance with all requirements. A minimum of 30 Days

before the one (1) year approval expires, the Supplier may request that the mix design be reissued. The Supplier shall provide test reports showing that the mix design met specification requirements during the issue period. Option 2 mix designs may be re-approved for no more than four (4) additional years.

At the discretion of the State Concrete Engineer, a mixture can be adjusted without re-batching by using "cement efficiency" calculations to determine the amount of change to the cement and the total cementitious content that is necessary to achieve the desired level of performance. When this procedure is allowed, the ratio of SCM to cement ratio will remain unchanged, the water content will remain unchanged, and the aggregates will be adjusted without changing the overall gradation to accommodate the changes in volume from changes made to the cement. All changes made by this method shall be approved by the State Concrete Engineer before being implemented in the field.

The approved mix design's constituent Materials shall not be changed without the State Concrete Engineer's written approval. The approved mix design's constituent Materials shall not be changed without the State Concrete Engineer's written approval.

509.2.7.8 Suspension and Revocation of Mix Design Approval

Mix design approval may be suspended by the State Concrete Engineer at any time during the approval period for any of the following reasons:

1. Unauthorized changes to the constituent Materials or proportions;
2. Conditions of the Supplier's Equipment or Quality Control adversely affects the strength or other properties of the concrete;
3. Drop in the statistical averages of the concrete below the minimums required for Acceptance in accordance with Section 510.3.5, "Acceptance;" and
4. Test cores indicate the mix is not performing as designed or is not meeting the specified design strength as determined in accordance with Section 510.3.5.4.1, "Testing Cores."

If a mix design approval is suspended or revoked, it shall not be Accepted for use on any Department construction Project.

In the event that a mix design approval is suspended for reasons 1 or 2, all of the Supplier's mix designs approvals may be suspended until such time that is demonstrated that the root cause for the suspension has been corrected.

The State Concrete Engineer will only consider a request to reinstate an approval after the Contractor has submitted and implemented a comprehensive "Corrective Action Plan" to address and correct the reason(s) for the suspension.

If the "Corrective Action Plan" fails to adequately address and correct the reason(s) for the suspension, the approval may be permanently revoked by the State Concrete Engineer. The mix design will then be required to be resubmitted in its entirety as a new mix design with updated comprehensive testing.

509.3 CONSTRUCTION REQUIREMENTS

Concrete or concrete items shall be constructed in accordance with the section of these Standard Specifications for which the concrete is used.

509.4 METHOD OF MEASUREMENT

The Department will measure concrete or concrete items in accordance with the section of these Standard Specifications for which the concrete is used.

509.5 BASIS OF PAYMENT

The Department will pay for concrete or concrete items in accordance with the section of these Standard Specifications for which the concrete is used.

SECTION 515: REINFORCED CONCRETE FOR MINOR STRUCTURES

515.1 DESCRIPTION

This Work consists of providing reinforced concrete for minor Structures.

515.2 MATERIALS

The Contractor shall provide Class A concrete with a design compressive strength of at least 3,000 psi in accordance with Section 510, "Portland Cement Concrete."

The Contractor shall provide Grade 40 or 60 reinforcing steel in accordance with Section 540, "Steel Reinforcement." The Department will allow field bending and cutting.

The Contractor shall thread pre-formed hookbolts for the entire depth of embedment, or make hookbolts using reinforcing bar stock.

The Contractor shall provide chemical adhesive for anchoring hookbolts in accordance with Section 522, "Chemical Adhesive Anchors."

515.3 CONSTRUCTION REQUIREMENTS

The Contractor shall construct reinforced concrete for minor Structures in accordance with Section 510, "Portland Cement Concrete," Section 511, "Concrete Structures," and Section 540, "Steel Reinforcement."

The Contractor shall construct collars to fit tightly for joining pipe-to-pipe or pipe-to-box Structures. The Contractor shall ensure concrete plugs at the ends of existing conduits or box openings fit tightly.

The Contractor shall provide bulkheads at the junction of different sized pipes and conduits to prevent leakage of fresh concrete and mortar into the conduit. The Contractor shall remove concrete or mortar that leaks into the conduit. If required to maintain smooth flow conditions within the conduit, the Contractor shall form fillets of fresh concrete to reduce turbulence at conduit junctions.

515.4 METHOD OF MEASUREMENT

The Department will measure reinforced concrete for minor Structures using the dimensions shown in the Contract or approved modifications.

515.5 BASIS OF PAYMENT

Pay Item	Pay Unit
<i>Reinforced Concrete for Minor Structures</i>	Cubic Yard

515.5.1 Work Included In Payment

The following items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

1. Reinforcing steel.
2. Waterstops.
3. Dowels, anchor bolts and hookbolts.

4. Excavation.

SECTION 519: SHOTCRETE

519.1 DESCRIPTION

This Work consists of constructing a pneumatically applied non-structural shotcrete onto rock, soil or structural shotcrete onto formed surfaces in accordance with the Contract and as directed by the Project Manager.

These Specifications refer to premixed cement and aggregate pneumatically applied by suitable Equipment and competent operators.

519.2 MATERIALS

Structural shotcrete shall have a design strength of 4000 psi at 28 Days. If structural shotcrete is required, the Contractor shall use a shotcrete mix that has been designed and proportioned in accordance with Section 509, "Portland Cement Concrete Mix Designs" and complies with the designated hardened properties for the class of concrete required in the specifications. All mix constituents must comply with Table 519.2:1, "Applicable Specification Sections." The Contractor shall determine all hardened properties in accordance with Section 519.2.6, "Acceptance Sampling and Testing."

Non-structural shotcrete shall have a design strength of 3000 psi at 28 Days. If the shotcrete is non-structural, the non-structural shotcrete mix design may be developed in accordance with Section 509, "Portland Cement Concrete Mix Designs" without using the special boxes required in Section 519.2.6, "Acceptance Sampling and Testing."

All shotcrete mix designs must be reviewed and approved by the State Concrete Engineer before being used on NMDOT Projects. The Contractor shall use either wet-mix or dry-mix shotcrete. The Contractor shall reinforce shotcrete in accordance with the Contract.

The Contractor shall provide Materials and perform construction requirements in accordance with the specification sections listed in Table 519.2:1, "Applicable Specification Sections."

Table 519.2:1
Applicable Specification Sections

Material/Construction Requirements	Section
Portland cement	Section 509, "Portland Cement Concrete Mix Designs"
Fly Ash	Section 509, "Portland Cement Concrete Mix Designs"
Pozzolans	Section 509, "Portland Cement Concrete Mix Designs"
Curing Materials and Admixtures	Section 509, "Portland Cement Concrete Mix Designs"
Water	Section 509, "Portland Cement Concrete Mix Designs"
Fine Aggregate	Section 509, "Portland Cement Concrete Mix Designs"
Coarse Aggregate	Section 509, "Portland Cement Concrete Mix Designs"
Neat Cement Grout	Section 521, "Non-Shrink Mortar"

Table 519.2:1
Applicable Specification Sections

Material/Construction Requirements	Section
Bar Reinforcement	Section 540, "Steel Reinforcement"
Welded Wire Fabric	Section 540, "Steel Reinforcement"
Surface evaporation	Section 512, "Superstructure Concrete"

519.2.1 Fine Aggregate Quality Requirements

The Contractor shall provide fine aggregate with the following properties:

1. A soundness Loss of 12 or less when tested in accordance with AASHTO T 104 using magnesium sulfate solution and a test duration of five (5) cycles; and
2. A sand equivalent of at least 75 when tested in accordance with AASHTO T 176.

519.2.2 Fine Aggregate Gradation Requirements

Fine aggregates shall comply with Table 519.2.2:1, "Fine Aggregate Gradation" for either Grading No.1 or Grading No. 2.

Table 519.2.2:1
Fine Aggregate Gradation

Sieve Size, U.S. Standard Square Mesh	Percent by Weight Passing Individual Sieves	
	Grading No.1	Grading No.2
¾ inch (19 mm)	---	---
½ inch (12 mm)	---	100
3/8 inch (10 mm)	100	90 to 100
No. 4 (4.75 mm)	95 to 100	70 to 85
No. 8 (2.4 mm)	80 to 98	50 to 70
No. 16 (1.2 mm)	50 to 85	35 to 55
No. 30 (600 µm)	25 to 60	20 to 35
No. 50 (300 µm)	10 to 30	8 to 20
No. 100 (150 µm)	2 to 10	2 to 10

519.2.3 Water

The Contractor shall use water in the shotcrete mix that is free of elements that could stain the mix and in accordance with Section 509.2.6, "Water."

519.2.4 Anchor Bars

The Contractor shall provide anchors of appropriate size to hold reinforcement in place. The Department will allow maximum anchor spacing of 24 inches on a grid pattern over the entire area for structural applications.

If using "L"-shaped anchors, the Contractor shall use those that consist of No. 5 reinforcement bars (or larger) bent into an "L" shape. The short leg of the "L" will be at least six (6) inches long and the long leg at least two (2) feet long.

519.2.5 Welded Wire Mesh

The Contractor shall provide non-galvanized eight (8) gauge steel with a four (4) inch x four (4) inch mesh (4 x 4-W2.1 x W2.1) in accordance with Section 540, "Steel Reinforcement" for welded wire mesh. For structural applications, the Contractor shall use welded wire mesh in accordance with the Contract and as approved by the State Bridge Engineer. The Contractor shall ensure that all wire mesh has been rigidly fixed in place to prevent rebound when struck by the shotcrete.

519.2.6 Fiber Reinforcement

Synthetic Fibers shall meet the requirements of ASTM C1116.

Steel fibers should meet the requirements set forth in ASTM A820.

519.2.7 Prepackaged Product

For non-structural shotcrete; a pre-mixed and prepackaged concrete product, with or without steel fibers, specifically manufactured as a shotcrete product for on-site mixed shotcrete, may be used if approved by the State Materials Bureau. The Material shall meet the requirements of ASTM C1480 and have a minimum strength of 3,000 psi at 28 Days for non-structural Shotcrete.

519.2.8 Acceptance Sampling and Testing for Structural and non-structural Shotcrete

The Contractor shall apply shotcrete to approved test panels. The Contractor shall orient the spray nozzle to the test panel in the same position as that used on the actual Project. The Contractor shall provide test panels constructed in accordance with the requirements of ASTM C 1140. The Contractor shall use test panels with the following characteristics:

1. Minimum dimensions of 30 inch² x eight (8) inch deep;
2. Constructed from wood and sealed plywood; and
3. 45° sloped sides to allow rebound to escape.

The Contractor shall use at least one (1) pre-construction trial to do the following:

1. Obtain test cores to confirm compliance with the hardened properties of Section 510, "Portland Cement Concrete."
2. For structural Shotcrete only, pre-qualify the proposed nozzle operator and strike-off persons. The Department will not allow nozzle operators and strike-off persons who have not been pre-qualified to apply shotcrete on the Project. Each nozzle operator and strike-off person shall shoot pre-construction test panels in the presence of the Project Manager or designated representative. Each nozzle operator shall have a minimum of the following qualifications:
 - 2.1. Supervisor, at least one (1) year of experience as a shotcrete nozzle operator and at least two (2) years of experience on shotcrete Projects.
 - 2.2. Nozzle operator and delivery Equipment operators, at least one (1) year of apprenticeship on similar applications with the same type of Equipment.
 - 2.3. Nozzle operators shall be ACI Certified Shotcrete Nozzle Operators.

The Contractor shall perform curing, coring, and testing of the shotcrete test panels and specimens at a private testing Laboratory approved by the State Materials Bureau for concrete mix designs.

The Contractor shall provide one half of the test panels with reinforcement and anchors representative of the same size and spacing required in the Contract for the actual Work. The Contractor shall provide the remaining panels with no reinforcement to allow for extraction of shotcrete test cores for compliance testing.

Each nozzle operator proposed for use on the Project shall shoot at least one (1) test panel at each orientation.

The Contractor shall obtain the required number of test cores in accordance with Section 510, "Portland Cement Concrete," from these test panels for testing at the designated ages for the specified performance parameters. The Contractor shall extract a minimum of three (3) four (4) inch diameter cores from locations of intersecting reinforcing steel and mesh to check the adequacy of consolidation of shotcrete around and behind the reinforcement. The Contractor shall take at least one (1) core at an anchor location.

The State Materials Bureau will evaluate the quality of the extracted cores and test panels. If the Department rejects a prequalification test panel, the Contractor shall have the nozzle operator shoot a second test panel. If the Department rejects the second test panel, the Contractor shall not allow the nozzle operator to shoot on the Project until the operator completes an appropriate training program and prepares an acceptable test panel.

The Contractor shall transport test panels in the wooden forms with care to not crack or damage the specimens.

The Contractor shall place the test panels in a moist room in the Laboratory that is maintained at a temperature of $73^{\circ}\text{F} \pm 3^{\circ}\text{F}$, and a relative humidity of $98 \pm$ two percent (2%). After three (3) Days, the Contractor shall remove the test panels from the wooden forms and return them to the moist room until testing time.

519.2.8.1 Production Testing for Structural Shotcrete

The Contractor shall shoot two (2) construction test panels for each nozzle orientation and for each nozzle operator each Day of shotcrete production in the presence of the Project Manager. The Contractor shall shoot one (1) set of panels for each nozzle operator in the morning and one (1) set of panels for each nozzle operator in the afternoon for a full Day's production.

The Contractor shall produce test panels in accordance with ASTM C 1140, a minimum 12 inch² × eight (8) inch deep. The Contractor shall use test panels constructed of wood and sealed plywood with 45° sloped sides to permit escape of rebound. The Contractor shall provide construction test panels that contain no reinforcement or embedments.

The Contractor shall store, handle, and cure construction test panels the same as specified for pre-construction test panels. The Contractor shall prepare test specimens the same as specified for pre-construction test specimens.

The Contractor shall use compressive strength test specimens that are four (4) inch × eight (8) inch cores (length/diameter ratio of 2:1).

The mean compressive strength is acceptable if the average of three (3) cores tested at the specified age is equal to or greater than 85% of the specified strength, with no individual

strength test being less than 75% of the specified strength.

The Contractor shall correct unacceptable shotcrete sections at no additional cost to the Department.

519.3 CONSTRUCTION REQUIREMENTS

519.3.1 Equipment

519.3.1.1 Shotcrete Placing Equipment

The Contractor shall apply wet mix shotcrete with one (1) of the following methods:

1. The "thick-stream" method, which involves the use of a regular concrete pump with air addition at the discharge nozzle to pneumatically apply the shotcrete on the receiving surface. The "thick-stream" method usually uses a two (2) inch to 2 1/2 inch internal diameter delivery hose.
2. The "thin-stream" method, which normally involves the use of a pressurized chamber to pneumatically send the shotcrete down the delivery hose to the receiving surface. The "thin-stream" method normally uses a hose with a maximum 1 1/2 inch internal diameter.

The Contractor shall only use the "thin-stream" method for non-structural shotcrete if pre-construction testing confirms the capability to properly consolidate shotcrete, fully encase reinforcing steel, and produce a Material that meets the required hardened properties.

The Contractor shall use shotcrete delivery Equipment in accordance with ACI 506R and that is capable of delivering a steady stream of uniformly mixed Material to the discharge nozzle at the proper velocity and rate of discharge.

The preferred type of the wet-mix shotcrete delivery system uses positive displacement pumps equipped with hydraulic or mechanically powered pistons (similar to conventional concrete piston pumps), surge-reduction devices, and compressed air added at the discharge nozzle. The Contractor may use pneumatic-feed guns, rotary-type feed guns (similar to dry-mix guns), and peristaltic squeeze-type pumps if the Contractor demonstrates that the guns can produce shotcrete in accordance with the performance requirements and the Project Manager approves.

The Contractor shall carefully monitor the air ring at the nozzle for signs of blockage of individual air holes. If non-uniform discharge of shotcrete becomes apparent, the Contractor shall stop shooting and clean the air ring or take other appropriate corrective actions.

The Contractor shall thoroughly clean the delivery Equipment at the end of each shift. The Contractor shall remove build-up of coatings in the delivery hose and nozzle liner. The Contractor shall regularly inspect the air ring and nozzle and replace as necessary.

519.3.1.2 Auxiliary Shotcrete Equipment

The Contractor shall supply a clean, dry air supply capable of maintaining sufficient nozzle velocity and simultaneous operation of a blow pipe.

The Contractor shall use an air supply system with a moisture and oil trap.

The Contractor shall provide auxiliary shotcrete Equipment, such as air delivery hoses, blow pipes, couplings, admixture dispensers, and fiber feeders, in accordance with the

recommendations of ACI 506R.

519.3.2 Batching and Mixing Shotcrete

519.3.2.1 Wet Mix Process

The Contractor shall batch, mix, and supply wet mix shotcrete using one (1) of the following systems:

1. Central Mixing with transit delivery; or
2. Transit mixing and delivery.

519.3.2.1.1 Central Mixing and Supply

The Contractor shall batch and mix ingredients in accordance with Section 510, "Portland Cement Concrete." The Contractor shall provide inspected transit mixers in accordance with Section 510, "Portland Cement Concrete."

The Contractor may only re-temper the shotcrete once with superplasticizer added directly to the transit mixer during the period of discharge to maintain workability (slump) of shotcrete. The Contractor shall mix the shotcrete for a minimum period of five (5) min at the rated mixing speed after adding the superplasticizer to the transit mixer.

The Contractor shall shoot shotcrete within 90 min of adding mix water to the batch. The Contractor shall use appropriate shotcrete batch sizes per load to meet this requirement.

519.3.2.1.2 Transit Mixing and Supply

The Contractor shall apply central mixing requirements to transit mixing, except add ingredients directly to the transit mixer, not the central mixer. The Contractor shall not charge transit mixers to more than 70% of their rated capacity.

519.3.2.2 Dry Mix Process for Non-Structural Shotcrete

The Contractor shall batch the cement and aggregate by weight directly at the Project site within the tolerances required in Section 510, "Portland Cement Concrete."

The Contractor shall pre-dampen the dry mix before flow into the main hopper and immediately after flow out of the packaging to ensure uniform shotcrete free of dry pockets.

The Contractor shall not use pre-dampened cement/aggregate mixtures that are more than 90 min old or that are unable to produce the specified hardened properties.

519.3.2.3 Batching and Mixing Steel Fibers

The Contractor shall submit the procedure used for adding steel fibers to the shotcrete to the Project Manager for approval. The Contractor shall demonstrate the procedure in the field to the satisfaction of the Project Manager before starting production operations.

If fiber addition takes place at the nozzle, the Contractor shall uniformly distribute fibers throughout the mortar matrix without isolated concentrations (clumping or balling).

If adding fibers to the dry or wet mix during the batching and mixing process, the Contractor shall use a screen with a mesh of from 1 1/2 inch to 2 1/2 inch to prevent fiber balls from entering the shotcrete line. The Department will not require batching through a screen if

the Contractor demonstrates that fiber balls are not forming.

The Contractor shall not add fibers to the dry or wet mix too quickly (so they can be blended with the other ingredients without forming balls or clumps). The Contractor shall use a vibrating screen or sift to pass bulk fibers (that have a tendency to stick) into the mix as individual elements and not as clumps.

519.3.2.4 Preparation and Hardware

519.3.2.4.1 Subsurface Preparation

The Contractor shall locate and remove loose, spalled, deteriorated, and delaminated concrete, stone, or other substrate. The Contractor shall use hammer sounding to locate specific de-laminated areas of concrete or rock. The Contractor shall not damage areas of sound concrete or reinforcing steel during concrete removal operations.

The Contractor shall remove concrete using one (1) or more of the following methods:

1. Chip with light duty pneumatic, or electric, chipping hammers (not to exceed 15 lb).
2. Scarifiers, scabblers or other suitable mechanical means.
3. High-pressure (15,000 psi to 40,000 psi) water jetting. (If using water jetting, do not allow water to collect so that surrounding areas are not contaminated or damaged.)

If the Contractor exposes corroded reinforcing steel, the Contractor shall continue concrete removal until there is a minimum 3/4 inch clearance around the exposed, corroded reinforcing bar. The Contractor shall not damage the bond to adjacent non-exposed reinforcing steel during concrete removal.

The Contractor shall taper the perimeter of removed concrete areas at approximately 45° angles. The Contractor shall sawcut the outer edges of chipped areas to a minimum depth of 3/4 inch to avoid feather edging.

The Contractor shall use abrasive blast cleaning to remove fractured surface concrete and traces of unsound Material or contaminants, such as oil, grease, dirt, slurry or Materials that could interfere with the bond of the freshly placed shotcrete. The Contractor shall apply shotcrete to abrasive blast cleaned areas within 48 h or re-blast them.

The Project Manager may waive the requirement for abrasive blast cleaning where the Contractor performed concrete removal with high-pressure water blasting and the prepared surface is free of residual slurry or other Material detrimental to an Acceptable shotcrete bond.

The Contractor shall install reinforcement in slope blankets that do not contain steel reinforcement. Unless otherwise specified, the reinforcement will consist of No. 4 steel reinforcing bars placed with maximum spacing of 12 inch for vertical and horizontal bars. The Contractor shall rigidly attach this reinforcement to the underlying forms or concrete Structure. The Contractor shall remove dust, debris, or laitance generated by this process in accordance with these abrasive blast cleaning procedures.

519.3.2.4.2 Repair or Replacement of Steel Reinforcement

If the Contractor exposes corroded reinforcing steel during concrete removal, the Contractor shall remove corrosion using abrasive grit blasting.

The Contractor shall remove and replace reinforcing steel displaying deep pitting or loss of more than 20% of cross-sectional area as directed by the Project Manager.

If pitting is isolated, the Contractor shall reinforce the steel by adding appropriately placed reinforcing bars of suitable length (the existing reinforcing steel need not be cut).

519.3.2.4.3 Steel Reinforcement

The Contractor shall use a minimum lap splice length of reinforcing steel that is in accordance with the AASHTO *LRFD Bridge Design Specification*. The Contractor shall place these bars in accordance with ACI 506R, Sections 5.4 and 5.5. In particular, the Contractor shall not bundle bars in lapped splices; place them so the minimum spacing around each bar is three (3) times the maximum aggregate size to allow for proper shotcrete encapsulation.

The Contractor shall tightly secure intersecting reinforcing steel bars to each other using 12 gauge or heavier tie wire and adequately support them to minimize vibration during shotcrete placement.

The Contractor shall place welded wire mesh fabric in accordance with the Contract. The Contractor shall lap sheets of adjoining mesh by at least two (2) spaces in both directions at intersections, and securely fasten.

The Contractor shall fasten mesh to preset or existing anchors and reinforce using 12 gauge or heavier tie wire on a grid not less than 12 inch². The Contractor shall avoid large knots of tie wire that could result in sand pockets and voids during shotcreting.

The Contractor shall provide a minimum clearance of 3/4 inch behind installed reinforcing steel or mesh and existing concrete forms or bare rock.

519.3.2.4.4 Structural Anchors

Unless otherwise specified in the Contract, the Contractor shall place anchor bars (for structural applications) at a maximum spacing of 24 inches on a grid pattern over the entire area.

The Contractor shall provide the types of anchors in accordance with the Contract and either mechanically set or grout, as specified.

The Contractor shall ensure anchors develop the minimum pullout force in accordance with the Contract. The Contractor shall randomly test anchors at a frequency in accordance with the Contract to verify pullout force. The Department will not accept a pull out force less than 150 lb. If anchors fail to meet the minimum acceptable pullout value, the Contractor shall remove and replace immediately and take corrective action. Also, the Contractor shall test the anchors in the same relative location as those that failed. The Project Manager will determine the area for corrective measures.

519.3.2.4.5 Non-Structural Anchors

For non-structural applications (slope blankets, etc.), the Contractor shall install anchor bars at ten (10) foot centers on a grid pattern over the entire area in one (1) inch diameter holes drilled into the rock or soil approximately 24 inches deep.

The Contractor shall completely fill the drilled hole with neat cement grout using a grout tube extending to the bottom of the hole.

The Contractor shall push the anchor bar into the grout-filled hole and center it such that the short leg of the "L"-shaped bar points upward and parallel to the slope and is located

approximately 1 1/2 inches from the rock or soil surface.

519.3.2.4.6 Weep Holes

For slope blankets, the Contractor shall provide weep holes throughout the shotcrete mat on maximum ten (10) foot centers, horizontally and vertically.

The weep hole drains will consist of two (2) inch diameter Schedule 40 PVC slotted drainpipe, two (2) feet in length, placed within predrilled holes and sloped five percent (5%) to drain. The exposed end will extend from one (1) inch to three (3) inch outside the slope.

The Department will not allow pre-drilled holes with diameters larger than three (3) inches.

The Contractor shall install the slotted drainpipe before placing shotcrete. During placement of shotcrete, the Contractor shall protect weep holes and drainpipes against contamination.

519.3.2.4.7 Alignment Control and Cover

The Contractor shall implement alignment control (to establish control over line and grade), and maintain the minimum specified shotcrete thickness and cover of reinforcing steel.

The Contractor shall perform alignment control with shooting wires (also called ground wires), guide strips, depth gauges, or forms. The Contractor shall submit the proposed means of alignment control to the Project Manager for review and approval.

The Contractor shall use shooting wires that are at least "piano wire"—sized high-strength steel wire combined with a turnbuckle and spring coil. The Contractor shall remove shooting wires after completion of shotcreting and screeding operations.

The Contractor shall not let guide strips and forms impede the ability of the nozzle operator to produce uniform, dense, properly consolidated shotcrete. The Contractor shall not use alignment control Material that causes the formation of sand-pockets and voids.

If using depth gauges for alignment control, the Contractor shall space no greater than four (4) ft in a grid pattern. The Contractor shall cut back metal depth gauges to 1/4 inch below the finished surface.

The Contractor shall cover reinforcing steel in accordance with Section 540, "Steel Reinforcement."

519.3.3 Quality Assurance and Quality Control Testing

519.3.3.1 Quality Assurance

The Department will implement a Quality Assurance Program for the shotcrete Work. The program will include the following:

1. Review of Contractor submittals;
2. Review of the approval of Contractor-proposed Materials, supply, Equipment, and crew. In particular, evaluation in the pre-construction testing program of shotcrete nozzle operator and strike-off person proposed for use on the Project; the Department will allow only nozzle operators and strike-off persons approved in writing by the State Materials Bureau to perform Work;

3. Examination and approval (before application of any shotcrete) of areas prepared for shotcreting, including installation of anchors, reinforcement, and alignment control devices;
4. Provision of Inspectors to monitor shotcrete installation and authority to require removal and replacement of defective shotcrete while still plastic;
5. Regular monitoring of Quality Control testing results;
6. Implementation of a program for in-place evaluation and Acceptance or rejection, if test results indicate shotcrete is unacceptable; and
7. Implementation of a program of remedial Work, if the Quality Assurance Program deems it necessary.

519.3.3.2 Quality Control Testing

The Contractor shall provide an independent testing Laboratory to establish and maintain a Quality Control program for the shotcrete Work to ensure compliance with Section 519, "Shotcrete." Such a program will include, but not be limited to, the following:

1. Maintenance of test records for Quality Control operations; and
2. Physical testing in accordance with Section 519.2.6.1, "Production Testing" for the confirmation of compliance with the specified hardened shotcrete properties.

519.3.3.3 Safety and Cleanup

519.3.3.3.1 Preparation

The Contractor shall implement a safety program during preparation for shotcreting to do the following:

1. Protect the structural integrity of structural elements (by shoring or other suitable means) during concrete and reinforcing steel removal operations.
2. Protect personnel from falling debris, blasting grit, and high-pressure water jets during concrete removal processes.

The Contractor shall dispose of debris, blasting grit, and hydro-demolition and water-jetting slurry in accordance with Section 107, "Legal Relations, Environmental Requirements, and Responsibility to the Public."

519.3.3.3.2 Shotcrete Operations

The Contractor shall implement a safety program using hoarding, shrouds, screens, or other appropriate measures to protect personnel and surrounding property from pneumatically applied shotcrete over-spray and rebound Materials during the shotcrete application process.

Personnel working near the shotcreting operation, including nozzle operator, strike-off persons, nozzle operator's helpers, supervisors, and Inspectors, shall wear appropriate protective Equipment. Such Equipment includes, but is not limited to, safety helmet, safety boots, gloves, appropriate clothing, safety glasses with side enclosures, and dust masks.

Nozzle operator's helpers shall keep a supply of water, cloth or towel, and backup safety glasses available for the nozzle operator so satisfactory vision can be maintained during shooting operations. The Contractor shall provide sufficient lighting so the nozzle operator has a clear view of the Work.

The Contractor shall provide readily available eyebaths and wash facilities in the

immediate vicinity of the shotcrete application. The shotcrete crew shall apply appropriate skin protection and adopt Work hygiene to protect against cement or accelerator alkali burn.

The Contractor shall install sufficient lighting and ventilation to provide the nozzle operator and helpers with clear, unhindered view of the shooting area. The Contractor shall terminate Work and adopt corrective measures if, in the opinion of the Project Manager, visibility is unsuitable for the safe application of quality shotcrete.

519.3.4 Shotcrete Application and Finishing

519.3.4.1 Shotcrete Application

The Project Manager will review and approve areas prepared for shotcrete application before application of shotcrete.

The Contractor shall flush surfaces with water at least one (1) hour before application of shotcrete. The Contractor shall allow flushed surfaces to dry back to saturated surface-dry condition before application of shotcrete. If necessary, the Contractor shall use a blowpipe with oil-free compressed air to facilitate removal of surface water. For very porous and dry substrates, the Contractor shall saturate the substrate the Day before shotcreting and then re-wet before shooting as described above.

The Contractor shall apply shotcrete in accordance with ACI 506R, except that if using silica-fume modified shotcrete; the Contractor may apply the full thickness of shotcrete in a single layer. The Contractor shall use the minimum number of layers required to build up the full thickness of shotcrete without sagging, separation, or sloughing. Wherever possible, the Contractor shall apply shotcrete to the full thickness in a single layer.

If using multiple-layer shotcrete construction, the Contractor shall prepare the first layer with one (1) of the following methods before applying a subsequent layer:

1. Broom the stiffening layer with a stiff bristle broom to remove loose Material, rebound, over-spray, or glaze, before the shotcrete attains initial set.
2. If the shotcrete has set, Delay surface preparation at least 24 h, then prepare the surface by sandblasting or high-pressure water blasting to remove loose Material, rebound, hardened over-spray, glaze, or other Material detrimental to good bond.

When successive layers of shotcrete are necessary to build up full shotcrete thickness, the Contractor shall prevent the first layer from drying out with fogging or wetting. The Contractor shall only use curing compound with the approval of the Project Manager. If using a curing compound, the Contractor shall remove it by abrasive blast cleaning or high-pressure water blasting, before application of the next layer of shotcrete. The Contractor shall clean the first layer of shotcrete of surface water and ensure it is in a saturated surface-dry condition when applying the next shotcrete layer.

The Contractor shall exercise care to protect adjacent surfaces from buildup of rebound and over-spray. The Department will not allow rebound and over-spray on the completed Work. The Contractor shall remove rebound and over-spray from surfaces to receive shotcrete while the Material is still plastic, using blowpipes, scrapers, wire brushes, or other suitable tools. The Contractor shall remove hardened rebound and overspray with abrasive blast cleaning, chipping hammers, high-pressure water blasting or other suitable techniques before applying additional shotcrete.

The Contractor shall provide scaffolding or other devices so the nozzle operator and helpers have free, unhindered access to the Work area.

The Contractor shall apply shotcrete from the nozzle in accordance with ACI 506R.

The Contractor shall not apply shotcrete during periods of rain or high wind, unless suitable protection is provided.

The Contractor shall apply shotcrete in accordance with the Contract using shooting wires, depth gauges, guide strips, forms, or other suitable devices. The Contractor shall apply the minimum cover of shotcrete to reinforcing steel in accordance with the Plans. The Contractor shall cut back metal depth gauges to within 1/4 inch of the shotcrete surface, to prevent corrosion staining of the surface.

When applying a 3/8 inch maximum aggregate size shotcrete, the Department will allow a final flash coat layer (1/4 inch to 3/4 inch thick) using 1/4 inch aggregate shotcrete.

519.3.4.2 Shotcrete Finishing

The Contractor shall leave shotcrete in the natural gun finish unless otherwise specified in the Contract.

If the Contract requires finishing, the Contractor shall cut back shotcrete to line and grade using cutting rods, screeds, or other suitable devices. The Contractor shall allow shotcrete to stiffen sufficiently before cutting and trimming, to prevent the formation of tears, cracks, and delaminations. The Contractor shall remove shooting wires on completion of cutting and trimming.

The Contractor shall apply one (1) or more of the following finishes if required:

1. Wood float finish, either as a preliminary finish for other surface treatments, or as a granular texture finish.
2. Rubber float finish, applied to either a flash coat or wood float finish, to produce a finer textured granular finish.
3. Brush finish, a fine hairbrush float finish that leaves a finely textured, sandy finish.
4. Steel trowel finish that leaves a dense, smooth hard finish.

The Contractor shall trim back shotcrete and over-spray from adjacent non-prepared concrete surfaces. The Contractor shall provide the edges of shotcrete repairs with a minimum square saw-cut edge 3/4 inch deep; finish shotcrete up to this edge. The Contractor shall not featheredge shotcrete (including flash coats).

519.3.4.3 Curing and Protection

On completion of finishing, the Contractor shall immediately prevent shotcrete from drying out by fogging or wetting.

If the Contract requires leaving shotcrete with a natural gun finish, the Contractor shall apply curing compounds at twice the application rate normally specified for smooth concrete finishes. The Contractor shall completely remove curing compounds by abrasive blasting or water blasting (with a pressure of 3,000 psi) before application of subsequent sealers.

Once the shotcrete achieves its final set, the Contractor shall keep it continuously moist for at least seven (7) Days. The Contractor shall perform moist curing using one (1) or both of the following procedures:

1. Wrap the elements in wet burlap presoaked in water for 24 h before installation;

wrap the wet burlap in plastic sheet to slow the drying rate of the burlap.

2. Install sprinklers, soaker hoses, or other devices that keep the shotcrete continuously wet. Do not use intermittent wetting procedures that allow the shotcrete to undergo cycles of wetting and drying during the curing period.

519.3.4.4 Hot and Cold Weather Protection

The Contractor shall apply shotcrete during periods of hot and cold weather in accordance with ACI 305R and ACI 306R.

If it is anticipated that shotcrete will be placed when the ambient temperature will fall below 35 °F, a Cold-Weather Shotcrete Plan must be prepared and submitted to the Project Manager at least 30 Days before the intended application. The Cold Weather Shotcreting Plan must be reviewed and approved by the State Concrete Engineer before shotcrete is permitted to be placed at temperatures below 35 °F.

The Contractor shall monitor the Surface Evaporation of the Shotcrete in accordance with Section 512, "Superstructure Concrete." The Contractor shall not proceed with shotcrete application if the average rate of surface evaporation of the shotcrete over any ten (10) minute period exceeds 0.2 lb per square foot per hour, in accordance with Section 512, "Superstructure Concrete." The Contractor shall not allow the prevailing ambient conditions (relative humidity, wind speed, air temperature, and direct exposure to sunlight) to cause either plastic shrinkage or early drying shrinkage cracking.

All cracked Structural shotcrete, regardless of the cause, shall be removed and replaced at no cost to the Department.

Subsequent efforts to prevent further cracking problems shall include, but not be limited to:

1. Rescheduling of the Work to a time when more favorable ambient conditions prevail; and
2. Adopt corrective measures, such as installation of sunscreens, windbreaks, or fogging devices to protect the Work.

During periods of cold weather, shotcreting may only proceed if the substrate to which the shotcrete is applied and the air temperature in contact with the shotcrete surfaces are both above 50 °F.

The Contractor shall maintain the air temperature in contact with the shotcrete surfaces at 60 °F or greater for at least four (4) Days after application of shotcrete. The Contractor shall submit the means of maintaining the air temperature to the Project Manager for approval. The Contractor shall not use unvented heaters.

The Contractor shall apply shotcrete at a temperature of between 50 °F and 90 °F. The Contractor shall use cooler mix temperatures during hot-weather shotcrete operations and warmer mix temperatures during cold-weather shotcrete operations.

519.3.4.5 Inspection and Remedial Work

The Contractor shall sound the surface of the cured shotcrete with a hammer to locate unsound areas.

The Contractor shall provide Equipment, hardware, and means necessary to perform the inspection operations. The inspection accommodations are subject to the approval of the

Project Manager.

The Contractor shall cut out and replace sags or other defects with another layer. If welded wire mesh reinforcement is damaged or destroyed by such repairs, the Contractor shall repair the damaged area by overlapping and tying additional wire mesh in accordance with Subsection 519.3.2.4.3, "Steel Reinforcement."

519.4 METHOD OF MEASUREMENT

The Department will measure shotcrete using the dimensions shown in the Contract or approved modifications.

519.5 BASIS OF PAYMENT

Pay Item	Pay Unit
<i>Structural Shotcrete</i>	Square Yard
<i>Non-structural Shotcrete</i>	Square Yard

519.5.1 Work Included in Payment

The following Work and item(s) will be considered as included in the payment for shotcrete and will not be measured or paid for separately:

1. Reinforcement;
2. Anchors;
3. Slotted pipe;
4. Ties;
5. Test molds;
6. Test samples;
7. Submittals;
8. Boring;
9. Cores; and
10. Grouting.

SECTION 543: METAL RAILING

543.1 DESCRIPTION

This Work consists of providing and placing metal railing.

543.2 MATERIALS

543.2.1 Steel Railings

Unless otherwise shown in the Contract, the Contractor shall provide railing in accordance with ASTM A 36 or AASHTO M 270, Grade 50.

The Contractor shall provide square or rectangular tube steel in accordance with ASTM A 500, Grade B or ASTM A 501.

The Contractor shall provide black, seamless steel pipe in accordance with ASTM A 53. Hydrostatic testing is not required.

543.2.2 Bolts

543.2.2.1 Anchor Bolts

The Contractor shall provide anchor bolts in accordance with ASTM A 325, ASTM A 449, ASTM F 1554 or fabricate alternatively from AISI C-1144 or AISI C-1045 steel bar. The Contractor shall hot dip galvanized anchor bolts in accordance with AASHTO M 232 or mechanically galvanize in accordance with ASTM B 695, Class 50. The Contractor shall provide heavy hex nuts in accordance with ASTM A 563 Grade DH. The Contractor shall provide washers in accordance with ASTM F 436.

If the anchor bolts are fabricated from AISI C1144 or C1045 steel bar, the manufacturer shall supply certifications that demonstrate the anchor bolts meet the strength requirements of ASTM F 1554.

543.2.2.2 Connection Bolts

The Contractor shall provide connection bolts in accordance with ASTM A 307, Grade A; connection nuts in accordance with ASTM A 563, Grade A; connection washers in accordance with ASTM F 844, unless otherwise noted on the Plans or Standard Drawings. The Contractor shall ensure that bolt dimensions are in accordance with ANSI B 18.2.1, and nut dimensions are in accordance with ANSI B 18.2.2. The Contractor shall ensure washer dimensions and tolerances are in accordance with Section 542.2.3, "Washers."

543.2.3 Caulking Compound

The Contractor shall use cold-applied, single component, chemically curing silicone joint sealant for concrete pavement (non sag). Sealant shall conform to ASTM D5893, Type NS.

543.3 CONSTRUCTION REQUIREMENTS

The Contractor shall fabricate, weld, and erect railing in accordance with Section 541, "Steel Structures."

For purposes of impact testing, the Department considers steel Bridge railings and posts as main members.

The Contractor shall submit railing shop drawings and erection Plans in accordance with Section 541.3.3, "Shop and Erection Drawings."

543.3.1 Erection Tolerances

For a Bridge on a tangent, the Contractor shall ensure the railing is visually straight. In general, the Contractor shall ensure that the railing does not deviate more than 3/8 inch within 20 horizontal feet.

For a Bridge on a curve, the Contractor shall not deviate more than 13/16 inch from the curve within 20 horizontal feet.

The Contractor shall ensure the rail posts are plumb within 1/4 inch over the full height.

543.3.2 Protective Coating

When the Contract specifies the railing to be colored, the Contractor shall powder coat the railing in accordance with Section 545, "Protective Coatings of Miscellaneous Structural Steel," unless otherwise specified in the Contract.

When the Contract specifies railing to be galvanized, the Contractor shall galvanize in accordance with AASHTO M 111.

543.3.3 Cutting Rail Posts

The Contractor shall bevel cut posts to compensate for Roadway grade, crown, and superelevation.

If the Roadway grade is less than or equal to one percent (1%), the Contractor shall fabricate rail posts perpendicular to the grade line, but bevel cut crown and superelevation where necessary.

543.3.4 Caulking Rail Post Base Plates

Before placing rail posts into position on a Bridge deck, the Contractor shall apply a full circle bead of caulking compound on the deck surface around each of the anchor bolts. After erecting and coating the Bridge railing, the Contractor shall apply a bead of caulking compound around the perimeter of each rail-post base plate. The Contractor shall clean the deck surface and the surface of the rail-post anchor plates before applying the caulking compound.

543.4 METHOD OF MEASUREMENT

The Department will measure in place metal railing from end to end.

543.5 BASIS OF PAYMENT

Pay Item

Metal Railing

Pay Unit

Linear Foot

543.5.1 Work Included in Payment

The following Work and items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

1. Submittals; nondestructive testing; protective coatings;
2. Additional weight of heavier sections provided solely for the Contractor's convenience; and
3. All Incidentals necessary for the completion of the Work.

SECTION 545: PROTECTIVE COATING OF MISCELLANEOUS STRUCTURAL STEEL

545.1 DESCRIPTION

This Work consists of coating new steel elements including Bridge railing, pedestrian railing, drop inlet grates and frames, cattle guard grates, field coating of new steel piling, CWB access panels, gates, headgates, and flapgates, I-beam posts, safety grates, sole plates, and bearing devices, and miscellaneous steel elements.

545.1.1 Terminology and Standards

The Contractor shall use terminology in accordance with the following standards:

1. Society for Protective Coatings (SSPC) Painting Manual Volume 2;
2. Surface Preparation Standards, Guides, and Specifications, Section 2 of the SSPC Painting Manual Volume 2 (SSPC-SP);
3. American Architectural Manufacturer's Association (AAMA);
4. American Association of State Highway and Transportation Official (AASHTO);
5. American Society for Testing and Materials (ASTM);
6. American Institute of Steel Construction (AISC); and
7. National Association of Corrosion Engineers (NACE).

545.2 MATERIALS

The Contractor shall apply the coating system specified within the Contract. If the Contract does not specify a specific coating system, the Contractor may select the coating system from Table 545.2:1, "Coating System Selection Matrix."

**Table 545.2:1
Coating System Selection Matrix**

Specification Section	Coating System								Color Comments
	galvanize	3-Coat poly	2-Coat epoxy shop	2-Coat epoxy field	2-Coat acrylic	Powder Coat	3-Coat poly	2-Coat acrylic	if not galvanized, color (unless otherwise noted in drawings)
	541	544	545	545	545	545	546	546	
	541.2.5.1	544.2.1	545.2.1	545.2.2	545.2.3	545.2.4	546.2.1	546.2.2	
Element									
structural steel	X	X					R		*
metal Bridge railing	X							R	*
metal Pedestria n railing	X							R	*
drop inlet grates & frames	X		X		X	X		R	*
cattle guard grates			X		X	X		R	safety yellow

**Table 545.2:1
Coating System Selection Matrix**

CWB Access Panels	Coating System								Color Comments
	X		X	X	X	X		R	*
Gates	X		X	X	X	X		R	interstate green
Headgate s & Flapgate s**			X	X	X	X		R	**
I-Beam Posts	X		X	X	X	X		R	interstate green
steel piling							X R		*
sole plates & bearing devices			X					R	*
safety grates	X		X	X	X	X		R	*
Misc. steel	X		X	X	X	X		R	*
Coating Component									
Galvanizi ng	C								
inorganic zinc primer		C	C		C				
organic zinc primer				C	C		C	C	
epoxy intermedi ate		C					C	***	
polyureth ane topcoat		C					C		
epoxy topcoat			C	C					
acrylic topcoat					C			C	
powder coating						C			

"X" denotes a coating system that is acceptable for each element. Specific coating systems noted in the Contract Documents supersede the information provided in this table.

"R" denotes the coating system that is allowable for recoating unless otherwise specified in the Contract Documents. Reference 546 "Recoating Structures" for additional information. All recoating is allowable as field applied.

"C" denotes the coating system component, reference specification section for details.

* If the Contract does not specify a color, the Contractor shall use the color Federal Standard 595A Color No. 22563 or approved equal.

** If purchased as an assembly, any corrosion inhibiting coating that is provided by the manufacturer is acceptable.

*** Intermediate or tie-coat to be provided if recommended by the manufacturer.

545.2.1 Coating System No. 1: Shop Applied 2-Coat with Epoxy Topcoat

The Contractor shall select a complete coating system comprised of products meeting all

performance requirements as listed in Table 545.2.1:1, "Acceptable Product Requirements" below. Testing shall be in accordance with AASHTO R-31. All products in each system shall be from the same manufacturer. All products shall be represented on the latest version of the manufacturer's product data sheet as being suitable for use on Bridges and capable of being applied at the specified dry film thickness requirements in Table 545.3.1.2.8:1, "Required Film Thicknesses."

Inorganic Zinc-Rich Primer – Shall achieve minimum SSPC Paint 20 Level 2 requirements for amount of zinc dust in the dry film of equal to or greater than 77% by weight.

Epoxy Topcoat Coat – Shall be a two (2)-component epoxy polyamide or polyamidoamine coating, including Phenalkamine coatings with minimum solids by volume of 65%.

Table 545.2.1:1
Acceptable Product Requirements

TEST	REF. NO.	PRODUCT(S)	ACCEPTANCE CRITERIA	COMMENTS
Slip Coefficient	ASTM A 325, Appendix A.	IOZ	Class B, Min. 0.5	
Salt Fog Resistance	ASTM B 117	P/T (IOZ)	(A) No Delamination Allowed (B) Rust – Max creep 4mm, Avg. creep 2mm @5000 Hrs. (C) Blister – Conversion #8 @ 4000 Hrs.	
Cyclic Weathering Resistance	ASTM D 5894	P/T (IOZ)	(A) No Delamination Allowed (B) Rust – Max creep 4mm, Avg. creep 2mm @5040 Hrs. (C) Blister – Conversion #9 @ 4032 Hrs.	
Adhesion Pull-Off Strength	ASTM D 4541	IOZ Alone	2.4 MPa (350 psi)	
		P/T (IOZ)	2.4 MPa (350 psi)	
Freeze-Thaw Stability Pull-Off Strength	ASTM D 4541	P/T (IOZ)	2.4 MPa (350 psi)	
			4.1 MPa (600 psi)	
			2.4 MPa (350 psi)	
			4.1 MPa (600 psi)	
Field History	NA	P/T (IOZ)	Five (5) Bridges with Minimum two (2) year successful field history	

P = Primer; T = Topcoat, IOZ = Inorganic Zinc Rich Primer

Primer information for the use of organic zinc for touch-up and repair is included in Section 546, "Recoating Structures."

545.2.2 Coating System No. 2: Field Applied 2 Coat with Epoxy Topcoat

The Contractor shall select products meeting all performance requirements as listed in Table 546.2.2:1, "Acceptable Product Requirements" below. Testing shall be in accordance with AASHTO R-31. All products used in a system shall be from the same manufacturer. All products shall be represented on the latest version of the manufacturer's product data sheet as being suitable for use on Bridges and capable of being applied at the specified dry film thickness requirements in Table 545.3.1.2.8:1, "Required Film Thicknesses."

Epoxy Organic Zinc-Rich Primer (used to prime exposed bare steel areas only, spot prime) shall achieve minimum SSPC Paint 20 Level 2 requirements for amount of zinc dust in the dry film of equal to or greater than 77% by weight.

Epoxy Top Coat over existing finishes (applied over zinc primer and other sound existing coatings deemed suitable for over coating by the coating manufacturer's representative) shall be a two (2)-component, surface tolerant epoxy coating with minimum solids by volume of 65%.

**Table 545.2.2:1
Acceptable Product Requirements**

TEST	REF. NO.	PRODUCT(S)	ACCEPTANCE CRITERIA	COMMENTS
Salt Fog Resistance	ASTM B 117	P/T (OZ)	(A) No Delamination Allowed (B) Rust – Max creep 8mm, Avg. creep 4mm @5000 Hrs. (C) Blister – Conversion #7 @ 4000 Hrs.	
Cyclic Weathering Resistance	ASTM D 5894	P/T (OZ)	(A) No Delamination Allowed (B) Rust – Max creep 8mm, Avg. creep 4mm @5040 Hrs. (C) Blister – Conversion #8 @ 4032 Hrs.	
Adhesion Pull-Off Strength	ASTM D 4541	OZ Alone P/T (OZ)	4.1 MPa (600 psi) 4.1 MPa (600 psi)	
Freeze-Thaw Stability Pull-Off Strength	ASTM D 4541	P/T (OZ)	2.4 MPa (350 psi) 4.1 MPa (600 psi)	Requires same average as adhesion pull-off strength results, with no tests

Table 545.2.2:1
Acceptable Product Requirements

TEST	REF. NO.	PRODUCT(S)	ACCEPTANCE CRITERIA	COMMENTS
			2.4 MPa (350 psi) 4.1 MPa (600 psi)	measuring less than 60% of those results
Field History	NA	P/T (OZ)	Five (5) Bridges with Minimum two (2) year successful field history	

P = Primer; T = Topcoat, OZ = Epoxy Organic Zinc Rich Primer

545.2.3 Coating System No. 3: Shop or Field Applied 2 - Coat with Acrylic Topcoat

The Contractor shall select products meeting all performance requirements as listed in Table 545.2.1:1, "Acceptable Product Requirements" above for Inorganic Zinc Rich Primer or Table 545.2.2:1, "Acceptable Product Requirements" for Organic Zinc Rich Primer and 545.2.3:1, "Acceptable Product Requirements" for Acrylic Top Coat below as applicable. It is Acceptable to use either inorganic or organic zinc rich primer for 545.2.3 Coating System 3. All products used in a system shall be from the same manufacturer. All products shall be represented on the latest version of the manufacturer's product data sheet as being suitable for use on Bridges and capable of being applied at the specified dry film thickness requirements in Table 545.3.1.2.8:1, "Required Film Thicknesses."

Epoxy Organic Zinc-Rich Primer (used to prime exposed bare steel areas) shall achieve minimum SSPC Paint 20 Level 2 requirements for amount of zinc dust in the dry film of equal to or greater than 77% by weight (Table 545.2.2:1, "Acceptable Product Requirements"), or;

Inorganic Zinc-Rich Primer (used to prime exposed bare steel areas) shall achieve minimum SSPC Paint 20 Level 2 requirements for amount of zinc dust in the dry film of equal to or greater than 77% by weight (Table 545.2.1:1, "Acceptable Product Requirements"), and;

Acrylic Topcoat (applied as overcoat over sound existing coatings deemed suitable for over coating by the coating manufacturer's representative or for repair to the finish of certain items per Section 545, "Protective Coating of Miscellaneous Structural Steel;" miscellaneous steel shall be a high performance DTM acrylic coating with minimum solids by volume of 38%. Suitable for application over zinc rich primers (Table 545.2.1:1, "Acceptable Product Requirements").

Table 545.2.3:1
Acceptable Product Requirements

TEST	REF. NO.	PRODUCT(S)	ACCEPTANCE CRITERIA	COMMENTS
Adhesion Pull-Off Strength	ASTM D 4541	HPA	> 500 lbs.	One (1) coat applied over blasted steel
Flexibility	ASTM D 522	HPA	Pass: No cracking / flaking	1/8 " conical mandrel One coat applied over blasted steel

Table 545.2.3:1
Acceptable Product Requirements

TEST	REF. NO.	PRODUCT(S)	ACCEPTANCE CRITERIA	COMMENTS
Hardness (Pencil)	ASTM D 3363	HPA	Final Cure: "F"	One (1) coat applied over blasted steel
Impact	ASTM D 2794	HPA	> 140 in. lbs.	One coat applied over blasted steel

HPA = High Performance Acrylic

545.2.4 Coating System No. 4 – Powder Coating

The Contractor shall obtain primer and topcoat from one (1) manufacturer. The Contractor shall select a coating system that meets the requirements of AAMA 2604.

545.2.5 Galvanizing or Zinc Coating

Reference Section 541.2.5.1, "Galvanizing or Zinc Coating."

545.2.6 Submittals

When the Contract requires painting more than 1,500 square feet of steel surface, the Contractor shall submit a coating Plan 30 Days prior to start of coating operations. The Project Manager shall have the option to waive the coating Plan requirement.

In addition to the submittals require per Section 106, "Control of Materials," the Contractor shall provide the following submittals to the Project Manager at least 30 Days before coating operations:

1. Product data and SDS for each product in the system;
2. Surface preparation requirements;
3. Application instructions:
 - a. Mixing and thinning directions;
 - b. Recommended spray nozzles and pressures;
 - c. Minimum / maximum drying times, including re-coat times for shop or field coatings;
 - d. Temperature requirements;
4. Letter from the manufacturer detailing the coating system components and the compatibility of those components to adjacent Materials including but not limited to:
 - a. Every product in the system (primer, intermediate, topcoat, etc.);
 - b. Any pre-applied or preexisting products (such as existing coatings);
 - c. Any post applied products (such as anti-graffiti coating);
 - d. Any modifications to the surface preparation or application instructions related to the total system performance;
5. If the color varies from the specified color, the Contractor shall submit color samples on boards at least eight (8) inches by ten (10) inches for review and approval; and
6. Documentation related to Contractor Qualifications per Section 546.2.7, "Contractor

Qualifications.”

545.2.6.1 Certification

Prior to coating application, the Contractor shall submit:

1. Notarized manufacturer's Certificates of Compliance stating that the Materials are the same as those described in the manufacturer's product data sheets; and
2. Certified test reports from an independent Laboratory performed in accordance with AASHTO R-31, showing Acceptable performance results as listed on the chart in Section 545, "Protective Coating of Miscellaneous Structural Steel."

545.2.6.2 Product Data Sheets

The Contractor shall provide manufacturer's product data sheets with each Submittal that shows the following:

1. Mixing and thinning directions;
2. Recommended spray nozzles and pressures;
3. Minimum/maximum drying time, including re-coat times, for shop or field applied coats; and
4. Manufacturer recommended application procedures, including surface preparation and temperature requirements.

545.2.7 Contractor Qualifications

When the Contract requires painting more than 1,500 sq ft of steel surface, the Contractor shall demonstrate qualification by one of the following two (2) methods:

Method 1

The Contractor shall obtain SSPC QP 1 certification for field painting or either SSPC-QP 3 certification or the AISC Sophisticated Paint Endorsement (SPE) for shop painting. The Contractor shall perform and document QA/QC inspections daily. QA/QC inspection documents shall be electronically submitted to the Project Manager on a weekly basis.

Method 2

The Contractor shall provide a coating Plan and provide for NACE certified inspection (Level 2 minimum). The inspection services shall include but not be limited to:

1. Surface preparation and cleanliness inspection verifying profile and appropriate surface preparation.
2. Confirm products match approved submittals and certification letters. Document the batch numbers of all coatings.
3. Inspection of primer coat to include dry film thickness readings. Review Contractor's QA/QC reports for environmental conditions and document.
4. Observe application of stripe coat on the intermediate coat and document environmental readings during the start up of application. Review Contractor's QA/QC reports.
5. Inspect intermediate coat to include dry film thickness readings. Review Contractor's QA/QC reports.
6. Observe start up of finish coat application and document environmental conditions.
7. Final inspection to include visual inspection for runs, sags, and foreign Material in

- coating. Also perform final dry film thickness inspection.
8. Inspect members after transportation, prior to subsequent coating and / or Final Acceptance.
 9. Electronically submit interim reports after each inspection to the Project Manager within three (3) Working Days.
 10. Electronically submit comprehensive final report including photos to the Project Manager within 14 Days of completion of inspection. Final report shall include QA/QC daily inspections performed by the Contractor.

Any deficiencies shall be corrected and reinspected by the NACE inspector prior to proceeding.

Samples of a coating Plan and QA/QC inspection documents are available on the NMDOT website.

Provisions for demonstration of qualifications are Incidental to the performance of the coating, no additional payment shall be made. NMDOT shall be granted open access to the coating operation to perform inspections and to review documentation of Contractor inspections.

The Project Manager shall have the option to waive the Contractor Qualification requirement for Miscellaneous Structural Steel scope.

545.3 CONSTRUCTION REQUIREMENTS

545.3.1 Liquid Coating Systems No. 1, No. 2, and No. 3

The Contractor shall apply coatings in conformance with SSPC – PA 1 “Shop, Field and Maintenance Painting of Steel” and with SSPC – PA Guide 13 “Guide Specification for Application of Coating Systems with Zinc-Rich Primers to Steel Bridges” (aka AASHTO/NSBA Steel Bridge Collaboration S 8.1) and the manufacturer’s application instructions.

545.3.1.1 Surface Preparation

The Contractor shall remove contaminants in accordance with SSPC-SP 1, or other methods approved by the Project Manager.

Surface preparation for all steel elements include in Section 545, “Protective Coating of Miscellaneous Structural Steel” shall be in accordance with SSPC-SP10 / NACE 2 Near White Blast Cleaning: When viewed without magnification shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products and other foreign matter of at least 95% of each unit area. Staining shall be limited to no more than five percent (5%) of each unit area, and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings. Unit area shall be approximately three (3) inch x three (3) inch (nine (9) sq. in.).

Prepared surfaces shall be evaluated using the SSPC-VIS 3 Guide and Reference Photographs. The Contractor shall provide a current copy of the SSPC-VIS 3 Guide and Standard to the Project Manager. It shall become the property of the Department.

The Contractor shall maintain the steel dust free and prime within eight (8) hours after

blast cleaning. The Contractor shall re-clean rusted or contaminated surfaces at no additional cost to the Department. The Contractor shall mask areas that require field welding before coating.

The Contractor shall clean again before applying each subsequent coat.

545.3.1.2 Coating

545.3.1.2.1 Mixing the Coating

The Contractor shall mix the coating with a power mixer to a smooth and lump-free consistency, in accordance with the coating manufacturer's Specifications.

The Contractor shall mix the coating as much as possible in the original containers and continue mixing until the metallic powder or pigment is in suspension. The Contractor shall keep mixed primers continuously agitated before and during application.

545.3.1.2.2 Thinning the Coating

The Contractor shall not thin the coatings without the approval of the Project Manager. If it is necessary to thin the coatings, the Contractor shall thin the Material in accordance with the manufacturer's recommendations.

545.3.1.2.3 Temperature and Weather Limitations

The Contractor shall only apply the coatings when the ambient air temperature and surface temperature of the steel are both above 50 °F and at least five (5) °F above the dew point.

The Contractor shall not apply the coatings when there is condensation or frost on the metal surfaces.

The Contractor shall not apply the coatings when the relative humidity is higher than 85 percent.

545.3.1.2.4 Coating Applications

The Contractor shall not apply coating until the Department approves the surface preparation. The Department may waive this inspection.

A stripe coat of primer and intermediate Material shall be applied to all edges, corners, seams, crevices, interior angles, junctions of joining members, rivets, bolt heads, nuts and threads, welds and similar irregularities. The stripe coats shall be of sufficient thickness to completely hide the surface being covered and shall be followed, as soon as practicable, by a full application of the appropriate coating to its specified thickness.

The Contractor shall repair coated areas where the primer or topcoat runs, sags or cracks.

The Contractor shall not apply any coating until the previous coat has fully cured or per the manufacturer's application requirements.

The Contractor shall allow the manufacturer's minimum recommended cure time to lapse between coats. If more than 30 Days elapse between the primer application and the topcoat application, the Contractor shall contact the coating system manufacturer for surface preparation recommendations before applying subsequent coats.

The Department may Accept minor cosmetic defects in ground level miscellaneous Structural Steel components not in public view, if the defects will not affect durability.

545.3.1.2.5 Required Coating of Components

The Contractor shall apply the primer and topcoat to steel surfaces, except those that will contact elastomeric bearing pads or are subject to sliding and rotational movements.

The Contractor shall coat new steel piling from the bottoms of the pier caps to two (2) ft below the finished grade or streambed elevations.

545.3.1.2.6 Coating of Sole Plates for Concrete Bridges

The Contractor shall deliver sole plates to the Project with one (1) coat of primer applied to all surfaces except masked-off strips, where the sole plates will be welded to the shoe plates, and surfaces that will contact elastomeric bearing pads.

Before installation, the Contractor shall clean surfaces that will contact pads in accordance with SSPC-SP 6. The Contractor shall clean off all rust on sole plates prior to installing and welding.

After installing the pads and welding the sole plates to the shoe plates, the Contractor shall touch up the primer and apply topcoat to exposed surfaces.

545.3.1.2.7 Spray Equipment

The Contractor shall apply the coatings with spray nozzles at the manufacturer recommended pressures.

545.3.1.2.8 Film Thickness Requirements

The Contractor shall apply coatings in accordance with Table 545.3.1.2.8:1, "Required Film Thicknesses."

545.3.1.2.8:1 Required Film Thicknesses	
Coating	Dry film thickness range (mils)
Primer (IOZ)	2 – 4
or	
Primer (OZ)	3 – 5
Topcoat (epoxy)	4 – 6
or	
Topcoat (acrylic)	2 – 4

545.3.1.2.9 Field Repair of Liquid Coatings

Field repair of liquid coatings shall be performed in accordance with Section 546, "Recoating Structures" and the manufacturer's recommendations. Field repair shall be accomplished with the same coating system used for the original application with the exception that organic zinc rich primer may always be used.

The Contractor shall field repair coated areas that are rusted or damaged. The Contractor shall prepare the surface in accordance with Section 546.3.1, "Surface Preparation of Existing Bridges and Structures" or with methods approved by the Project Manager.

The Contractor shall prime large areas using spray Equipment, brush, or roller. The Contractor shall prime small areas with a brush. The Contractor shall spray or brush the topcoat. Two (2) or more coats may be necessary to build up the required film thickness. The Contractor shall apply topcoat only to areas where the topcoat is damaged. Requirements of Section 546.3, "Construction Requirements" apply to field repairs.

545.3.2 Powder Coating System No. 3

545.3.2.1 Surface Preparation

The Contractor shall remove contaminants in accordance with SSPC-SP 1, or other methods approved by the Project Manager. The Contractor shall blast clean in accordance with SSPC-SP10 Near-White Metal Blast Cleaning. Additionally, for powder-coated surfaces, an iron or zinc phosphate wash shall be included to provide long-term corrosion protection.

545.3.2.2 Primer Application

The Contractor shall use a primer that is a zinc rich epoxy powder coating designed for use over ferrous metal substrates. The Contractor shall apply the zinc rich epoxy powder coat primer to a minimum of two (2) mils dry film thickness, above the peaks of any blast profile.

545.3.2.3 Topcoat Application

The Contractor shall use a topcoat that is a super durable polyester powder coating designed to provide for maximum UV exposure protection. The Contractor shall apply the polyester topcoat to a minimum of three (3) mils dry film thickness before the primer has cured or as recommended by the manufacturer.

**Table 545.3.2.3:1
Required Film Thicknesses**

Coating	Dry film thickness range (mils)
Zinc-rich epoxy primer	Min. 2 mils
Polyester topcoat	Min. 3 mils

The Contractor shall use a magnetic film thickness gage or an electronic film thickness detector to determine dry film thickness per SSPC – PA 2, "Procedure for Determining Conformance to Dry Coating Thickness Requirements."

545.3.2.4 Fixturing

The Contractor shall suspend the components by suitable metal hooks or fixtures to provide a sufficient electrical grounding path. The Contractor shall affix the components with a

minimum of direct contact area with the fixture device.

545.3.2.5 Curing

The Contractor shall place the powder-coated components in a suitable oven and cure per the manufacturer's recommended cure cycle. The Contractor shall remove the components from the oven and allow cooling. The Contractor shall visually inspect the components to ensure a smooth continuous uniform finish, free from runs, sags, pinholes or other defects.

545.3.2.6 Touch-up Painting / Field Repair of Powder Coatings

Field repair of powder coatings shall be performed in accordance with Section 546, "Recoating Structures" and the manufacturer's recommendations. The Contractor shall use Coating System No. 2 from Section 546.2, using the inorganic zinc-rich primer only where bare metal is exposed.

Surface preparation shall be done in accordance with the manufacturer's recommendations. In the absence of manufacturer recommendations, the surface shall be prepared in accordance with SSPC-3 on the minimum surface area possible to accomplish the repair.

The Contractor shall field repair coated areas that are rusted or damaged.

545.3.3 Handling Steel

The Contractor shall handle or load newly coated Structural Steel only when the coating has fully cured.

The Contractor shall store coated components on pallets or in other approved ways so that the steel does not rest on soil.

The Contractor shall protect steel coatings from binding chains with approved softeners. The Contractor shall hoist with padded hooks and slings. The Contractor shall space parts during shipment to ensure that no rubbing occurs.

545.3.4 Provisions for Inspection

The Contractor will be responsible for performing and documenting Quality Control (QC) inspections of all shop / field surface preparation and coating activities. When the Contract requires painting more than 1,500 sq. ft. of steel surface, the Contractor shall reference Section 544.2.7, "Contractor Qualifications." When the Contract required painting less than 1,500 sq. ft. of steel surface, the Contractor shall document all QC inspection activities, measurements and observations on the Daily Inspection report. These reports shall be submitted to the Project Manager at a minimum on a weekly basis and shall account for all Work performed.

After completing erection, the Project Manager will inspect the surfaces to be embedded in concrete. The Contractor shall repair damaged or rusted surfaces before placing decks. After placing the deck and at an agreed upon time, the Project Manager will inspect the entire steel Structure for coating system damage. The Project Manager will mark damaged areas for repair and will re-inspect after repairs are complete.

545.3.5 Protection of the Work and Public

During the coating operations, the Contractor shall protect the work and the public from blast cleaning operations, paint splatter, splashes and smirches with protective covering or other methods approved by the Project Manager.

When the protective devices or procedures are ineffective, the Project Manager may suspend the Work until corrections take place.

545.4 METHOD OF MEASUREMENT—Reserved

545.5 BASIS OF PAYMENT

The Department will pay for the coating system(s) as Incidental to the new Steel.

SECTION 607: FENCE

607.1 DESCRIPTION

This Work consists of constructing fence and gates.

607.2 MATERIALS

607.2.1 Certification

The Contractor shall submit independent testing Laboratory certification to the Project Manager that indicates the fencing Materials meet these Specifications. The Department may inspect the manufacturing methods at manufacturing plants and may obtain Material samples for testing and may base Acceptance on the quality of manufacturing lots.

607.2.2 Barbed Wire and Woven Wire Fence

607.2.2.1 Wire

The Contractor shall provide wire and wire components with at least a Class 1 zinc coating in accordance with ASTM A 121 or ASTM A 116, unless otherwise specified in the Contract. Instead of Class 1 coating, the Contractor may coat the wire with aluminum alloy covering at least 0.3 oz per square foot of wire surface.

607.2.2.1.1 Barbed Wire

The Contractor shall provide barbed wire and barbs in accordance with ASTM A 121. The Contractor shall provide composite barbed wire strands that consist of two (2) coated wires with diameters of 0.099 inch. The Contractor shall provide round barbs that have a coated diameter of 0.08 inch, with either two (2)-point barbs spaced four (4) inches apart or four (4)-point barbs spaced five (5) inches apart. The Contractor shall provide stays for barbed wire fences in accordance with ASTM A 116, with a coated diameter of at least 0.142 inch and with lengths and spacing in accordance with the Contract.

607.2.2.1.2 Woven Wire

The Contractor shall provide woven wire in accordance with ASTM A 116, Design Number 832-6-11, unless otherwise specified in the Contract.

607.2.2.1.3 Post Fasteners

The Contractor shall provide coated staples with a diameter of at least 0.148 inch and a length of at least 1 1/2 inch; use for fastening fence wire to wood posts.

607.2.2.1.4 Brace Wire

The Contractor shall provide coated brace wire with a diameter of at least 0.148 inch; use for constructing braces and intermediate braces with wood posts.

607.2.2.1.5 Tie Wire

The Contractor shall provide coated tie wire for fastening barbed or woven wire to steel posts with a diameter of at least 0.099 inch. The Contractor may use wire fasteners or metal clamps with thicknesses of 0.12 inch or greater instead of tie wires, if approved by the Project Manager.

607.2.2.2 Posts

The Contractor shall provide metal or wood corner, brace, intermediate brace gate, and line posts of the specified type, size, and length in accordance with the Contract. The Contractor shall permanently cap all vertical metal pipes on fence and gate supports. The Contractor shall ensure that the top coating and color of the pipe is maintained.

607.2.2.2.1 Metal Posts

The Contractor shall provide metal posts and braces of rail, billet, or commercial-grade steel in accordance with ASTM A 702 or ASTM F 1083 for galvanized, standard weight pipe. The Contractor shall provide C-section posts in accordance with ASTM A 1011.

The Contractor shall galvanize steel posts in accordance with AASHTO M 181 for Grade 1 steel and provide a top coating specified for Grade 2 steel, or an equivalent or better coating, from the Department's *Approved Products List*. The Contractor shall coat edges and damaged areas of posts in accordance with ASTM A 780. The Contractor shall use posts of the same coating and color.

The Contractor shall provide posts that weigh no less than 95% of the specified weight; and are of the specified length + two (2) inch, - one (1) inch.

The Contractor shall provide line posts with a minimum weight of 1.33 lb per foot, not including anchor plates. The Contractor may provide I-beam, T-beam, U-beam, Y-bar, or C-section line posts. The Contractor shall provide line posts with corrugations, lugs, ribs, or notches spaced one (1) inch on centers to attach fence wire. The Department will not Accept posts with punched tabs used for crimping around the wire.

The Contractor shall provide anchor plates with an area of at least 18 inch² and that weigh at least 0.67 lb. The Contractor shall clamp, weld, or rivet anchor plates to the post section to prevent displacement when driving the posts.

607.2.2.2.2 Wood Posts

The Contractor shall provide wood posts cut from live southern yellow pine, lodge pole pine, or ponderosa pine trees. The Contractor shall provide straight posts that are free of decay and other defects, bark-free, trimmed smooth of knots and projections, and with both ends sawed off perpendicular to the centerline.

The Contractor shall provide an average nominal diameter at the top of each post of at least six (6) inches. The Contractor shall ensure the circumference of corner, brace, intermediate brace, and gate posts is at least 19 inches, measured six (6) inches below the top of the post.

The Contractor may provide line posts with a slight crook in one (1) direction, but the post may not vary more than 1 1/2 inch from a straight line connecting both ends of the post. The Contractor shall ensure the average nominal diameter of the top of each line post is at least three (3) inches. The Contractor shall ensure the circumference of line posts is at least nine (9) inches, measured six (6) inches below the top of the post.

The Contractor shall provide coast region douglas fir or New Mexico red spruce or fir braces for wood posts.

607.2.2.2.2.1 Preservative Treatment of Wood Posts

The Contractor shall provide wood posts pressure treated with pentachlorophenol in accordance with Section 550.2.2, "Preservatives and Treatment Methods," treated according to AASHTO M-133, all in accordance with AWPA Standard U1 and Commodity Standard B: Posts and AWPA Standards P8 and P9.

607.2.2.3 Gates

The Contractor shall provide two (2)-inch 16-gauge tubular gates meeting the requirements of ASTM A513 with a wall thickness of .065 inches and a tolerance of plus (+0.003) or minus (-0.011) unless otherwise specified in the Contract.

Gates shall be coated in accordance with Section 607.2.2.2.1, "Metal Posts," or coat in accordance with Section 545, "Protective Coating for Miscellaneous Structural Steel." The Contractor shall use "Interstate Green" as the finished color coating, except for galvanized gates and unless otherwise shown in the Contract.

607.2.2.4 Fittings

The Contractor shall provide fittings, hardware, and appurtenances for fences and gates that are of commercial-quality steel, malleable iron, or wrought iron, and galvanized in accordance with ASTM A 153.

607.2.3 Chain Link Fence

607.2.3.1 Posts

The Contractor shall provide posts that are tubular steel, H-column, or C-section (for line posts). The Contractor shall provide either Grade 1 or Grade 2 steel posts in accordance with AASHTO M 181. The Contractor shall provide Grade 1 tubular posts, braces, and top rails in accordance with ASTM F 1083 for galvanized, standard weight pipe. The Contractor shall provide Grade 2 steel posts in accordance with ASTM A 1011 or ASTM A 653.

The Contractor shall provide C-section line posts in accordance with ASTM A 1011. The Contractor shall provide H-column posts in accordance with ASTM A 36.

The Contractor shall provide pipe with minimum wall thickness as specified in the Contract. The Contractor shall ensure that the product of the yield strength and section modulus of the pipe is in accordance with ASTM F 1083.

The Contractor shall provide posts that securely hold tension wires in position without vertical movement.

607.2.3.2 Fittings

The Contractor shall provide fittings in accordance with Section 607.2.2.4, "Fittings."

The Contractor shall provide stainless steel straps and seals in accordance with ASTM A 176.

The Contractor shall provide coated tension wires that are galvanized coil spring steel wire of commercial quality with a diameter of 0.148 inch. The Contractor shall provide galvanized ferrules for tension take-up in accordance with ASTM A 1011.

The Contractor shall provide pull cable and tension truss rods with diameters of at least

3/8 inch, with drop forged turnbuckles or other approved tension devices.

The Contractor shall provide pull cable and tension wires with a minimum zinc coating of 0.8 oz per square foot of uncoated individual wire surface, tested in accordance with ASTM A 90.

The Project Manager will determine the uniformity of the coating by visual inspection. The Project Manager may reject coating with excessive roughness, blisters, discoloration spots, bruises, and flaking. The Department may make other inspections and tests at the manufacturer's plant, before shipment.

607.2.3.3 Tie Wires and Fasteners

The Contractor shall provide galvanized, coated tie wires for fastening chain link fabric to posts and rails with a diameter of at least 0.148 inch. The Contractor may provide galvanized steel or non-corrosive metal bands or fasteners instead of tie wires, as recommended by the manufacturer.

607.2.3.4 Compression Braces

The Contractor shall provide compression braces that meet the same requirements as top rails in accordance with Section 607.2.3.1, "Posts."

607.2.3.5 Chain Link Fabric

The Contractor shall provide chain link fabric in accordance with AASHTO M 181, with a Class C coating or better. The Contractor shall provide chain link fabric full height. The Contractor shall provide galvanized, coated wire with a diameter of 0.148 inch. The Contractor shall provide two (2) inch mesh fabric. The Contractor shall measure the mesh size as the distance between the wires forming parallel sides of the mesh.

607.2.3.6 Gates

The Contractor shall provide double drive, single drive, or single walk gates. The Contractor shall provide galvanized steel pipe gate frames in accordance with ASTM F 1083 and ASTM A 123.

607.2.3.7 Vinyl-Coated Chain Link Fence

The Contractor shall provide vinyl-coated chain link fences in accordance with Section 607.2.3, "Chain Link Fence," except as modified in this subsection.

If providing PVC coated chain link fabric, the Contractor shall use vinyl-coated fabric, posts, and hardware in accordance with AASHTO M 181 for Class A PVC coating. The Contractor shall continuously bond the vinyl coating (do not spray or dip) over the galvanized steel wire by the extrusion bonding process under pressure.

The Contractor shall ensure the vinyl coating resists damage from prolonged exposure to dilute solutions of common mineral acids, sea water, and dilute solutions of salts and alkali.

The Contractor shall galvanize using the electrolytic process before coating with PVC.

The Contractor shall provide wire that was vinyl-coated before weaving and is free and flexible at the joints.

607.2.4 Post and Cable Access Fence

607.2.4.1 Cable

The Contractor shall provide wire cable in accordance with AASHTO M 30. The Contractor shall provide cable of Type I, Class A, 0.75 in diameter rope, unless otherwise specified in the Contract.

607.2.4.2 Hardware and Fittings

The Contractor shall provide galvanized or cadmium plated parts, hardware, and fittings. The Contractor shall galvanize in accordance with AASHTO M 232. The Contractor shall provide cadmium plating in accordance with ASTM B 766, for Class 12, Type III. The Contractor shall provide bolts in accordance with ASTM A 307 and nuts in accordance with ASTM A 563.

The Contractor shall provide externally threaded fittings such as end tie rods, anchor rods, and splicing rods that transmit direct tensile stress, having a minimum tensile strength of 75,000 psi.

The Contractor shall provide internally threaded fittings such as turnbuckles, cable sockets, and nuts capable of withstanding a proof load that is 85% of the proof load requirements for nuts, as specified in accordance with ASTM A 563, Table 3.

The Contractor shall provide cable splices and connections that withstand a proof load equal to the tensile strength required of the attached wire rope cable.

The Contractor shall provide steel rectangular plate washers and cable clamps with a minimum tensile strength of 60,000 psi. The Contractor shall provide plain washers of ferrous metal in accordance with ANSI B 18.22.1, Type A.

607.2.4.3 Wood Posts

The Contractor shall provide wood posts from one (1) of the following species:

1. Northern White Cedar;
2. White Pine;
3. Jack Pine;
4. Red (Norway) Pine;
5. Southern Yellow Pine; or
6. Ponderosa Pine.

The Contractor shall provide posts from live trees that are stacked and properly seasoned. The Contractor shall peel the entire length of each post, closely trim knots, saw both ends square, and shave the entire length of the post to the white.

The Contractor shall provide posts with a top diameter after shaving of four (4) inches; - 1/2 inch, +1 1/4 inch.

The Contractor shall ensure posts are free of sap rot, woodpecker holes, plugged holes, ant-eaten areas, and hollow knots extending to center of the post. The Contractor shall not allow butt rot to exceed five percent (5%) of the butt area. The Contractor shall provide posts with sound tops, however, the Department will allow one (1) pipe rot not exceeding a diameter of 3/8 inch on a cedar post. The Contractor shall provide posts that do not have excessive

checking. The Contractor shall ensure that the posts do not have short kinks or more than one (1) one-way sweep exceeding two (2) inches, however, the post may have a winding twist.

The Department will not allow posts exhibiting both the maximum crook and maximum butt rot, and will not allow more than ten percent (10%) of the posts specified in the Contract to contain the maximum crook or butt rot.

The Department may reject posts with other defects that give the post an unsightly appearance or impair its durability or strength. The Contractor shall complete debarking, trimming, and sizing operations before treatment.

607.2.4.4 Preservative Treatment of Posts for Post and Cable Barrier

The Contractor shall provide pressure treated wood posts with pentachlorophenol in accordance with Section 550.2.2, "Preservatives and Treatment Methods," treated according to AASHTO M-133, in all accordance with AWPA Standard U1 and Commodity Standard B: Posts and AWPA Standards P8 and P9.

607.2.5 Snow Fence

The Contractor shall provide snow fence of 1/2 inch × 1 1/2 inch wooden pickets spaced 3 1/2 inch on center and woven between five (5) cables. Each cable will consist of at least two (2) strands of galvanized steel wire with diameters of 0.099 in or larger.

The Contractor shall provide wooden pickets that are at least 48 inches long and treated or painted in accordance with the manufacturer's recommendations.

The Contractor shall provide wire, braces, attachments, and fittings in accordance with ASTM A 116 and applicable requirements of Section 607.2.2, "Barbed Wire and Woven Wire Fence."

607.2.6 Concrete

The Contractor shall provide Class A concrete bearing blocks and anchors in accordance with Section 510, "Portland Cement Concrete." The Contractor may provide a prepackaged, pre-blended cementitious Material to which the Contractor only adds water at the site.

607.3 CONSTRUCTION REQUIREMENTS

607.3.1 General

The Contractor shall clear the fence lines of trees, bush, stumps, logs, weeds, existing fences, and other obstructions that may interfere with fence construction, unless the Project Manager requires certain trees to remain in place. The Contractor shall dispose of removed Material in accordance with Section 601, "Removal of Structures and Obstructions."

If the Contractor is to embed posts, braces, or anchors in concrete, the Contractor shall install temporary guys or bracing to hold the posts in position until the concrete sets. Unless otherwise specified, the Contractor shall not install Materials on posts and do not strain posts, braces, or anchors set in concrete until seven (7) Days after concrete placement, or until the concrete has reached a compressive strength of 2,500 psi, whichever occurs first. The Contractor shall crown the concrete at the top of the foundation to shed water.

The Contractor shall only cut the tops of posts as approved by the Project Manager. The

Contractor shall apply protective coating to cut posts in accordance with Section 607.3.8, "Repair of Damaged Coating on Pull Cables and Tension Wires."

The Contractor shall firmly attach wire and fencing to the posts and braces. The Contractor shall tightly stretch wire and install it at the required elevations. The Contractor shall place fence wire on the field side of the posts, except on the inside of curves.

At each location where an electric transmission, distribution, or secondary line crosses new fence, the Contractor shall provide and install a ground connection in accordance with the NEC®.

The Contractor shall build new fences adjacent to existing fence before removing existing fences. When removing and rebuilding fences, the Contractor shall maintain the security of livestock and protect adjacent properties and the traveling public. The Contractor shall remove the existing fence or unused Materials and neatly roll it up in single strand rolls. The Contractor shall remove the fence posts without damaging them and place the posts with the rolls of wire within the Right of Way for property owners to salvage, unless otherwise directed by the Project Manager. If the property owners do not pick the fence up within the allotted time, the Contractor shall dispose of the fence as directed by the Project Manager.

607.3.2 Barbed Wire and Woven Wire Fence

The Contractor shall set posts plumb and in accordance with the Plans. The Contractor may drive metal line posts. The Contractor shall excavate for footings and anchors in accordance with the Plans or as directed by the Project Manager. The Contractor shall place post hole backfill in thin layers and compact each layer.

The Contractor shall attach Right of Way fences to Roadway Structures, in accordance with the Plans.

607.3.2.1 Fence Tensioning

The Contractor shall stretch fence wire with a mechanical stretcher or other similar device. The Contractor shall not allow the length between pull posts to exceed 990 ft for barbed wire, and 660 ft for woven wire.

607.3.2.2 Braces and Corner Posts

The Contractor shall place intermediate braces at intervals of 990 ft or less and at every fence grade-change, such as edges of arroyos, bottoms and tops of hills, and as directed by the Project Manager. The Contractor shall maintain the required distance between the bottom wire and the ground. The Contractor shall space intermediate braces evenly between corner and gateposts or cattle guards. The Contractor shall place a corner post and brace at the intersection of cross fences and the Right of Way fence. The Contractor shall stretch the wires and firmly attach them to the corner posts.

607.3.3 Chain Link Fence

The Contractor shall install braces, tension rods, cables, hardware, and appurtenances in accordance with the manufacturer's recommendations and the Contract.

The Contractor shall not attach chain link fabric to posts until the concrete footings have reached a compressive strength of 2,500 psi, or until three (3) Days after concrete placement, whichever occurs first.

After permanently positioning posts, setting anchorages firmly, and drawing tension wires and pull cables tight with turnbuckles or other approved tension devices, the Contractor shall secure the tension wires to the posts with tension bands and tie wires. The Contractor shall secure the chain link fabric at one end and stretch away from the secured end. The Contractor shall stretch the fabric with a mechanical stretcher or other device approved by the Project Manager.

607.3.3.1 Chain Link Fence Post Placement

The Contractor shall set posts plumb in concrete footings. The Contractor shall space chain link fence posts at intervals of ten (10) feet or less. The Contractor shall measure the intervals from center to center of posts. Pull posts are line posts braced to adjacent line posts. The Contractor shall position pull posts at intervals of 500 ft or less. The Contractor shall provide end posts with an outside diameter of at least 2.875 inch. The Contractor shall brace end posts in the same way as corner posts.

607.3.3.2 Chain Link Security Fence

The Contractor shall use chain link security fence in accordance with Section 607.3.3, "Chain Link Fence." The Contractor shall supply security appurtenances on gates for access.

607.3.4 Post and Cable Access Fence

607.3.4.1 Post Placement

The Department will allow a depth of post embedment that is greater than specified in the Contract if the finished top of the post meets the required elevation. The Contractor shall compact the bottom of the holes to provide a stable foundation. The Contractor shall set the posts plumb with the front faces in a neat uniform line and with full contact on the foundation surface. The Contractor shall backfill holes with granular Material and compact in layers so the posts maintain the specified position and alignment.

Instead of setting posts in previously dug holes and backfilling, the Contractor may drive the posts, except if the Contract specifies bearing blocks. The Contractor shall only drive if there is adequate lateral stability and as long as the Shoulders and adjacent slopes are not damaged from the driving operations.

The Contractor shall remove posts that do not meet the requirements or are damaged below cutoff during driving, and replace with sound posts. If upward vertical adjustment of posts is necessary, the Contractor shall remove and reinstall them.

The Contractor may cut off the tops of posts to the elevation specified in the Contract. The Contractor shall round the tops of round posts to an approximate domed hemispherical shape centered on the axis of the post. After cutting off treated posts, the Contractor shall apply two (2) coats of pentachlorophenol preservative to the cut surfaces.

607.3.4.2 Setting of Anchors, Cable, and Fittings for Post and Cable Access Fence

If a bolt projects more than one (1) inch from the nut, the Contractor shall cut off 1/2 inch and burr. The Contractor shall paint the ends of cut-off bolts with aluminum paint. The Contractor shall bore holes for cable supports after the posts are set. The Contractor shall place end and intermediate anchorages and bearing blocks in accordance with the Contract.

The Contractor shall excavate trenches for anchor blocks to their neat lines. The Contractor shall perform excavation for anchor rod installation without excessively disturbing

the earth between the block and the anchored posts. The Contractor shall excavate holes for bearing blocks to their neat lines, then place and level the block with anchor rods in place on undisturbed soil. The Contractor shall place backfill Material and compact in layers. The Contractor shall not apply final tension to the anchor assembly until after completing the backfilling.

After completing the anchor assemblies, the Contractor shall properly adjust and securely fasten the cables, draw the cables tight, then loosen them to meet Contract requirements for the applicable temperature range.

The Contractor shall use three (3) inch wide reflective sheeting in accordance with Section 701.2.2.1, "Retroreflective Sheeting," Silver White No. 2. The Contractor shall mount the sheeting on flexible aluminum alloy. The Contractor shall fix the sheeting to each end post and at maximum intervals of 100 ft on intermediate posts, with a minimum of three (3) strips per installation. The Contractor shall completely wrap the reflective strips around each post before installing the post plate washers.

607.3.5 Snow Fence

The Contractor shall construct snow fence in accordance with the manufacturer's recommendations and the Contract.

607.3.6 Pedestrian/Bicycle Railing

The Contractor shall construct pedestrian and bicycle railing in accordance with the Contract or as directed by the Project Manager.

607.3.7 Removing and Rebuilding Fence

The Contractor shall remove and rebuild existing fences in accordance with the Contract or as directed by the Project Manager. The Contractor shall construct new fences in the same or better condition than the original fence.

The Contractor shall salvage Materials from removed fences and incorporate into the rebuilt fences. If the Project Manager determines that some Materials are not reusable, the Contractor shall replace those Materials as necessary and in accordance with Section 109.5, "Payment for Changes, Differing Site Conditions, and Extra Work."

The Contractor shall firmly reset posts to the staked alignment. The Contractor shall use the same spacing of the posts and the same number of wires strung and stapled to the posts as the original fence. The Contractor shall use new staples to fasten the wires to the posts.

607.3.8 Repair of Damaged Coating on Pull Cables and Tension Wires

The Contractor may repair pull cables and tension wires that exhibit minor damage to the zinc coating by wire-brushing the damaged area and removing loose, cracked, or weld-burned zinc coating. The Contractor shall paint the cleaned area with two (2) coats of zinc oxide-zinc dust paint in accordance with Federal Specification TT-P-641 or Military Specification MIL-P-21035 or with an equivalent coating approved by the Project Manager. The Contractor shall make repairs and provide repair Materials at no additional cost to the Department.

607.3.9 Gates

The Contractor shall fabricate and construct gates, and stile and post wire traps in accordance with the Contract.

607.3.9.1 Remove and Reset Gate

The Contractor shall remove and reset existing gates in accordance with the Contract or as directed by the Project Manager.

607.4 METHOD OF MEASUREMENT

The Department will measure fences and watergap gates along the top from outside to outside of end posts for each continuous run of fence or watergap gate.

607.5 BASIS OF PAYMENT

Pay Item	Pay Unit
<i>Barbed Wire Fence ____ft</i>	Linear Foot
<i>Game Fence ____ft</i>	Linear Foot
<i>Woven Wire Fence ____ft</i>	Linear Foot
<i>Chain Link Fence ____ft</i>	Linear Foot
<i>Chain Link Security Fence ____ft</i>	Linear Foot
<i>Vinyl-Coated Chain Link Fence ____ft</i>	Linear Foot
<i>Snow Fence ____ft</i>	Linear Foot
<i>Pedestrian/Bicycle Railing ____ft</i>	Linear Foot
<i>Pedestrian Screening Fence Type ____ft</i>	Linear Foot
<i>Post and Cable Access Fence ____ft</i>	Linear Foot
<i>Remove and Rebuild (type) Fence</i>	Linear Foot
<i>Standard Gate ____ft</i>	Each
<i>Barbed Wire Gate, ____ft</i>	Each
<i>Chain Link Gate, ____ft Span</i>	Each
<i>Chain Link Gate, ____ft Span by ____ft Rise</i>	Each
<i>Pipe Gate ____ft</i>	Each
<i>Water Gap Gate</i>	Linear Foot
<i>Turnstile Gate ____ft</i>	Each
<i>Remove and Reset Gate</i>	Each
<i>Stile and Post Wire Trap</i>	Each
<i>Braces/Corner Posts</i>	Each

607.5.1 Work Included in Payment

The following Work and items will be considered as included in the payment for the main item(s) and will not be measured or paid for separately:

1. Clearing and grubbing,
2. Grading,
3. Excavation,
4. Backfill,
5. Disposal of surplus Material,
6. Concrete, fasteners,

7. Galvanizing,
8. Coating repairs; and
9. All additional bracing required for grade changes.

OTHER SPECIFICATIONS

SECTION 668
UTILITY ALLOWANCE

1. Where possible, all conflict with existing utilities shall be avoided by minor adjustments to the alignment of proposed facilities as directed by the Owner's Project Manager. Where conflicts are determined to be unavoidable by the Owner's Project Manager, the utility shall be relocated.
2. The Contractor shall notify the utility owner at Notice to Proceed Number 1. The Contractor shall be responsible for coordinating this work and paying invoiced cost to the utility owner. The Contractor may be required by the utility owner to pay for such relocation work prior to the actual relocation work being performed. Cost of coordination with utility owners will be incidental to the cost of relocating the utility.
3. The utility allowance price for each utility shall be measured on a per each basis. The Contractor shall submit a utility relocation estimate from the utility owner plus contractors' coordination fee to the Project Manager for review and approval prior to the actual direction from SSCAFCA to relocate the utility. The fee per each will be based upon receipt of invoices submitted from the utility company after work is performed plus a contractor's fee for coordination. All invoices and other necessary documentation must be submitted prior to any payment being made on a particular utility allowance item.
4. Payment will be made as a lump sum per each utility relocation required and as directed by SSCAFCA, completed, installed and operational, to be billed against overall project utility allowance. This price shall include the cost of all labor, material, equipment, utility charges, excluding coordination with utility owners, and all incidentals necessary to complete this item in accordance with all requirements of the utility company. The utility relocation allowance price may be paid as a percentage of utility relocation allowance completed. The percentage shall be computed by dividing the total of utility company invoices by the total price included in this bid for utility relocation allowance.
5. Contractor will be required to coordinate with all utility companies including telecommunication. Coordination with the Utility companies is included in the cost of the project and no additional compensation shall be made. Coordination with utility companies shall begin at Notice to Proceed Number 1. Any unknown or unidentified utility conflicts shall be paid per items 2-4 above.

Pay Item
Utility Allowance

Pay Unit
Allowance (AL)

Interim Guideline SECTION 1013
SLOPE STABILIZATION AND SEEDING

1013.1 GENERAL

1013.1.1 SCOPE

Furnish all labor, materials and equipment necessary for preparation of seedbed, furnishing and installation of seed, erosion control measures, soil amendments, and related work specified herein and as indicated on plans or as authorized by the LANDSCAPE ARCHITECT or ENGINEER.

This specification shall apply to large ponding areas on sites where a landscape plan for building permit is not required, and all ponds that are greater than or equal to 2 acres in size.

Smaller water quality ponds shall incorporate Low Impact Development Strategies as described in the City of Albuquerque Development Process Manual (DPM). Treatments described in this specification may apply as Best Management Practices where deemed practicable by the LANDSCAPE ARCHITECT or ENGINEER.

1013.1.2 APPLICABLE STANDARDS & REFERENCES:

1013.1.2.1 Drawings and general provisions of the Contract, including City of Albuquerque Standard Specifications for Public Works Construction, Latest Edition. General Conditions and any Supplemental Special Provisions, apply to this Section.

1013.1.2.2 All seed shall be certified by state of origin. The certification authority for the state of New Mexico is the New Mexico Crop Improvement Association.

1013.1.2.3 Reclamation efforts are controlled by the requirements stipulated in the National Pollution Discharge Elimination System General Permit for Region VI of the Environmental Protection Agency.

1013.1.3 PERFORMANCE REQUIREMENTS

1013.1.3.1 The CONTRACTOR shall be responsible for protecting and caring for seeded areas until final acceptance of the work and shall repair at CONTRACTOR expense any damage to seeded areas caused by pedestrian, vehicular traffic, vandalism or other cause.

1013.1.4 SUBMITTALS

1013.1.4.1 THIS PUBLICATION - Section 1502 - Submittals

1013.1.4.2 Certification of Seed: From seed vendor for each mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging. Include state, origin and name and telephone number of supplier.

1013.1.4.3 Product Certificates: For organic amendments from manufacturer.

1013.1.4.5 Sources of supply, color, and size for aggregate mulch.

1013.4.6 Source of supply and product information for wood mulch.

1013.1.5 DELIVERY, STORAGE & HANDLING

1013.1.5.1 Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

1013.1.5.2 Bulk Materials:

a. Do not dump or store bulk materials near fuel containers, herbicides, structures, utilities, walkways and pavements, or on existing turf areas or plants.

b. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

c. Accompany each delivery of bulk materials with appropriate certificates.

1013.2 PRODUCTS

1013.2.1 SEED

1013.2.1.1 Seed: The seed species and rate of application shall be as shown below and shall be used based on the type of soil or as specified on the plans or in the Supplemental Technical Specifications.

1013.2.1.2 Seed shall be fresh, re-cleaned seed of the latest crop, mixed in the proportions by weight, and be pure live seed as denoted within these specifications or as per the plans.

1013.2.1.3 Seed shall be delivered to the site in the original unopened containers which shall bear the vendor's guarantee of analysis. Labeling of seed shall be in accordance with Federal Seed Laws and the New Mexico Department of Agriculture labeling laws. Federal seed laws require that analysis shall be no older than five months for seed shipped interstate and no older than nine months for seed shipped intra-state. Seeds may be pre-mixed by a seed dealer. Documentation must be provided, the same as if the seeds were sold or bagged separately. The LANDSCAPE ARCHITECT or ENGINEER shall receive all labels from all bags of seed used for verification. For each species included in the mix the following information will be found on each bag tag:

a. Variety - specify if certified.

b. Kind of seed

**Interim Guideline SECTION 1013
SLOPE STABILIZATION AND SEEDING**

- c. Lot number
- d. Purity
- e. Germination
- f. % of Crop seed, % inert, % noxious weed
- g. Origin
- h. Test date
- i. Pounds of this species or percentage of total lot.

1013.2.1.4Seed Mixture and Rate: Seed species mixtures and application rates shall be as follows and shall be used based on the soil type unless otherwise specified in the plans or Supplemental Technical Specifications.

- a. Gravelly Uplands and Slopes (Mainly East Foothills): Seed rate is given in pounds of pure live seed (PLS) per acre.. Mix shall include at least four of the wildflower species listed below at a total application rate of at least 2.0# PLS/AC.

a. Gravelly Uplands & Slopes	#PLS/AC	Notes
<i>Bouteloua gracilis</i> 'Hachita' – Blue Grama	7.0	
<i>Bouteloua curtipendula</i> 'Niner' - Sideoats Grama	5.0	
<i>Stipa neomexicana</i> – Needle & Thread Grass	2.0	
<i>Oryzopsis hymenoides</i> - Indian Rice Grass	2.0	
<i>Koeleria macrantha</i> – June Grass	1.0	
<i>Aristida purpurea</i> – Purple Threeawn	1.0	
<i>Pleuraphis jamesii</i> 'Viva' – Galleta	1.0	
<i>Dalea purpurea</i> var <i>purpurea</i> – Purple Prairie Clover	.25	Perennial Wildflower
<i>Ratibida columnifera</i> forma <i>pulcherrima</i> – Mexican Hat	.25	Perennial Wildflower
<i>Gaillardia aristata</i> - Blanket Flower	.25	Perennial Wildflower
<i>Sphaeralcea parvifolia</i> - Nelson Globemallow	.25	Perennial Wildflower

<i>Oenothera pallida</i> - White Evening Primrose	.25	Perennial Wildflower
<i>Baileya multiradiata</i> - Desert Marigold	.25	Perennial Wildflower
<i>Berlandiera lyrata</i> – Chocolate Flower	.25	Perennial Wildflower
<i>Abronia fragrans</i> or <i>Abronia villosa</i> - Sand Verbena	.25	Perennial Wildflower

- b. Sandy Soils: (Mainly Westside Areas) Seed rate is given in pounds of pure live seed (PLS) per acre. Mix shall include at least four of the wildflower species listed below at a total application rate of at least 2.0# PLS/AC.

b. Sandy Soils	#PLS/AC	Notes
<i>Hilaria jamesii</i> 'Viva' - Galleta	7.0	
<i>Oryzopsis hymenoides</i> 'Paloma' - Indian Rice Grass	5.0	
<i>Bouteloua gracilis</i> 'Hachita' – Blue Grama	2.0	
<i>Bouteloua curtipendula</i> 'Vaughn' – Sideoats Grama	1.0	
<i>Agropyron smithii</i> 'Arriba' – Western Wheat	1.0	
<i>Sporobolus cryptandrus</i> – Sand Dropseed	1.0	
<i>Sporobolus airoides</i> 'Salado' – Alkali Sacaton	1.0	
<i>Artemisia frigida</i> – Fringed sagebush	.25	Low Shrub
<i>Sphaeralcea ambigua</i> – Desert Globemallow	.25	Perennial wildflower
<i>Sphaeralcea parvifolia</i> – Nelson Globemallow	.25	Perennial wildflower
<i>Helianthus annuus</i>	.5	Annual wildflower
<i>Oenothera pallida</i> – White Evening Primrose	.25	Perennial wildflower
<i>Baileya multiradiata</i> – Desert Marigold	.25	Biennial wildflower
<i>Abronia fragrans</i> or <i>Abronia villosa</i> – Sand Verbena	.25	Perennial wildflower

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SLOPE STABILIZATION AND SEEDING**

b. Sandy Soils	#PLS/ AC	Notes
<i>Dalea purpurea</i> var <i>purpurea</i> – Purple Prairie Clover	.25	Perennial Wildflower
<i>Machaeranthera canescens</i> – Hoary tanseyaster	.25	Perennial wildflower
<i>Berlandiera lyrata</i> – Chocolate Flower	.25	Perennial Wildflower
<i>Ratibida columnifera</i> forma <i>pulcherrima</i> – Mexican Hat	.25	Perennial Wildflower

c. Clay, Clay Loam Soils: Mainly Valley & Bosque areas). Seed rate is given in pounds of pure live seed (PLS) per acre. Mix shall include at least four of the perennial wildflower species listed below at a total application rate of 2.0# PLS/AC.

c. Clay, Clay Loam Soils	#PLS/AC	Notes
<i>Hilaria jamesii</i> ‘Viva’ - Galleta	4.0	
<i>Bouteloua curtipendula</i> ‘Vaughn’ – Sideoats Grama	3.0	
<i>Oryzopsis hymenoides</i> ‘Paloma’ - Indian Rice Grass	2.0	
<i>Sporobolus airoides</i> ‘Salado’ – Alkali Sacaton	2.0	
<i>Agropyron smithii</i> ‘Arriba’ – Western Wheat	1.0	
<i>Bouteloua gracilis</i> ‘Hachita’ – Blue Grama	1.0	
<i>Sporobolus cryptandrus</i> – Sand Dropseed	1.0	
<i>Soraghastrum nutans</i> – Indian Grass	.5	
<i>Artemisia ludoviciana</i> – Prairie Sage	.25	Low Shrub
<i>Oenothera hookeri</i> – Evening Primrose	.25	Perennial wildflower
<i>Oenothera pallida</i> – White Evening Primrose	.25	Perennial wildflower

<i>Machaeranthera canescens</i> – Hoary tanseyaster	.25	Perennial wildflower
<i>Linum lewisii</i> – Blue Flax	.25	Perennial wildflower
<i>Helianthus annuus</i> - Sunflower	.5	Annual wildflower
<i>Sphaeralcea ambigua</i> Desert Globemallow	.25	Perennial wildflower
<i>Dalea purpurea</i> var <i>purpurea</i> – Purple Prairie Clover	.25	Perennial Wildflower
<i>Ratibida columnifera</i> forma <i>pulcherrima</i> – Mexican Hat	.25	Perennial Wildflower

d. Specific seed mixture application areas shall be determined in the field with the LANDSCAPE ARCHITECT or ENGINEER prior to seed installation. Alternate seed mixes, variations of species, and variations of application rates are acceptable if noted on the plans or approved in writing by the LANDSCAPE ARCHITECT or ENGINEER. Variations in application rates due to the presence of irrigation are acceptable if noted on the plans or approved in writing by the LANDSCAPE ARCHITECT or ENGINEER.

1013.2.3 MULCHES

1013.2.3.1 Aggregate Mulch on slopes flatter than 3:1

a. Aggregate mulch shall be 1” to 4” size angular material. Pumice and black aggregate are not acceptable.

1013.2.3 Aggregate Mulch on slopes between 3:1 and 2:1

a. Aggregate mulch shall consist of 2” to 8” size angular material. Pumice and black aggregate are not acceptable.

1013.2.4 Aggregate Mulch at base of slope

a. Aggregate mulch at base of slope shall consist of 2” to 4” size angular material. Pumice and black aggregate are not acceptable.

1013.2.5 Wood mulch: Base of slope

a. Wood mulch installed under angular aggregate at base of slope shall be chipped or shredded and free of foreign materials (see materials supply guide from the City of Albuquerque). Individual pieces of wood shall vary in size.

1013.2.4 SOIL AMENDMENT

1013.2.4.1 Soil Amendments:

The Contractor shall furnish and place composted mulch in all revegetation areas flatter than 3:1 slope (see materials supply guide from the City of Albuquerque).

Interim Guideline SECTION 1013
SLOPE STABILIZATION AND SEEDING

1013.3 EXECUTION

1013.3.1 EXAMINATION

1013.3.1.1 Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

- a. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
- b. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
- c. Uniformly moisten excessively dry soil that is not workable or which is dusty.

1013.3.1.2 Proceed with installation only after unsatisfactory conditions have been corrected.

1013.3.1.3 If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by the LANDSCAPE ARCHITECT or ENGINEER and replace with new planting soil at no additional cost to the OWNER.

1013.3.2 PREPARATION

1013.3.2.1 Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by seeding operations.

- a. Protect grade stakes set by others until directed to remove them.

1013.3.2.2 Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. Reference project NEPA and/or SWPPP requirements if applicable.

1013.3.3 SEED BED PREPARATION

1013.3.3.1 Prior to the starting of any seed bed preparation the final grades of all earthwork shall be inspected and approved by the LANDSCAPE ARCHITECT or ENGINEER.

1013.3.3.2 No preparation shall be performed when the surface is wet or muddy or when the soil moisture content is such that the soil is not fully loosened by the disking operation.

1013.3.3.1. No preparation shall be performed when the ground is frozen or when air temperatures are below 32 degrees Fahrenheit.

1013.3.3.3 The extent of seed bed preparation shall not exceed the area on which seeding and mulching operations can be completed prior to crusting or wind or water erosion of the prepared surface. If erosion, crusting or re-compaction occurs, the affected area shall be re-worked beginning with seed bed preparation. Depth of preparation must be approved by the LANDSCAPE ARCHITECT or ENGINEER prior to the seeding and mulching operations.

1013.3.3.4 Mechanical Preparation: All areas flatter than 3:1 slope shall be mechanically prepared. Seed beds shall be prepared to a minimum depth of 4 inches, tilling with a disc, harrow or chiseling tools. Seed bed preparation shall be confined to disturbed areas unless otherwise specifically directed by the LANDSCAPE ARCHITECT or ENGINEER. Area of heavy or compacted soil may require additional preparation such as chiseling or ripping if disking alone does not result in specified depth. All competitive vegetation shall be uprooted during seed bed preparation and the soil shall be uniformly worked to a smooth, firm surface free of clods, stones or other foreign materials, 4 inches or larger, that would interfere with seeding or crimping equipment operations and germination. Tilling shall not occur when the steady wind speed is over 15 mph and is causing a dust problem to adjoining areas. No work shall be done when the moisture content of the soil is unfavorable or the ground is frozen or is otherwise in an un-tillable condition.

Following disking of seed beds, 1" depth of compost shall be applied to all mechanically prepared areas and disked or tilled to a 4" depth.

1013.3.3.5 Hand preparation: Areas which cannot be prepared with mechanized equipment because of small size or irregular shape, significant existing vegetation which is to remain, may be loosened to a minimum depth of 2 inches using hand tools or small mechanized equipment. Any such areas will be specified on the plans or approved in writing by the LANDSCAPE ARCHITECT or ENGINEER.

1013.3.5 SEEDING

1013.3.5.1 General: Three specific seed mixes have been specified for distinct areas of the city. Seeded areas shall be drill seeded and mulched where slopes are flatter than 3:1 unless otherwise directed by the LANDSCAPE ARCHITECT or ENGINEER. Slopes steeper than 3:1 shall be broadcast seeded or hydro-seeded as per plans or as directed by the LANDSCAPE ARCHITECT or ENGINEER.

- a. Seeding shall not start until the seed bed preparation has been inspected and approved by the LANDSCAPE ARCHITECT or ENGINEER.

- b. CONTRACTOR'S vehicles and other equipment shall not travel over the prepared areas. If, as determined by the LANDSCAPE ARCHITECT or ENGINEER, that rain or some other factor has impacted prepared surfaces so that it is not possible to seed to the proper depth, the CONTRACTOR shall again prepare the seed bed without additional compensation.

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SLOPE STABILIZATION AND SEEDING

c. No more area may be seeded than can be stabilized (i.e. covered with gravel mulch if on a slope) by the end of the work day. No seeding operations may be conducted when steady wind speeds exceed 15 mph. If steady winds exceed 15 mph, seeding operations will be halted and any areas seeded shall be mulched.

d. Weather Limitations: Proceed with seeding operations only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to this specification.

1013.3.5.2 Drill Seeding: Drill seeding is required for areas flatter than 3:1 unless otherwise specified in the plans or in the Supplemental Technical Specifications or approved in writing by the LANDSCAPE ARCHITECT or ENGINEER. Seed shall be applied with a landscape seeder with double rollers, or "rangeland" type seed drill equipped with packer wheels. Seed shall be drilled to a maximum depth of 1/2 inch unless otherwise specified. Direction of seeding shall be in long sweeping and overlapping S-curves on flats and perpendicular to slopes and on the contour whenever possible.

1013.3.5.3 Broadcast Seeding: Seed may be applied by hand or by utilizing a rotary spreader or a seeder box with a gear feed mechanism if mechanized seeding is not possible due to limited size, irregular shape, or slopes between 3:1 and 2:1. Rice hulls or other fillers shall be used to prevent uneven separation of lighter seed. Seed shall be evenly distributed and applied at a rate which is a minimum of twice that of drilled seed rate unless otherwise specified. Immediately following the seeding operation, the seed-bed shall be lightly raked to provide approximately 1/2 inch cover of soil over the seed.

1013.3.5.4 Hydro Seeding: Areas with slopes between 3:1 and 2:1 may be hydroseeded. Seed shall be applied in a slurry with biodegradable dye and 500 lbs/acre of wood fiber. Hydroseed shall be uniformly using broad sweeping strokes. Seed shall not remain in the tank for more than 30 minutes.

1013.3.7 MULCHING

1013.3.7.1 General: All seeded areas on slopes shall be mulched unless otherwise specified on the plans or in the Supplemental Technical Specifications or approved in writing by the LANDSCAPE ARCHITECT or ENGINEER. The pond bottom does not require mulching.

1013.3.7.2 On seeded areas that are level no mulch is required unless otherwise specified on the plans or in the Supplemental Technical Specifications or with prior written approval of the LANDSCAPE ARCHITECT or ENGINEER. On seeded areas that have slopes only gravel mulch may be used as specified on the plans and in the Supplemental Technical Specifications.

1013.3.7.6 Aggregate Mulch on sloped areas flatter than 3:1

a. Slopes shall receive aggregate mulch immediately following seeding operations. 1" – 4" size aggregate mulch shall be placed in a layer one rock deep over seeded areas. Aggregate mulch shall be installed at a density approximately equal to 80%-100% coverage of the surface area. Gaps present between pieces of aggregate are desired. Contractor shall not fill the inherent gaps with smaller graded aggregate. Seeding and mulching shall be completed simultaneously in strips from the top of the slope to the bottom so that seeded areas are not damaged by equipment for installation of aggregate. See sketch 1013-SKL-1.

1013.3.7.7 Aggregate mulch on sloped areas between 3:1 and 2:1

a. Slopes shall receive aggregate mulch immediately following seeding operations. 2" – 8" size aggregate mulch shall be placed in a layer one rock deep over seeded areas. Aggregate mulch shall be installed at a density approximately equal to 80%-100% coverage of the surface area. Gaps present between pieces of aggregate are desired. Contractor shall not fill the inherent gaps with smaller graded aggregate. Seeding and mulching shall be completed simultaneously in strips from the top of the slope to the bottom so that seeded areas are not damaged by equipment for installation of aggregate. See sketch 1013-SKL-2.

1013.3.7.8 Aggregate mulch at base of slope

a. An approximately 6'-0" buffer at the base of the slope shall receive a 4" depth of aggregate mulch over wood mulch. See sketches 1013-SKL-1 and 1013-SKL-2.

b. All other slopes shall receive aggregate mulch immediately following seeding operations.

1013.3.7.9 Wood Mulch at base of slope at pond edges

a. Wood mulch at base of slope at pond edges shall be installed at a 3" depth under aggregate. See sketches 1013-SKL-1 and 1013-SKL-2.

**Interim Guideline SECTION 1013
SLOPE STABILIZATION AND SEEDING**

1013.3.7.10 SUMMARY OF EXECUTION

Operation	Basin Bottom	Base of Slope at ponding area	Slope flatter than 3:1	Slope between 3:1 and 2:1
<u>Disk seed bed to four inches (4")</u>	X		X	
<u>Apply one inch (1") of compost, disk to 4"</u>	X		X	
<u>Drill Seed</u>	X		X	
<u>Hand Broadcast or Hydroseed</u>	X		X	X
<u>Apply 3" depth chipped or shredded wood mulch</u>		X		
<u>Apply one-rock deep layer of 1" – 4" aggregate</u>		X	X	
<u>Apply one-rock deep layer of 2"-8" aggregate</u>				X

1013.3.8 MAINTENANCE AND PROTECTION

1013.3.8.2 The CONTRACTOR shall be responsible for protecting seeded and mulched areas until final acceptance of the work and shall repair at his/her expense any damage to seeded and mulched areas caused by pedestrian or vehicular traffic or vandalism.

1013.3.11 WARRANTY

1013.3.11.1 If at the end of one complete growing season, it has been determined by the LANDSCAPE ARCHITECT or ENGINEER that insufficient germination has occurred in the CONTRACTOR shall reseed such areas with no additional cost to the OWNER.

1013.3.11.3 CONTRACTOR shall provide a certificate to the OWNER prior to final acceptance that all requirements of this specification have been met.

1013.3.12 REVIEWS AND OBSERVATIONS

1013.3.12.1 The following shall be the minimum required reviews and observations during the course of construction. Additional reviews and observations can be made at any time

at the discretion of the LANDSCAPE ARCHITECT or ENGINEER. It shall be the responsibility of the CONTRACTOR to notify the LANDSCAPE ARCHITECT or ENGINEER, in writing, 48 hours in advance of each required review or observation.

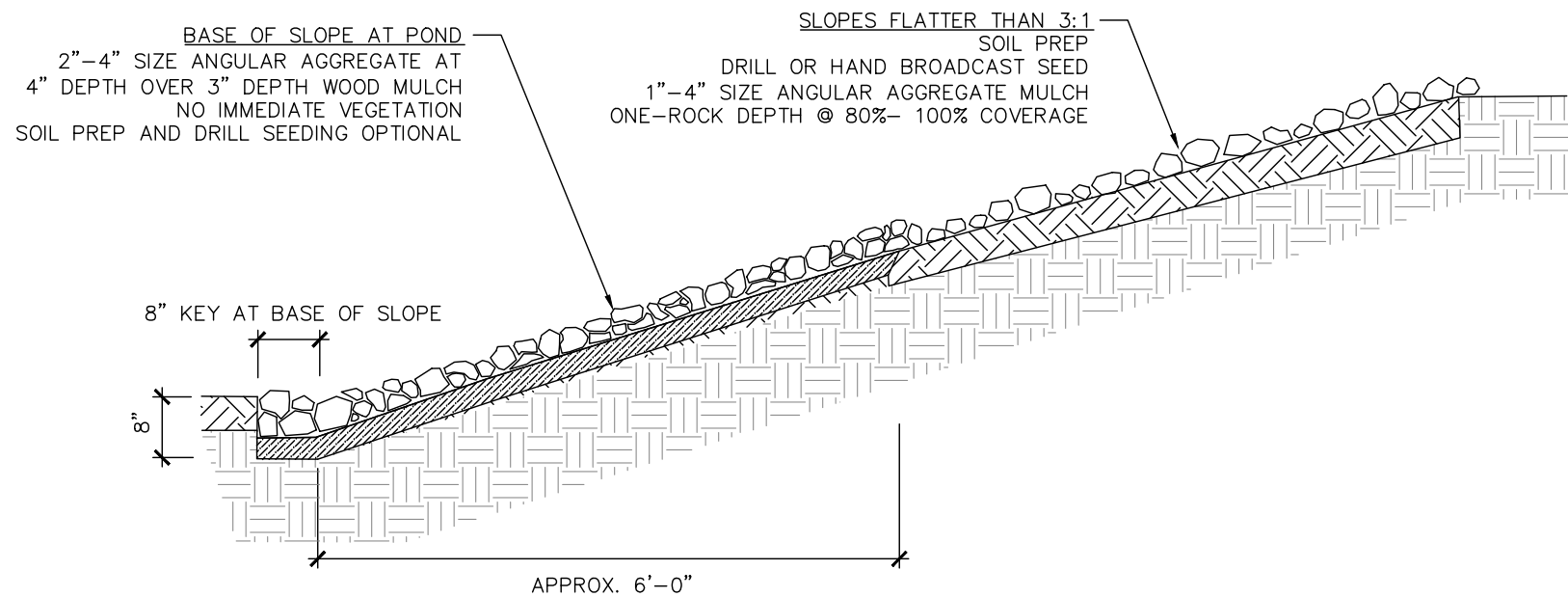
1013.3.12.2 The sequence of required reviews and observations shall not be changed from the sequence listed below. The CONTRACTOR shall not proceed with work of the next phase without written approval of the work of the previous phase by the LANDSCAPE ARCHITECT or ENGINEER. Payment will not be approved for items which have not been reviewed and approved in writing.

- a. Each phase of soil preparation shall be observed in process.
- b. Finish grade shall be reviewed.
- c. Implementation plan shall be approved prior to seeding.
- d. Seed shall be reviewed prior to seeding.
- e. Seeded area shall be reviewed after completion.
- f. Mulched areas shall be reviewed after completion.
- g. Final review and acceptance.
- h. Warranty review

1013.3.13 MEASUREMENT & PAYMENT

1013.3.13.1 Measurement: The measurement of grass seeding shall be by the acre.

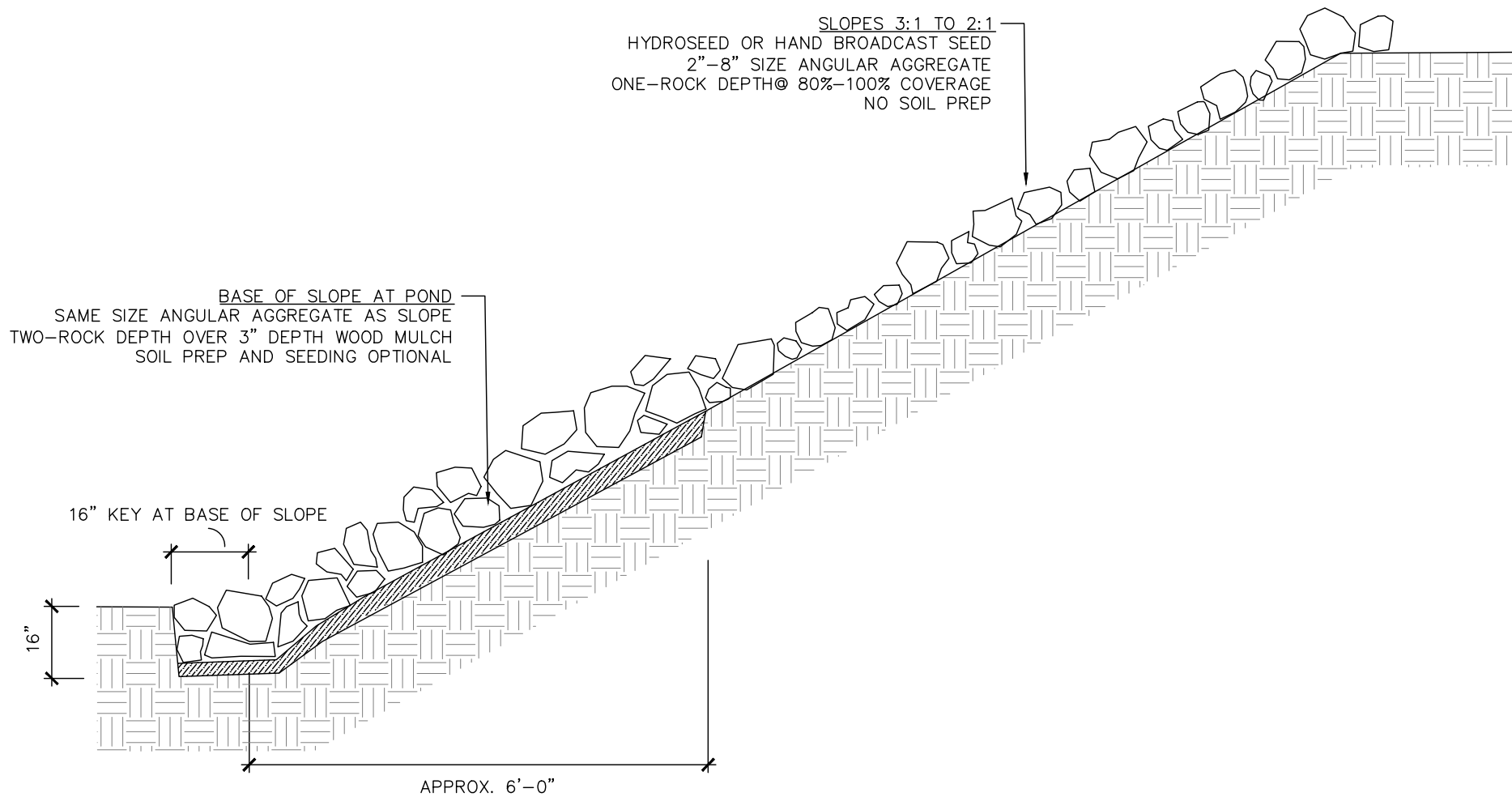
1013.3.13.2 Payment: Payment shall be made at the contract unit price per acre, of seeding complete in place, which shall include the seed, area preparation, seeding, soil amendments, and mulching.



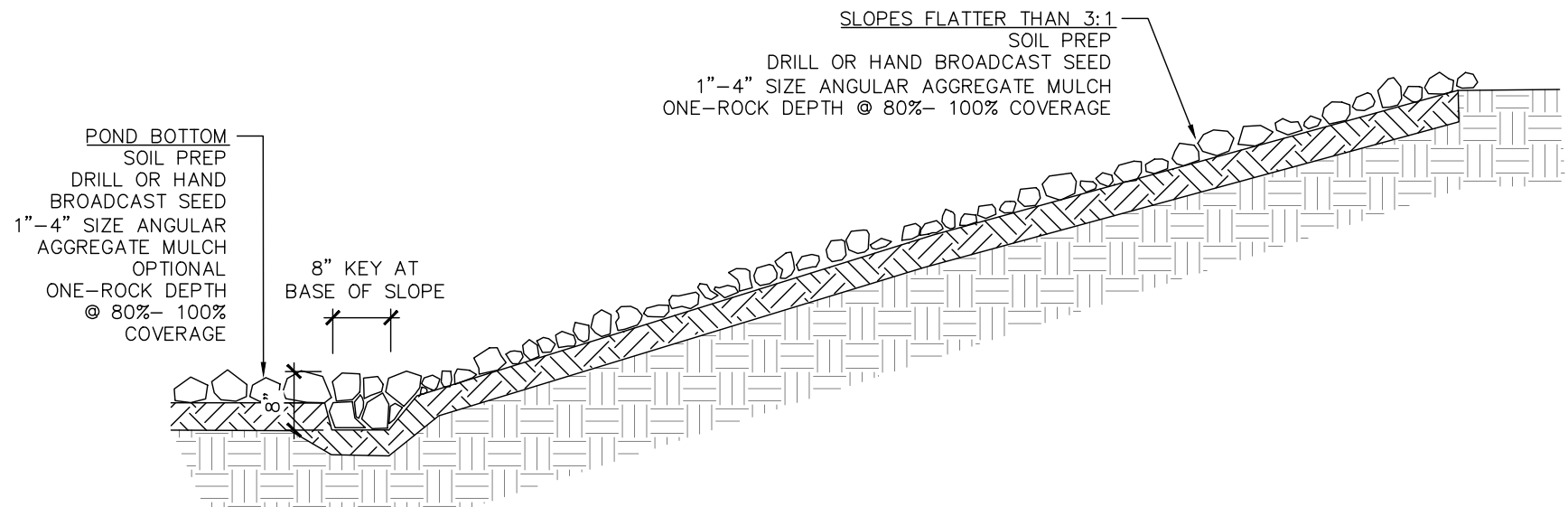
A1

1013-SKL-1: SLOPES FLATTER THAN 3:1

SCALE: N.T.S.



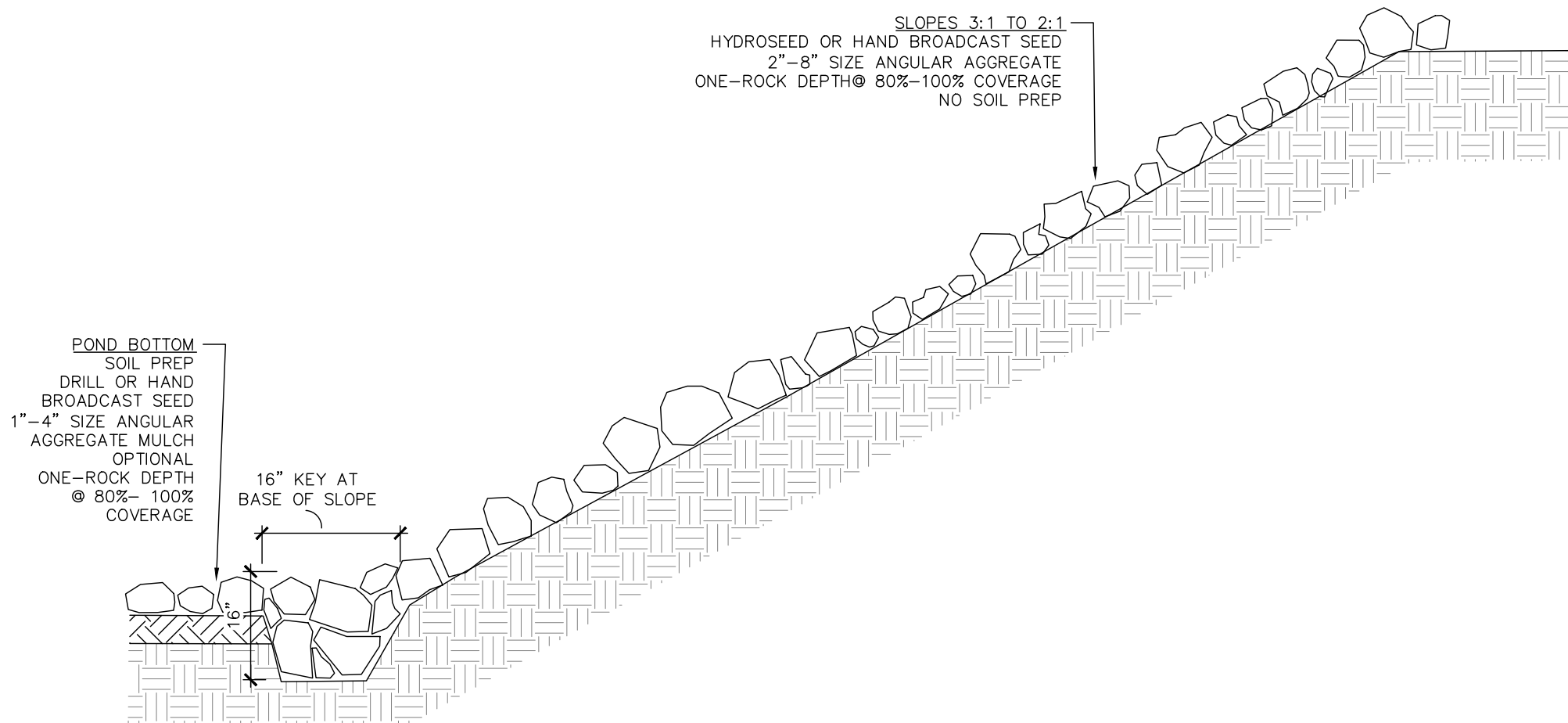
A2 1013-SKL-2: SLOPES 3:1 TO 2:1
SCALE: N.T.S.



A3

SLOPES FLATTER THAN 3:1, PRIVATE PONDS

SCALE: N.T.S.



A4 SLOPES 3:1 TO 2:1, PRIVATE PONDS

SCALE: N.T.S.

SECTION 1502

SUBMITTALS

1502.1 GENERAL

The requirements of this section of the specifications consist of furnishing all manufacturer's data, shop drawings, samples, certifications, guarantees, reports, operation manuals, maintenance manuals, lubrication charts, spare parts lists, special tools and factory representative required for installation of special items, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

1502.2 SUBMITTAL CHECK LIST

The Submittal Check List that will be part of the Supplemental Specifications on each project, lists items which will be required to construct the project for which submittals will be required by the ENGINEER. The list of submittals is for the convenience of the CONTRACTOR and supplier, and should not be considered as the complete and final requirements. Additional submittals and material may be required by the ENGINEER as project progresses.

1502.3 WHAT TO SUBMIT

1502.3.1 The following is an explanation of what to submit if indicated on the check list.

- A. Manufacturer's Data: Any catalog type literature on the item.
- B. Shop Drawings: Detail drawings with all dimensions and locations shown.
- C. Samples: The item that will be supplied.
- D. Certifications: Any certifications required by these specifications or standard specifications and/or requirements for that item, to cover raw materials and testing of the final product.
- E. Guarantees: A copy of the guarantee to be given to the Owner on that item.
- F. Lab Test Reports: Laboratory test reports required to show that the item meets all specified requirements.
- G. Operation Manuals and Maintenance Manuals: The manufacturer's standard Operation and Maintenance Manuals on that item.
- H. Special Tools: A list of special tools required to operate and maintain that item and the number of each tool the manufacturer will supply.

- I. Lubrication Charts and Grease Specs: A list of all lubrication points on that item with frequency and type of lubricant to be used at each point.
- J. Spare Parts List: A list of spare parts that the manufacturer recommends the Owner maintains.
- K. Factor Representative: A factory representative will be required to be present for installation and/or start-up of that item of equipment.
- L. Field Test Reports: The field test reports are reports and/or tests that have been conducted on the item in an existing installation over a period of time.
- M. Pump and Blower Curves: Certified curves based on the test performance of each pump or blower to be installed on this project.
- N. Load Design: Load design calculations shall show the maximum load the item can carry under the support conditions shown on the drawings for both uniform and concentrated loads. These calculations shall be under a New Mexico registered professional engineer's signature.
- O. Additional literature, reports and/or tests may be required by the ENGINEER.

1502.3.2 When pumps of any type are part of the project, in addition to the other information required on pump submittals the CONTRACTOR shall submit the following data for each unit of pumping equipment.

- A. Name of manufacturer
- B. Type of pumps.
- C. Number of stages and speed.
- D. Diameter of impeller.
- E. Type of bearings.
- F. Size of suction and discharge piping and barrel.
- G. Type of thrust bearing.
- H. Shut-off pressure.
- I. Impeller material.
- J. Pump shaft material and diameter.
- K. Capacity and head.
- L. Make and type of motor.
- M. Horsepower of motor with proper NEMA Standard insulation.
- N. Type of motor bearings.
- O. Net weight of complete unit.

- P. Guaranteed KWH required to pump 1,000 gallons against the required head.
- Q. Discharge column:
 - Material
 - Weight per foot
 - Type of Joint
 - Spacing of joints
 - Inside diameter
- R. Line shaft:
 - Material
 - Diameter
 - Length of sections
- S. Line Shaft Bearing:
 - Length
 - Spacing Type
 - Material
- T. Thrust Bearing:
 - Complete computations on thrust conditions.
 - Computed pump thrust at shut-off.
 - Computed pump thrust at operating condition.
 - Rated bearing capacity.
 - Manufacturer.
 - Method of cooling.
 - Weight of bearing.
- U. Combined overall efficiency of pump and motor when operating at rated condition.
- V. Does equipment offered differ from specification requirement?
- W. Do catalogs, descriptive literature, etc., covering all equipment accompany the bid?

SECTION 1502

SUBMITTAL CHECK LIST

[illegible]

TECHNICAL SPECIFICATION 1503

MOBILIZATION

Revised 08/19/2025

1503.1 DESCRIPTION

This work shall consist of preparatory and final work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project; and, for all other work and operations which must be performed or costs incurred prior to beginning work on the project.

1503.2 ADMINISTRATION REQUIREMENTS

1503.2.1 DEFINITIONS

“Total Original Contract Amount” shall mean the total amount bid as compensation for the contract.

“Total Original Contract Amount Less Mobilization” shall mean the total amount bid as compensation for the contract less the amount bid for mobilization.

1503.2.2 GENERAL

It is the intent of this specification to provide for the contractor to receive 100% of the amount bid for Mobilization by the time the Contractor has performed 10% of the total original contract amount less Mobilization.

1503.2.3 PAYMENT PROCEDURES

The following will apply in effecting mobilization payments:

- A. When the Contractor is eligible for payment of less than 5% of the total original contract amount bid less mobilization, the Contractor will be paid 25% of the amount bid for mobilization.
- B. When the Contractor is eligible for payment of from 5% to less than 10% of the total original amount bid less mobilization, the Contractor will be paid 50% of the amount bid for mobilization minus any mobilization amount already paid.
- C. When the Contractor is eligible for payment of 10% or more of the total original contract amount less mobilization, the Contractor will be paid 100% of the amount bid for mobilization minus any mobilization amount already paid.

1503.2.4 PAYMENT CALCULATION

PM = Mobilization Payment

M = Total amount bid for Mobilization

fM = Mobilization payment percentage factor (0.25, 0.50, or 1.0, as applicable)

PM = M x fM

EXAMPLE MOBILIZATION PAYMENT CALCULATION

Total Original Contract Amount Bid	\$110,000
Amount Bid for Mobilization	\$ 5,000
Total Original Contract Amount Less Mobilization	\$105,000

Percent of Work Completed	Fm	M	PM
< 5% of \$105,000	0.25	5,000	\$1,250
> 5% to < 10% of \$105,000	0.50	5,000	\$2,500*
≥ 10% of \$105,000	1.00	5,000	\$5,000*
<i>*minus previously paid amounts</i>			

1503.3 METHOD OF MEASUREMENT

See example provided in 1503.2.4.

1503.4 BASIS OF PAYMENT

Mobilization will be paid for at the contract price provided in the Unit Cost Bid Proposal, in accordance with this specification.

No additional payments will be made for demobilization and remobilization due to shutdowns or suspensions of the work or for other mobilization and demobilization activities required to complete the contract.

END OF SECTION

TECHNICAL SPECIFICATION 1507

MATERIALS TESTING

Revised 08/19/2025

1507.1 DESCRIPTION

This specification includes materials testing and quality control measures required on this project. This specification is additional to requirements specified for testing and quality assurance in the construction plans.

Materials and equipment are subject to inspection, sampling, and testing before acceptance of the work.

1507.2 RELATED WORK

General and Supplemental General Conditions of the Contract.

1507.3 REFERENCES AND DEFINITIONS

- 1507.3.1 All materials and equipment shall be tested, by the CONTRACTOR, pursuant to their technical specification (unless otherwise specified herein) and the manufacturer's recommendations.
- 1507.3.2 "Structure" shall include but is not limited to: parking lots, pavement, sidewalk, curb and gutter, foundations, structural concrete, piping, wet-wells, manholes, retaining walls, junction boxes, and buildings.

1507.4 TESTING SUBMITTALS

- 1507.4.1 Test Reports from tests performed by independent testing firm: Submit for acceptance, complete test reports from approved independent testing laboratories certifying that product conforms to performance characteristics and testing requirements specified herein and in other supplemental/standard specifications. Independent firm to submit reports to the ENGINEER and CONTRACTOR, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- 1507.4.2 Test Reports from tests performed by CONTRACTOR: Submit for acceptance, complete test reports from CONTRACTOR certifying that product conforms to performance characteristics and testing requirements specified herein and in other supplemental/standard specifications.

1507.5 QUALITY ASSURANCE

- 1507.5.1 Quality Assurance/Control of Installation – The CONTRACTOR shall:
 - A. Comply fully with manufacturers' instructions, including each step in sequence.
 - B. Request clarifications from ENGINEER before proceeding should manufacturers' instructions conflict with Contract Documents.
 - C. Request clarification from ENGINEER before proceeding if the specified reference standards conflict with Contract Documents. The contractual relationship of the parties

to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

- D. Comply with specified standards as a minimum quality for the work except when more stringent specified tolerances, codes, or requirements indicate higher standards or more precise workmanship are required.
- E. Make sure work is performed by qualified persons.
- F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1507.5.2 Testing Laboratory Services

- A. Reports will be submitted by the independent firm to the ENGINEER and CONTRACTOR, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

1507.6 TESTING METHODS

Testing methods shall comply with ASTM Standards and as specified in the technical specifications and construction plans for the project.

1507.7 EXECUTION

1507.7.1 Testing Laboratory Services

- A. The CONTRACTOR will employ and pay for services of an independent testing firm to perform testing.
- B. The independent firm will perform tests and other services specified in individual Specification Sections and as required by the OWNER.
- C. CONTRACTOR shall:
 - I. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
 - II. Notify ENGINEER and independent firm **8 hours** prior to expected time for operations requiring services.
 - III. Make arrangements with independent firm and pay for additional samples and tests required for CONTRACTOR's use.

1507.7.2 Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the ENGINEER. No additional payment will be made for re-testing due to failing tests.

1507.8 TESTING FREQUENCY & TYPES OF TESTING

Frequency and type of testing shall be per the requirements listed in the specifications for each type of Work. The ENGINEER may increase and/or add testing for any Work items. The Testing Allowance will be adjusted for increases in testing by [Section 1507.9](#).

1507.9 MEASUREMENT & PAYMENT

1507.9.1 Testing shall be paid for as an ALLOWANCE. The CONTRACTOR may request percent of MATERIALS TESTING payments during construction, however, the CONTRACTOR shall provide

actual testing lab invoices as back-up for the percent complete that is being requested in a Pay Application.

1507.9.2 Testing Allowances are provided as part of the project. Invoices for testing will be paid for through this allowance.

1507.9.3 Costs included in testing price include:

- A. Cost of engaging an independent testing firm, execution of tests by the testing firm, and reporting results by the testing firm.
- B. Costs of incidental labor and facilities required to assist testing firm.
- C. Costs of testing laboratory services used by CONTRACTOR separate from Contract Document requirements
- D. Costs of re-testing due to failure of previous tests will be included in the cost for testing and no additional payment will be made for this work.

1507.9.4 The CONTRACTOR shall submit copies of the testing firm's invoice to OWNER with Pay Application. Reimbursement to the CONTRACTOR will be for actual invoiced costs and no mark-up will be added to this invoice. CONTRACTOR shall receive reimbursement for actual invoice of testing firm upon certification that payment has been made to the testing laboratory. Payment will be made at the next application for payment from OWNER.

END OF SECTION

TECHNICAL SPECIFICATION 1508

PROJECT RECORD DOCUMENTS

Revised 08/20/2025

1508.1 GENERAL

This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

1508.2 RECORD DRAWINGS

Record Prints: Maintain one set of red-lined prints of the Contract Drawings and Shop Drawings. These prints shall be updated no less frequently than once per week. These prints will be reviewed for verification of updates by the OWNER or OWNER's representative on a regular basis, depending on the length of the contract.

Immediately before inspection for Certificate of Substantial Completion, CONTRACTOR will review marked-up Record Prints with ENGINEER.

- 1508.2.1 Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Mark whichever drawing is most capable of showing field conditions fully. Require individual or entity who obtained record data, whether individual or entity is Installer, SUB-CONTRACTOR, or similar entity, to prepare the marked-up Record Prints.
- a) Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b) Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
- 1508.2.2 Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-references on the Contract Drawings.
- 1508.2.3 Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 1508.2.4 Note Construction Change Directive numbers (field orders or Request for Information changes), alternate numbers, Change Order numbers, and similar identification, where applicable.
- 1508.2.5 Verification of current record prints status will be included in the [monthly payment approval process](#) that will be noted by the Construction Observer's field reports.

1508.3 RECORD SPECIFICATIONS

Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. Give

particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

Note related Change Orders, field order notes, Request for Information (RFI) notes, Record Product Data, and Record Drawings where applicable.

1508.4 MISCELLANEOUS RECORD SUBMITTALS

Assemble Certifications, Lab Test Reports, and Field Test Reports required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1508.5 SUBMITTALS

See New Mexico Standard Specifications For Public Works Construction [Section 1502](#).

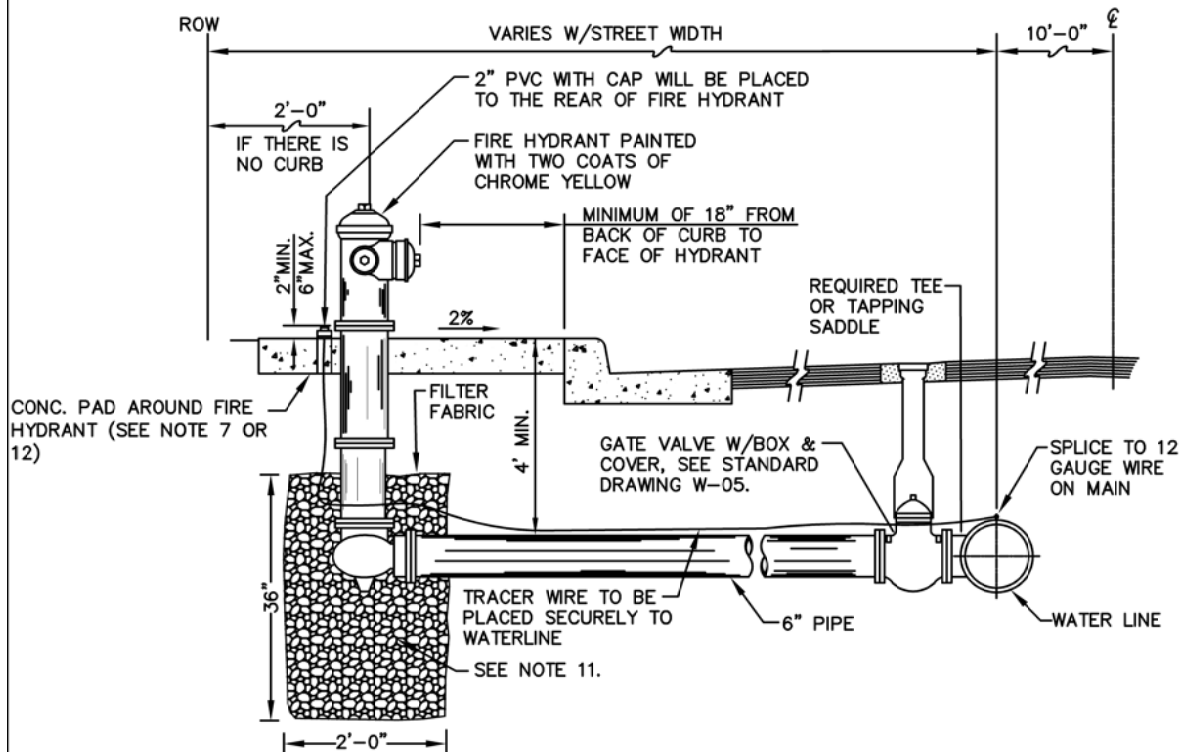
1508.6 RECORDING & MAINTENANCE

- 1508.6.1 Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur.
- 1508.6.2 Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. It is not advisable to use Project Record Documents for construction purposes. Provide access to Project Record Documents for ENGINEER's reference on the project site.

1508.7 MEASUREMENT & PAYMENT

The cost of project record documents shall be incidental to the Work and no separate payment shall be made for this effort. However, the Project Record Documents shall be reviewed per [Section 1508.2.5](#) and they shall be updated prior to pay applications being processed.

END OF SECTION



GENERAL CONSTRUCTION NOTES:

1. GATE VALVE WITH BOX, COVER, AND CIRCULAR COLLARS SHALL BE INSTALLED ON NEW AND EXISTING WATER MAINS.
2. FIRE HYDRANTS SHALL HAVE 5 1/4" VALVE OPENING, BE DRY BARREL/ DRY TOP, TRAFFIC MODEL, WITH ONE 4 1/2" PUMPER NOZZLE, TWO 2 1/2" HOSE NOZZLES, NS THREAD, PENTAGON OPERATING NUT (1 1/2" POINT TO FLAT) WITH 1" SIDES, WHICH SHALL OPEN LEFT (COUNTER-CLOCKWISE), WITH MECHANICAL JOINT CONNECTION TO 6" DUCTILE IRON OUTSIDE DIAMETER PIPE WITH 4' MIN. COVER.
3. ALL FIRE HYDRANTS SHALL BE PAINTED WITH TWO COATS OF CHROME YELLOW.
4. ALL FIRE HYDRANTS SHALL MEET THE REQUIREMENTS OF AMERICAN WATER WORKS ASSOCIATION STANDARD C502.
5. WRAP ALL AREAS WITH 10MIL PLASTIC BEFORE INSTALLATION OF CONCRETE THRUST BLOCKS.
6. A FIRE HYDRANT ASSEMBLY MUST BE LOCATED 10 FEET FROM THE END OF ANY DEAD END WATERLINE.
7. IN PAVED OR UNPAVED RIGHT-OF-WAY WITHOUT SIDEWALK, POUR A 3'X4.5'X6" CONCRETE COLLAR CENTERED ON FIRE HYDRANT. CONCRETE SHALL HAVE AN $f'c = 3,000$ psi.
8. FIRE HYDRANT COLLARS SHALL BE INSTALLED AT 2" TO 6" ABOVE FINISHED OR EXISTING ROAD GRADE ON ALL UNPAVED ROADS.
9. FIRE PROTECTION FIRE HYDRANT'S ON PRIVATE PROPERTY TO FOLLOW STANDARD DRAWING CITY OF RIO RANCHO.
10. A MECHANICAL RESTRAINT SYSTEM SHALL BE UTILIZED ON FITTINGS AND PIPING FOR THRUST RESTRAINT. CONCRETE THRUST BLOCKING TO BE USED ONLY FOR SPECIAL CONDITIONS (SUCH AS, CAPS WHERE MAIN WILL BE EXTENDED IN THE FUTURE) OR AS SPECIFICALLY APPROVED BY CITY OF RIO RANCHO. DESIGN ENGINEER SHALL BE RESPONSIBLE FOR SIZING ALL CONCRETE THRUST BLOCKING AND RESTRAINT LENGTHS.
11. 3/4" CRUSHED STONE OR GRAVEL SHALL BE PLACED AROUND THE BOTTOM OF THE HYDRANT FOR A RADIUS OF AT LEAST 12" AND EXTEND AT LEAST 12" ABOVE THE OUTLET. DO NOT BLOCK WEEP HOLES. WRAP GRAVEL IN FILTER FABRIC.
12. IN PAVED RIGHT-OF-WAY WITH SIDEWALK, THE CONCRETE PAD AROUND THE FIRE HYDRANT SHALL HAVE THE FOLLOWING DIMENSIONS: 3' WIDE X 6" THICK X THE BUFFER LENGTH. CONCRETE SHALL HAVE AN $f'c = 3,000$ psi.



City of Rio Rancho
Department of Public Works

FIRE HYDRANT ASSEMBLY

DATE MODIFIED:

MARCH 2019

DWG. NO. W-15

APRIL 22, 2016