



LISBON CHANNEL SOUTHERN BLVD TO PEDESTRIAN BRIDGE

BID & CONTRACT DOCUMENTS

VOLUME 2 of 2: PROJECT SPECIFICATIONS

Southern Sandoval County Arroyo Flood Control
Authority

IFB # 2025-03

SSCAFCA PROJECT NUMBER: BL_P0037-01

FUNDING SOURCES:

DR-4529-0006-NM

Conformed – Modified with Addendum 01

July 2025



LISBON CHANNEL SOUTHERN BLVD TO PEDESTRIAN BRIDGE

BID & CONTRACT DOCUMENTS

VOLUME 2 of 2: PROJECT SPECIFICATIONS

Southern Sandoval County Arroyo Flood Control Authority

IFB # 2025-03

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:



Table of Contents

SSCAFCA Specifications

- SSCAFCA 1510 – Excavation, Borrow, & Fill
- SSCAFCA 1511 – NPDES Compliance
- SSCAFCA 1512 – Control of Storm Water and Nuisance Flow
- SSCAFCA 1513 – Construction Staking
- SSCAFCA 1515 – Removal of Structures & Obstructions

APWA Specifications

- APWA 109 – Riprap Stone
- APWA 123 – Reinforced Concrete Pipe
- APWA 201 – Clearing & Grubbing
- STS 201 – Clearing & Grubbing
- APWA 301 – Subgrade Preparation
- APWA 302 – Aggregate Base Course Construction
- APWA 603 – Riprap Surface Treatment
- APWA 701 – Trenching, Excavation and Backfill
- APWA 1012 – Native Grass Seeding
- STS 1012 – Native Grass Seeding Supplemental Technical Specification
- APWA 1200 – Traffic Control
- APWA 1502 – Submittals

NMDOT Specifications

- NMDOT 519 – Shotcrete

Other Specifications

- STS 668 – Utility Allowance
- STS 1503 – Mobilization
- STS** 1507 – Materials Testing
- STS 1508 – Project Record Documents

SSCAFCA Specifications



TECHNICAL SPECIFICATION 1510

EXCAVATION, OVER-EXCAVATION, BORROW, AND FILL

Revised 12/10/2024

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:

- | | |
|--|--|
| <ul style="list-style-type: none">• ASTM D-1557• ASTM D-422• ASTM D-4318• ASTM D-6938 | <p>This publication:</p> <ul style="list-style-type: none">• NM APWA Section 201• SSCAFCA 1513• 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 Geotechnical 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 tests will be performed 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 08/21/2020

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 07/24/2020

1512.1 DESCRIPTION

This work covers the control of storm and nuisance flow water in the vicinity of this project.

1512.2 CONSTRUCTION REQUIREMENTS

All permanent work shall be performed in areas free from water. The CONTRACTOR shall construct and maintain all dikes and drainage ditches necessary for the elimination of water from work areas and shall furnish, install, maintain, and operate all necessary pumping and other dewatering equipment required for dewatering the various work areas. Two (2) types of flow can be expected;

- 1) Continuous or intermittent flow through the main arroyo;
- 2) Local sheet flow from adjacent properties or adjacent streets.

The CONTRACTOR is responsible for adequacy of the scheme or plans, or for furnishing all equipment, labor and materials necessary for dewatering the work areas and breaking up and removing such ice or snow as may have formed or settled in the work area. The CONTRACTOR shall be fully responsible for all dewatering operations, and the cost of all dewatering operations shall be included in the lump sum price for this work. The CONTRACTOR shall also be responsible for removal of any sediment deposited by storm and nuisance water, and the cost of sediment removal work shall be included in the lump sum price for this work.

In the event that storm flow, snowmelt or other water flows overtop the Contractor's diversion method, the Contractor will be responsible for any and all damage, including damage to the existing channel and any damage to new work and is responsible for immediate resolution and repair in a manner acceptable to SSACFCA.

Diversion methods may be by use of sandbag diversion channels, sandbag dams, pumping or piping around or over the work areas, or any method or combination.

1512.3 BASIS OF PAYMENT

The bid item for this effort will be on a Lump Sum (LS) basis. Providing and maintaining the diversion and care of water, regardless of the amount of water actually handled, shall be paid for as follows:

Payment 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 STAKING

Revised 09/16/2021

1513.1 DESCRIPTION

This work consists of 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

The 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 Engineer, points shall be referenced so that they may later be re-established.

1513.3 CONSTRUCTION REQUIREMENTS

The 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 Project Manager, to assure compliance with the plans.

1513.4 CONSTRUCTION SURVEYS

The 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:

Phase 1: A topographic survey, with a contour resolution of 1-ft or greater, to determine the Project Site (including Borrow Area, if applicable) existing ground elevations prior to construction, after clearing and grubbing and after removal of trash and debris. Data collected shall be of sufficient detail, including all breaks in the terrain, to be able to create an original ground digital terrain model (DTM). The Project Site & Borrow Area (if applicable) "original ground" DTM shall be submitted to the Engineer for review and acceptance prior to proceeding with excavation and export of material. Survey data must be sufficient to determine future earthwork quantities.

Phase 2: A topographic survey, with a contour resolution of 1-ft or greater, to determine the Borrow Area (if applicable) finished ground elevations post-construction, after all required borrow material is removed. Data collected shall be of sufficient detail, including all breaks in the terrain, to be able to create a finished ground digital terrain model (DTM). The Borrow Area "finished ground" DTM shall be submitted to the Engineer for review and acceptance prior to payment for "Borrow" Bid Item. Survey data must be sufficient to determine earthwork quantities.

Phase 3: A topographic survey, with a contour resolution of 1-ft or greater, will be completed for the project site (excluding borrow area) after construction to demonstrate compliance with the design grades, structure elevations, inverts, alignments/profiles, etc. shown on the plan set. Phase 3 Survey will also include the update and completion of as-built survey for the project. 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 survey.

All surveys must be certified by the Professional Surveyor and include complete documentation. Borrow Area surveys (Phases 1 and 2) must be used by the Professional Surveyor to compute the quantity of excavation, subject to the provisions for measurement in [Technical Specification 1510](#). Volume shall be determined based on the "average end area" computation. All computations of excavation must be submitted to the Engineer in sufficient detail. This submittal shall be such that methods and computations can be fully verified and are subject to approval by the Engineer. The Contractor shall also submit the electronic survey point files, including break lines, in a format compatible with AutoCAD Civil3D such that the Engineer can use the data for verification of cut/fill quantities.

At the end of the Project, the Engineer will transcribe the as-built information provided by the Contractor onto the Record Drawing. The Contractor's Professional Surveyor will be required to stamp, sign and certify the information shown on the as-built drawings.

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

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

1513.7 SSCAFCA will make partial payments in accordance with the approved construction-staking schedule of values.

END OF SECTION



TECHNICAL SPECIFICATION 1515

REMOVAL OF STRUCTURES & OBSTRUCTIONS

Revised 11/16/2021

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, $FA:C+I :r$.

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. (%)
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.

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.

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 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 +/- 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	SPECIFICATION LIMIT(S)	
	Fine	Course
Aggregate Type		
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 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 ½ 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.

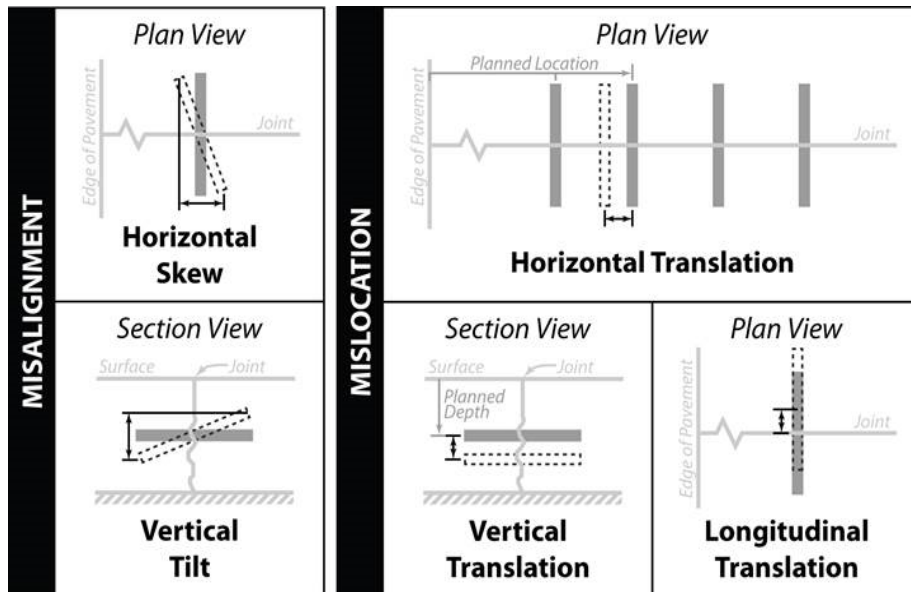
450.3.4.2 Transverse Joints

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:
 - 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:
 - Addition of dowel bars using an approved dowel bar retrofit method.
- Depth:
 - Inadequate cover above the bar - Remove the bar and install a replacement bar using an approved dowel bar retrofit method.
 - Inadequate cover below the bar - Addition of dowel bars using an approved dowel bar retrofit method.
- Missing Dowel Bars:
 - 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 Contactor 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 ever 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 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 × four (4) inch mesh (4 × 4-W2.1 × 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 × 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 $73\text{ }^{\circ}\text{F} \pm 3\text{ }^{\circ}\text{F}$, 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 603

RIPRAP SURFACE TREATMENT

603.1 GENERAL

The construction of riprap surface treatment shall consist of furnishing and placing stone, with or without grout, with or without wire mesh, or sacked concrete riprap. The depth and type of riprap shall be as shown on the construction plans.

603.2 REFERENCES

603.2.1 ASTM C 143

603.2.2 This publication: SECTION 101 SECTION 109

603.3 MATERIAL

603.3.1 Riprap stone shall be as specified in Section 109 of these specifications.

603.3.2 Other materials necessary for completion of various types of Riprap Surface Treatments shall be as specified in the following subsections.

603.4 PREPARATION OF GROUND SURFACES

603.4.1 The bed for the riprap shall be shaped and trimmed to provide even surfaces. A footing trench shall be excavated along the toe of the slope as shown on the plans.

603.4.2 Specified filter cloth shall be placed on earth bed prior to placement of stone.

603.4.3 Earth surface shall be shaped and trimmed to conform to the construction plans prior to the placement and compaction of the gravel type of filter material.

603.5 PLACING RIPRAP STONE

603.5.1 When the required riprap is less than 20 inches in depth, stone shall be placed by hand unless otherwise authorized by the ENGINEER. Stone shall be placed to provide a minimum of voids. The larger stone shall be placed in the toe return, foundation course, and on the outer surface of the riprap. Stones shall be placed with their longitudinal axis normal to the face of the embankment and so arranged that each rock above the foundation course has at least a 3 point bearing on the underlying

stones. Bearing on smaller stones used to chink voids will not be acceptable. Interstices between stones shall be chinked with small stones and spalls.

The finished surface shall be even and tight and shall not vary from the planned surface by more than 3 inches per foot of depth. When the required riprap is 20 inches or more in depth, the stone may be placed by dumping and spread in layers by bull-dozers or other suitable equipment.

603.5.2 Riprap shall be placed to its full design thickness (depth) in one operation.

603.6 GROUTED RIPRAP

603.6.1 Riprap shall be placed as specified and grouted with Portland cement mortar. The grout shall consist of one part cement and 3 parts by volume of aggregate. The Portland cement shall be Type I or Type II as specified in Section 101 and the aggregate shall be 2 parts sand and 1 part gravel passing a 3/8 inch square mesh screen. The amount of water shall be such as to permit gravity flow into the interstices with limited spading and brooming. The consistency of the grout shall be as approved by the ENGINEER.

603.6.2 Except when hand mixing is permitted by the ENGINEER, grout shall be mixed in an approved machine mixer for not less than 1 1/2 minutes. Should hand mixing be permitted, the cement and aggregate shall be thoroughly mixed in a clean, tight mortar box until the mixture is of uniform color after which clean water shall be added in such quantity as to provide a grout of the specified consistency.

603.7 SACKED CONCRETE RIPRAP

603.7.1 The Portland cement, aggregates, and mixing shall be as specified in Section 101 and as herein specified. The aggregate may be pit-run material, at least 80 percent of which shall pass a 1 1/2 inch square mesh screen. Separating aggregates by primary sizes will not be required. Los Angeles abrasion tests and soundness tests will not be required.

603.7.2 The mixed concrete shall contain 376 pounds (4 sacks) of Portland cement per cubic yard.

603.7.3 The amount of water shall be such as to produce a mixture with a slump of 3 to 5 inches when tested in accordance with ASTM C 143.

603.7.4 Sacks shall be made of at least 10 ounce burlap and shall be approximately 19 1/2 inches by 36 inches measured inside the seams when the sack is laid flat.

603.7.5 Slopes on which the sacked concrete riprap is to be placed shall be finished within 0.2 foot of the designated grades. The first course shall be a double row of stretchers laid in a neatly trimmed trench. The second course shall be a single row of headers. The third and remaining courses shall be stretchers or headers as shown on the plans and shall be placed so that joints between courses are staggered. Dirt and debris shall be removed from the tops of sacks before the next course is laid thereon. Headers shall be placed with the folds upward. Not more than 4 vertical courses shall be placed in any tier until the initial set has taken place in the first course of any such tier.

603.7.6 When, in the opinion of the ENGINEER, there will not be proper bearing or bond due to delays in placing succeeding layers or the hampering of work by storm, mud, or for any cause, a small trench shall be excavated back of the row of sacks already in place and this trench filled with fresh concrete before more sacks are placed. Payment for the concrete in the trenches shall be at the price per cubic yard for sacked concrete riprap. Payment for excavating the trenches shall be considered as included in the payment for the concrete in the trench.

603.7.7 Sacked concrete riprap shall be cured by sprinkling with a fine spray of water every 2 hours during daylight for not less than 3 days.

603.8 WIRE ENCLOSED RIPRAP

603.8.1 Wire enclosed riprap shall consist of a layer of rock of the required thickness enclosed on all sides in wire fabric in conformity with the details shown on the plans. The wire fabric shall be drawn tightly against the rock on all sides and tied with galvanized wire of the required gauge. The ties shall be spaced approximately 2 feet on centers and shall be anchored to the bottom layer of wire fabric, extended through the rock layer, and tied securely to the top layer of wire fabric. When indicated on the plans, wire enclosed riprap shall be anchored to the slopes by steel stakes driven through the riprap into the embankment. Stakes shall be spaced as shown on the plans. Wire fabric used for riprap shall conform to the mesh, gauge, and weight shown on the plans. Tie wire shall be galvanized and of the gauge shown on the plans. Wire fabric shall be furnished in such lengths and widths as to reduce

the number of splices to a minimum.

603.8.2 Steel stakes shall be cut to the required length from steel railroad rails, galvanized steel pipe, or steel angles of the dimension and weight shown on the construction plans.

603.9 FILTER CLOTH

603.9.1 MATERIAL: The filter cloth shall be a non-woven polyester geotextile, such as: Mirafi No. 140N drainage Fabric, Mirafi Inc., Charlotte, North Carolina, or approved equal.

603.9.2 INSTALLATION: The surface to receive the cloth shall be prepared to a relatively smooth condition free of obstructions, depressions, and debris. The cloth shall not be laid in a stretched condition but shall be laid loosely with a long dimension perpendicular to the channel centerline. The cloth shall be placed so the upstream edge overlaps the downstream edge a minimum of 12 inches, with securing pins inserted through both layers at no greater than two-foot intervals. Cloth damaged or displaced before or during installation or placement of the overlaying riprap shall be replaced or repaired to the satisfaction of the ENGINEER at the CONTRACTOR'S expense.

603.10 GRAVEL TYPE OF FILTER MATERIAL

603.10.1 MATERIAL: Filter material shall be comprised of sand, gravel, and cobble in mixes as specified on the plans. Alternate materials such as milled Portland cement concrete, concrete wash, or reclaimed material may be substituted with the ENGINEER'S approval.

603.10.2 INSTALLATION: Filter material shall be used as a subbase for riprap as shown on the plans. The minimum depth of filter material shall be one foot unless the plans provide an alternate detail for filter blanket construction.

603.11 MEASUREMENT AND PAYMENT

603.11.1 Riprap, such as: plain stone, grouted, wire enclosed, or sacked concrete, shall be measured by the cubic yards placed to the lines and grades shown on the construction plans. Payment for riprap will be made at the unit price per cubic yard for the type of riprap as specified in the Bid Proposal and shall include materials, labor, and equipment necessary to complete the work.

603.11.2 Filter cloth shall be measured by the square foot and overlaps shall be measured as a

single layer of cloth. Payment shall be made at the unit price per square foot as per Bid Proposal, and shall include shipping, handling, storage, seams, special fabrication, securing pins, and/or installation.

603.11.3 Gravel type filter material shall be measured by the cubic yard of material in place, in accordance with the construction plans. Payment will be made at the unit price per cubic yard as per Bid Proposal and shall include all materials, labor, and equipment necessary for the installation of the material.

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.

--	--	--

- * 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 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 curtipendula	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
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 Mats, 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:
-

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.

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?

NMDOT Specifications

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 × four (4) inch mesh (4 × 4-W2.1 × 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 × 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.

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)

TECHNICAL SPECIFICATION 1503

MOBILIZATION

Revised 12/10/2024

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

The following definitions shall apply:

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)

$PM = M \times fM$

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*

**minus previously paid amounts*

1503.3 METHOD OF MEASUREMENT

The 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 Project Manager, to assure compliance with the plans.

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 12/10/2024

1507.1 DESCRIPTION

This SPECIFICATION includes 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

- A. All materials and equipment shall be tested, by the CONTRACTOR, pursuant to their technical specification (unless otherwise specified herein) and the manufacturer's recommendations.
- B. 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 SUBMITTALS

- A. 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.

- B. 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

A. Quality Assurance/Control of Installation – The CONTRACTOR shall:

1. Comply fully with manufacturers' instructions, including each step in sequence.
2. Request clarifications from ENGINEER before proceeding should manufacturers' instructions conflict with Contract Documents.
3. Request clarification from ENGINEER before proceeding should 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.
4. 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.
5. Make sure work is performed by qualified persons.
6. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

B. Testing Laboratory Services

1. 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 for the project.

1507.7 EXECUTION

A. Testing Laboratory Services

1. The CONTRACTOR will employ and pay for services of an independent testing firm to perform testing.

2. The independent firm will perform tests and other services specified in individual Specification Sections and as required by the OWNER.
3. CONTRACTOR shall:
 - a. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
 - b. Notify ENGINEER and independent firm 8 hours prior to expected time for operations requiring services.
 - c. Make arrangements with independent firm and pay for additional samples and tests required for CONTRACTOR'S use.

B. 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.D.

1507.9 MEASUREMENT & PAYMENT

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.

Testing allowances are provided as part of the project and invoiced for testing will be paid for through this allowance.

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.

The CONTRACTOR shall submit two 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. The 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 12/10/2024

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 construction observer on a regular basis, depending on the length of the contract. Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with ENGINEER.

- 1508.6.1 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.

- 1508.6.2 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.
- 1508.6.3 Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 1508.6.4 Note Construction Change Directive numbers (field orders or Request for Information changes), alternate numbers, Change Order numbers, and similar identification, where applicable.
- 1508.6.5 Verification of current record prints status will be included in the monthly payment approval process that will be noted by the construction's 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