



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
16 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0016

Paul R. LePage
GOVERNOR

January 5, 2016
Subject: Culvert Rehabilitation
State WIN: 020269.00
Location: **Freeport**
Amendment No. 5

David Bernhardt
COMMISSIONER

Dear Sir/Ms

Please make the following changes to the Bid Documents:

REMOVE pages 12-15 "SCHEDULE OF ITEMS" dated 11/23/2015 and **REPLACE** with the attached revised "SCHEDULE OF ITEMS", 5 pages, dated 01/04/2016.

REMOVE pages 16-23 "CONTRACT AGREEMENT, OFFER & AWARD" and **REPLACE** with the attached revised "CONTRACT AGREEMENT, OFFER & AWARD", 8 pages.

REMOVE pages 48-50 "SPECIAL PROVISION SECTION 502 ANNULAR SPACE GROUTING" dated 4/14/2010 and **REPLACE** with the attached revised "SPECIAL PROVISION SECTION 502 ANNULAR SPACE GROUTING", 3 pages, dated 12/29/2015.

REMOVE pages 52-55 "SPECIAL PROVISION SECTION 509 CULVERT SLIPLINING" dated 10/27/2015 and **REPLACE** with the attached revised "SPECIAL PROVISION SECTION 509 CULVERT SLIPLINING", 4 pages, dated 12/31/2015.

REMOVE pages 56-62 "SPECIAL PROVISION SECTION 517 SHOTCRETE" dated 8/10/2012 and **REPLACE** with the attached revised "SPECIAL PROVISION SECTION 517 SHOTCRETE", 7 pages, dated 12/29/2015.

INSERT attached "SPECIAL PROVISION SECTION 502 ALUMINUM FISH PASSAGE WEIRS", 1 page, after page 51.

INSERT attached "SPECIAL PROVISION SECTION 509 ALUMINUM TUNNEL LINER PLATE", 1 page, after page 55.

ADD on page 9, of "NOTICE TO CONTRACTORS" after the fourth paragraph the sentence beginning with Scope of Work..." the following, "**The basis of award will be Section 1 combined with chosen Alternate 1 (Section 2), or Section 1 Combined with chosen Alternate 2 (Section 3).**" **ADD** this in pen and ink.

ADD on page 34, of "GENERAL NOTES" note 36) The interior of the existing pipe shall have a layer of shotcrete installed to contain the annular grout. **ADD** this in pen and ink.



PRINTED ON RECYCLED PAPER

These questions were asked by Bidders during and after Pre-Bid meeting held on December 28, 2015:

Question: What will happen if the proposed ID 96" pipe does not fit halfway through the installation process?

Answer: The Department expects all means and methods to be exhausted, including the possibility of cutting timbers or manipulating stones, as part of the installation process. All efforts to insert the pipe shall be incidental to the sliplining items. In the event that the Department finds the work cannot be completed, eliminated materials shall be handled in accordance with Standard Specification 109.2 Elimination of Items.

Question: Is it possible to reduce the size of the ID to 90" or 84"?"

Answer: No.

Question: Will the bid opening date be changed?

Answer: Please refer to Amendment #4 that changed the bid opening date to January 13, 2016.

Question: Is it possible to improve the inlet treatment?

Answer: No.

Question: Can the type of pipe be changed?

Answer: See changes to pipe types in this amendment.

Question: Can the pipe outside of the culvert be different than the pipe inside of the culvert?

Answer: Differing OD pipe may be utilized, however the materials shall be homogenous. See updated Special Provision 509.

Question: Is the intent of the slipline for structural repair?

Answer: Yes, the loose stones pose a long term concern for structural integrity.

Consider this change and information prior to submitting your bid on **January 13, 2016**.

Sincerely,



George M. A. Macdougall P.E.
Contracts & Specifications Engineer

Maine Department of Transportation

Proposal Schedule of Items

Proposal ID: 020269.00

Project(s): 020269.00

SECTION: 1 COMMON ITEMS

Alt Set ID: Alt Mbr ID:

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0010	201.11 CLEARING	0.600 AC	_____	 _____	_____	 _____
0020	202.203 PAVEMENT BUTT JOINTS	175.000 SY	_____	 _____	_____	 _____
0030	203.20 COMMON EXCAVATION	300.000 CY	_____	 _____	_____	 _____
0040	203.25 GRANULAR BORROW	750.000 CY	_____	 _____	_____	 _____
0050	304.10 AGGREGATE SUBBASE COURSE - GRAVEL	200.000 CY	_____	 _____	_____	 _____
0060	403.209 HOT MIX ASPHALT 9.5 MM (SIDEWALKS, DRIVES, INCIDENTALS)	8.000 T	_____	 _____	_____	 _____
0070	403.2104 HOT MIX ASPHALT 9.5 MM - THIN LIFT SURFACE TREATMENT	70.000 T	_____	 _____	_____	 _____
0080	403.211 HOT MIX ASPHALT (SHIMMING)	50.000 T	_____	 _____	_____	 _____
0090	403.213 HOT MIX ASPHALT 12.5 MM BASE	40.000 T	_____	 _____	_____	 _____
0100	409.15 BITUMINOUS TACK COAT - APPLIED	40.000 G	_____	 _____	_____	 _____
0150	517.60 SHOTCRETE	100.000 CY	_____	 _____	_____	 _____
0160	526.301 TEMPORARY CONCRETE BARRIER TYPE I	LUMP SUM	_____	 LUMP SUM	_____	 _____

Maine Department of Transportation

Proposal Schedule of Items

Proposal ID: 020269.00

Project(s): 020269.00

SECTION: 1 COMMON ITEMS

Alt Set ID: Alt Mbr ID:

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0170	606.23 GUARDRAIL TYPE 3C - SINGLE RAIL	312.500 LF	_____	_____	_____	_____
0180	606.231 GUARDRAIL TYPE 3C - 15 FOOT RADIUS AND LESS	25.000 LF	_____	_____	_____	_____
0190	606.265 TERMINAL END - SINGLE RAIL - GALVANIZED STEEL	1.000 EA	_____	_____	_____	_____
0200	606.353 REFLECTORIZED FLEXIBLE GUARDRAIL MARKER	4.000 EA	_____	_____	_____	_____
0210	606.81 TANGENT GUARDRAIL TERMINAL - ENERGY ABSORBING	1.000 EA	_____	_____	_____	_____
0220	610.08 PLAIN RIPRAP	800.000 CY	_____	_____	_____	_____
0230	613.319 EROSION CONTROL BLANKET	50.000 SY	_____	_____	_____	_____
0240	615.07 LOAM	45.000 CY	_____	_____	_____	_____
0250	618.14 SEEDING METHOD NUMBER 2	10.000 UN	_____	_____	_____	_____
0260	619.1201 MULCH - PLAN QUANTITY	10.000 UN	_____	_____	_____	_____
0270	620.58 EROSION CONTROL GEOTEXTILE	1,600.000 SY	_____	_____	_____	_____
0280	627.733 4" WHITE OR YELLOW PAINTED PAVEMENT MARKING LINE	1,380.000 LF	_____	_____	_____	_____

Maine Department of Transportation

Proposal Schedule of Items

Proposal ID: 020269.00

Project(s): 020269.00

SECTION: 1 COMMON ITEMS

Alt Set ID: Alt Mbr ID:

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0290	627.78 TEMPORARY 4 INCH PAINTED PAVEMENT MARKING LINE, WHITE OR YELLOW	1,380.000 LF	_____	 _____	_____	 _____
0300	629.05 HAND LABOR, STRAIGHT TIME	15.000 HR	_____	 _____	_____	 _____
0310	631.12 ALL PURPOSE EXCAVATOR (INCLUDING OPERATOR)	20.000 HR	_____	 _____	_____	 _____
0320	631.172 TRUCK - LARGE (INCLUDING OPERATOR)	20.000 HR	_____	 _____	_____	 _____
0330	631.18 CHAIN SAW RENTAL (INCLUDING OPERATOR)	10.000 HR	_____	 _____	_____	 _____
0340	631.22 FRONT END LOADER (INCLUDING OPERATOR)	20.000 HR	_____	 _____	_____	 _____
0350	639.19 FIELD OFFICE TYPE B	1.000 EA	_____	 _____	_____	 _____
0360	643.72 TEMPORARY TRAFFIC SIGNAL	LUMP SUM		 LUMP SUM	_____	 _____
0370	652.33 DRUM	25.000 EA	_____	 _____	_____	 _____
0380	652.34 CONE	50.000 EA	_____	 _____	_____	 _____
0390	652.35 CONSTRUCTION SIGNS	220.000 SF	_____	 _____	_____	 _____

Maine Department of Transportation

Proposal Schedule of Items

Proposal ID: 020269.00

Project(s): 020269.00

SECTION: 1 COMMON ITEMS

Alt Set ID: Alt Mbr ID:

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0400	652.36 MAINTENANCE OF TRAFFIC CONTROL DEVICES	53.000 CD	_____	 _____	_____	 _____
0410	652.38 FLAGGER	330.000 HR	_____	 _____	_____	 _____
0420	656.75 TEMPORARY SOIL EROSION AND WATER POLLUTION CONTROL	LUMP SUM		LUMP SUM	_____	 _____
0430	659.10 MOBILIZATION	LUMP SUM		LUMP SUM	_____	 _____
Section: 1			Total:		_____	 _____

SECTION: 2 POLYETHYLENE ALTERNATE

Alt Set ID: AL Alt Mbr ID: 1

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0120	509.201 CULVERT SLIPLINING	130.000 LF	_____	 _____	_____	 _____
0130	509.203 HIGH DENSITY POLYETHYLENE FISH WEIRS	LUMP SUM		LUMP SUM	_____	 _____
Section: 2			Total:		_____	 _____

Maine Department of Transportation

Proposal Schedule of Items

Proposal ID: 020269.00

Project(s): 020269.00

SECTION: 3 ALUMINUM ALTERNATE

Alt Set ID: AL

Alt Mbr ID: 2

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0110	509.193 ALUMINUM TUNNEL LINER PLATE	130.000 LF	_____	_____	_____	_____
0140	509.204 ALUMINUM FISH WEIRS	LUMP SUM	LUMP SUM		_____	_____
Section: 3			Total:		_____	_____
			Total Bid:		_____	_____

CONTRACT AGREEMENT, OFFER & AWARD

AGREEMENT made on the date last signed below, by and between the State of Maine, acting through and by its Department of Transportation (Department), an agency of state government with its principal administrative offices located at Child Street Augusta, Maine, with a mailing address at 16 State House Station, Augusta, Maine 04333-0016, and

_____ with
a corporation or other legal entity organized under the laws of the State of _____, with
its principal place of business located at _____

The Department and the Contractor, in consideration of the mutual promises set forth in this Agreement (the "Contract"), hereby agree as follows:

A. The Work.

The Contractor agrees to complete all Work as specified or indicated in the Contract including Extra Work in conformity with the Contract, WIN 020269.00, for the Culvert Rehabilitation in the town of Freeport, County of Cumberland, Maine. The Work includes construction, maintenance during construction, warranty as provided in the Contract, and other incidental work.

The Contractor shall be responsible for furnishing all supervision, labor, equipment, tools supplies, permanent materials and temporary materials required to perform the Work including construction quality control including inspection, testing and documentation, all required documentation at the conclusion of the project, warranting its work and performing all other work indicated in the Contract.

The Department shall have the right to alter the nature and extent of the Work as provided in the Contract; payment to be made as provided in the same.

B. Time.

The Contractor agrees to complete all Work, except warranty work, on or before October 15, 2016. Further, the Department may deduct from moneys otherwise due the Contractor, not as a penalty, but as Liquidated Damages in accordance with Sections 107.7 and 107.8 of the State of Maine Department of Transportation Standard Specifications, November 2014 Edition and related Special Provisions.

C. Price.

The quantities given in the Schedule of Items of the Bid Package will be used as the basis for determining the original Contract amount and for determining the amounts of the required Performance Surety Bond and Payment Surety Bond, and that the amount of this offer is

Section 1 \$ _____

Section 2 \$ _____

Section 3 \$ _____

Performance Bond and Payment Bond each being 100% of the amount awarded under this Contract (see award amount in Section G below).

D. Contract.

This Contract, which may be amended, modified, or supplemented in writing only, consists of the Contract documents as defined in the Plans, Standard Specifications, November 2014 Edition, Standard Details November 2014 Edition as updated through advertisement, Supplemental Specifications, Special Provisions, Contract Agreement; and Contract Bonds. It is agreed and understood that this Contract will be governed by the documents listed above.

E. Certifications.

By signing below, the Contractor hereby certifies that to the best of the Contractor's knowledge and belief:

1. All of the statements, representations, covenants, and/or certifications required or set forth in the Bid and the Bid Documents, including those in the Contract are still complete and accurate as of the date of this Agreement.
2. The Contractor knows of no legal, contractual, or financial impediment to entering into this Contract.
3. The person signing below is legally authorized by the Contractor to sign this Contract on behalf of the Contractor and to legally bind the Contractor to the terms of the Contract.

F. Offer.

The undersigned, having carefully examined the site of work, the Plans, Standard Specifications November 2014 Edition, Standard Details November 2014 Edition as updated through advertisement, Supplemental Specifications, Special Provisions, Contract Agreement; and Contract Bonds contained herein for construction of:

WIN 020269.00 Route 1 Culvert Rehabilitation plus other incidental work State of Maine, on which bids will be received until the time specified in the "Notice to Contractors" do(es) hereby bid and offer to enter into this contract to supply all the materials, tools, equipment and labor to construct the whole of the Work in strict accordance with the terms and conditions of this Contract at the unit prices in the attached "Schedule of Items".

The Offeror agrees to perform the work required at the price specified above and in accordance with the bids provided in the attached "Schedule of Items" in strict accordance with the terms of this solicitation, and to provide the appropriate insurance and bonds if this offer is accepted by the Government in writing.

As Offeror also agrees:

First: To do any extra work, not covered by the attached "Schedule of Items", which may be ordered by the Resident, and to accept as full compensation the amount determined upon a "Force Account" basis as provided in the Standard Specifications, November 2014 Edition, and as addressed in the contract documents.

Second: That the bid bond at 5% of the bid amount or the official bank check, cashier's check, certificate of deposit or U. S. Postal Money Order in the amount given in the "Notice to Contractors", payable to the Treasurer of the State of Maine and accompanying this bid, shall be forfeited, as liquidated damages, if in case this bid is accepted, and the undersigned shall fail to abide by the terms and conditions of the offer and fail to furnish satisfactory insurance and Contract bonds under the conditions stipulated in the Specifications within 15 days of notice of intent to award the contract.

Third: To begin the Work as stated in Section 107.2 of the Standard Specifications November 2014 Edition and complete the Work within the time limits given in the Special Provisions of this Contract.

Fourth: That this offer shall remain open for 30 calendar days after the date of opening of bids.

Fifth: The Bidder hereby certifies, to the best of its knowledge and belief that: the Bidder has not, either directly or indirectly, entered into any agreement, participated in

any collusion, or otherwise taken any action in restraint of competitive bidding in connection with its bid, and its subsequent contract with the Department.

IN WITNESS WHEREOF, the Contractor, for itself, its successors and assigns, hereby execute two duplicate originals of this Agreement and thereby binds itself to all covenants, terms, and obligations contained in the Contract Documents.

CONTRACTOR

Date

(Signature of Legally Authorized Representative
of the Contractor)

Witness

(Name and Title Printed)

G. Award.

Your offer is hereby accepted for (see checked boxes):

- Section 1
- Section 2
- Section 3

Contract Amount: _____

This award consummates the Contract, and the documents referenced herein.

MAINE DEPARTMENT OF TRANSPORTATION

Date

By: David Bernhardt, Commissioner

Witness

CONTRACT AGREEMENT, OFFER & AWARD

AGREEMENT made on the date last signed below, by and between the State of Maine, acting through and by its Department of Transportation (Department), an agency of state government with its principal administrative offices located at Child Street Augusta, Maine, with a mailing address at 16 State House Station, Augusta, Maine 04333-0016, and

_____ with
a corporation or other legal entity organized under the laws of the State of _____, with
its principal place of business located at _____

The Department and the Contractor, in consideration of the mutual promises set forth in this Agreement (the "Contract"), hereby agree as follows:

A. The Work.

The Contractor agrees to complete all Work as specified or indicated in the Contract including Extra Work in conformity with the Contract, WIN **020269.00**, for the **Culvert Rehabilitation** in the town of **Freeport**, County of **Cumberland**, Maine. The Work includes construction, maintenance during construction, warranty as provided in the Contract, and other incidental work.

The Contractor shall be responsible for furnishing all supervision, labor, equipment, tools supplies, permanent materials and temporary materials required to perform the Work including construction quality control including inspection, testing and documentation, all required documentation at the conclusion of the project, warranting its work and performing all other work indicated in the Contract.

The Department shall have the right to alter the nature and extent of the Work as provided in the Contract; payment to be made as provided in the same.

B. Time.

The Contractor agrees to complete all Work, except warranty work, on or before **October 15, 2016**. Further, the Department may deduct from moneys otherwise due the Contractor, not as a penalty, but as Liquidated Damages in accordance with Sections 107.7 and 107.8 of the State of Maine Department of Transportation Standard Specifications, November 2014 Edition and related Special Provisions.

C. Price.

The quantities given in the Schedule of Items of the Bid Package will be used as the basis for determining the original Contract amount and for determining the amounts of the required Performance Surety Bond and Payment Surety Bond, and that the amount of this offer is

Section 1 \$ _____

Section 2 \$ _____

Section 3 \$ _____

Performance Bond and Payment Bond each being 100% of the amount awarded under this Contract (see award amount in Section G below).

D. Contract.

This Contract, which may be amended, modified, or supplemented in writing only, consists of the Contract documents as defined in the Plans, Standard Specifications, November 2014 Edition, Standard Details November 2014 Edition as updated through advertisement, Supplemental Specifications, Special Provisions, Contract Agreement; and Contract Bonds. It is agreed and understood that this Contract will be governed by the documents listed above.

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2. The Contractor knows of no legal, contractual, or financial impediment to entering into this Contract.
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F. Offer.

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WIN 020269.00 Route 1 Culvert Rehabilitation plus other incidental work State of Maine, on which bids will be received until the time specified in the "Notice to Contractors" do(es) hereby bid and offer to enter into this contract to supply all the materials, tools, equipment and labor to construct the whole of the Work in strict accordance with the terms and conditions of this Contract at the unit prices in the attached "Schedule of Items".

The Offeror agrees to perform the work required at the price specified above and in accordance with the bids provided in the attached "Schedule of Items" in strict accordance with the terms of this solicitation, and to provide the appropriate insurance and bonds if this offer is accepted by the Government in writing.

As Offeror also agrees:

First: To do any extra work, not covered by the attached "Schedule of Items", which may be ordered by the Resident, and to accept as full compensation the amount determined upon a "Force Account" basis as provided in the Standard Specifications, November 2014 Edition, and as addressed in the contract documents.

Second: That the bid bond at 5% of the bid amount or the official bank check, cashier's check, certificate of deposit or U. S. Postal Money Order in the amount given in the "Notice to Contractors", payable to the Treasurer of the State of Maine and accompanying this bid, shall be forfeited, as liquidated damages, if in case this bid is accepted, and the undersigned shall fail to abide by the terms and conditions of the offer and fail to furnish satisfactory insurance and Contract bonds under the conditions stipulated in the Specifications within 15 days of notice of intent to award the contract.

Third: To begin the Work as stated in Section 107.2 of the Standard Specifications November 2014 Edition and complete the Work within the time limits given in the Special Provisions of this Contract.

Fourth: That this offer shall remain open for 30 calendar days after the date of opening of bids.

Fifth: The Bidder hereby certifies, to the best of its knowledge and belief that: the Bidder has not, either directly or indirectly, entered into any agreement, participated in

any collusion, or otherwise taken any action in restraint of competitive bidding in connection with its bid, and its subsequent contract with the Department.

IN WITNESS WHEREOF, the Contractor, for itself, its successors and assigns, hereby execute two duplicate originals of this Agreement and thereby binds itself to all covenants, terms, and obligations contained in the Contract Documents.

CONTRACTOR

Date

(Signature of Legally Authorized Representative
of the Contractor)

Witness

(Name and Title Printed)

G. Award.

Your offer is hereby accepted for (see checked boxes):

Section 1

Section 2

Section 3

Contract Amount: _____

This award consummates the Contract, and the documents referenced herein.

MAINE DEPARTMENT OF TRANSPORTATION

Date

By: David Bernhardt, Commissioner

Witness

SPECIAL PROVISION
SECTION 502
Fish Passage Weirs

Measurement & Payment

Weirs satisfactorily installed and accepted will be measured as one lump sum price, in accordance with the plans or authorized changes to the Plans. The accepted work will be paid for at the Contract lump sum price. Payment will be full compensation for installing aluminum sheeting and all incidentals necessary to complete the work satisfactorily.

Weir Plate Detail for aluminum fish weirs will be supplied to the Contractor before the Pre-Construction Meeting.

Add the following Pay Item and its associated Pay Unit:

Payment will be made under:

	<u>Pay Item</u>	<u>Pay Unit</u>
509.204	Aluminum Fish Weirs	Lump

SPECIAL PROVISION
SECTION 502
ANNULAR SPACE GROUTING

Description: This work shall consist of providing and placing non-shrink grout as described below. The annular space (void between the host and liner pipes) shall be completely grouted to support the liner and provide long-term stability. The Contractor shall provide testing of the materials and methods for compliance with the following requirements. Prior to any work the Contractor shall furnish an acceptable plan for performing and testing the grouting.

Preparation: After slip liner installation but prior to grouting, bulk heading of the ends and venting shall be constructed.

After bulk heading of the ends and venting, test the integrity of the installed liner pipe and constructed bulkheads for any leaks.

Planned Vents: The Contractor shall submit shop drawings or indicate in the installation plan the proposed number and location of vents relative to pipe diameter and stiffness for the grouting operations.

Materials: The grout material shall consist of portland cement (portland cement and fly ash) and/or additives as described in the following Subsections of Division 700 - Materials:

Portland Cement	701.01
Water	701.02
Air-Entraining Admixtures	701.03
Fine Aggregate	701.01
Fly Ash	701.10 Type F or C
Chemical Admixtures	701.04
Accelerating Admixtures	AASHTO M-194 Type "C"

(a) Compressive Strength: The grout shall have a minimum penetration resistance of 700 kPa [100 psi] in 24 hours when tested in accordance with ASTM C403 and a minimum compressive strength of 3500 kPa [500 psi] in 28 days when tested in accordance with ASTM C495 or C109.

(b) Performance Requirements: The Contractor shall submit the proposed grout mix, methods, plans and criteria of the grouting operations. The grouting system shall have sufficient gauges, monitoring devices and tests to determine the effectiveness of the grouting operation and to ensure compliance with the liner pipe specifications and design parameters.

(c) Mix Designs: One or more mixes shall be developed to completely fill the annular space based on the following requirements:

- (1) Size of annular void
- (2) Void (size) of the surrounding soil
- (3) Absence or presence of groundwater
- (4) Sufficient strength and durability to prevent movement of the liner pipe, and
- (5) Provide adequate retardation.

Qualifications: The Contractor shall demonstrate to the Resident its worker's capabilities of filling the annular space and performing their work in conformance with the Plans and the Specifications.

Grouting Equipment: The materials shall be mixed in equipment of sufficient size and capacity to provide the desired amount of grout material for each stage in a single operation. The equipment shall be capable of mixing the grout at densities required for the approved procedure and shall also be capable of changing density as dictated by field conditions any time during the grouting operation.

Injection Procedure and Pressure: The gauged pumping pressure shall not exceed the liner pipe Manufacturer's approved recommendations. Pumping equipment shall be of a size sufficient to inject grout at velocity and pressure relative to the size of the annular space. Gauges to monitor grout pressure shall be attached immediately adjacent to each injection port. The gauge shall conform to an accuracy of not more than one-half percent error over the full range of the gauge. The range of the gauge shall be not more than 100 percent greater than the design grout pressure. Pressure gauges shall be instrument oil filled and attached to a saddle type diaphragm seal (gauge saver) to prevent slogging with grout. All gauges shall be certified and calibrated in accordance with ANSI B40 Grade 2A.

Test Section: The Contractor shall be required to perform a test on each type of grout and grout system proposed to be used.

Submittals and Required Calculations: The Contractor shall submit the following to the Resident for his review and approval at least 30 working days prior to the start of the grouting operation:

- (1) The proposed grouting mix
- (2) The proposed densities and viscosities
- (3) Initial set time of the grout
- (4) The proposed grouting method
- (5) The maximum of injection pressures
- (6) The 24-hour and 28 day compressive strengths

- (7) Proposed grout stage volumes
- (8) Bulkhead designs
- (9) Buoyant force calculations
- (10) Flow control
- (11) Provisions for service connections
- (12) Pressure gauge certification
- (13) Vent location plans
- (14) Certification that grouting plan conforms with all provisions, cautions and restrictions or the liner manufacturer.

These shall be submitted as a complete package for a single or sample section only. The Contractor shall notify the Resident of any changes to be made in grouting.

Method of Measurement: Grout satisfactorily placed and accepted will be measured by cubic yard placed. Grout satisfactorily placed and accepted will be measured by the cubic yard, in accordance with the pay limits established, if such limits have been established.

Basis of Payment: The accepted work done under Annular Space Grouting including all forms, berms, bulkheads, pumping, and incidentals necessary will be **considered incidental to Item 509.201 Culvert Slip-lining.**

SPECIAL PROVISION
SECTION 509
ALUMINUM TUNNEL LINER PLATE

509.01 Description: This work shall consist of designing, furnishing, and inserting an aluminum alloy tunnel liner plate into an existing culvert and constructing seals at the ends of the new pipe and filling the voids between the new and existing culvert with grout in accordance with the plans and specifications and in reasonably close conformity with the lines and grades shown in the Contract Documents.

509.02 Material:

Liner Plates:

Liner Plates shall be fabricated from aluminum plates conforming to alloy 5052 as defined by ASTM B 209. Plates shall be punched and curved to suit the tunnel liner plate cross section and the tunnel geometry section as shown. Standard corrugated aluminum structural plate with 9" x 2-1/2" corrugations will not be considered for this project.

End plates shall be neatly cut to the skew and slope shown on the Plans. Burnt or cut edges shall be free of oxide and burrs.

All plates shall be punched for bolting on both longitudinal and circumferential seams and shall be so fabricated as to permit complete erection from the inside of the tunnel. The longitudinal seam shall be of the lapped type, with an offset equal to the gage of metal for the full width of plate to allow the cross section of the plate to be continuous through the seam. Circumferential bolt hole spacing shall be 6 1/4". Grout holes shall be two inches (2") in diameter and shall be provided as shown on the plans to permit grouting as the assembly of the liner plate proceeds.

Marking:

Individual plates shall be marked with identification numbers and letters that allow for clear field identification with respect to the approved shop drawings.

Bolts and Nuts:

All nuts and bolts used on the structure are to be galvanized steel.
Bolts and nuts shall be 5/8" in diameter and length as recommended by the manufacturer. Bolts shall conform to ASTM A 449, TYPE 1 OR ASTM A 307. For plate thickness less than 0.200", the bolts shall be A 307, GRADE A. All circumferential bolts may be A 307, GRADE A. Nuts shall conform to ASTM A 563, GRADE A, HEX. Galvanizing when required shall be in accordance with the requirements of ASTM B-695, CLASS 50.

509.03 Fabrication and Submittals:

The Contractor shall submit design calculations (assuming no structural contribution from the host structure) that include thickness calculations per AASHTO LRFD and shop drawings for the tunnel liner plate to the Department for approval. The liner plate material shall be one thickness larger than required by the AASHTO calculations for added durability. So if 0.150" plate is required structurally, the manufacturer will provide 0.175" plate. A Maine Licensed Professional Engineer shall sign and seal all structural design calculations and drawings. The Contractor shall prepare and submit Shop Drawings, erection/assembly diagrams, or other necessary Working Drawings in accordance with Section 100 of the Standard Specifications. These drawings will be reviewed and approved in accordance with the applicable requirements of Section 100. Drawings shall conform to Section 105.7 - Working Drawings.

509.04 General Construction Requirements:

Handle and assemble all elements of the structure in accordance with the manufacturer's instructions and the Standard Specification, except as modified herein, on the plans or as ordered by the Resident in writing.

The Contractor will dewater, inspect, and clean the existing culvert. The Contractor shall provide strutting and bracing to ensure the stability of the existing culvert during this operation.

The pipe sections shall be braced against the existing culvert so that the new pipe shall remain in place during grouting operations. The Contractor is responsible for assuring that the pipe does not lift, float or shift during the grouting operation. A minimum 25 mm [1 in] of grout shall be between the new and existing culverts. Bracing material shall not significantly impede grout flow into the annular space between the culverts.

Grout retaining bulkheads:

Place plywood or material of equivalent strength, in the annular space at each end of the culvert, to retain grout. Seals may be left in place providing they do not interfere with bank protection and/or fish passage.

Installation:

Liner plate shall be assembled in accordance with manufacturer's recommendations. Longitudinal seams shall be staggered between rings. Voids occurring between liner plate and existing structure or ground shall be grouted until completely filled. Grout material and method of grouting shall be reviewed by the manufacturer and approved by the engineer prior to the commencement of work.

509.09 Basis of Payment:

The accepted structure will be paid for at the respective Contract unit price per linear foot, complete in place, which price shall be full compensation for: design and engineering of proposed structures; furnishing all labor, materials, equipment necessary to manufacture, assemble and install the pipe complete and in place, and all incidental items required to complete the work, including: but not limited to dewatering, preparation of the bed, the horizontal end reinforcing ribs, cleaning, inspecting, strutting, bracing, skids, concrete grout filler, joint bands, seals, installing grout nipples, plugs, fittings, hardware, damaged pipe repair, bolts and the calibrated torque wrench for use by the Resident. Grout used to fill the annular space and backfill voids will be completed according to Special Provision Section 502, Annular Space Grouting.

Payment will be made under:

	<u>Pay Item</u>	<u>Pay Unit</u>
509.193	Aluminum Tunnel Liner Plate	Linear Foot

SPECIAL PROVISION
SECTION 509
CULVERT SLIPLINING
(Plastic Pipe)

Description: This work shall consist of inserting a new pipe into an existing culvert and constructing seals at the ends of the new pipe and filling the voids between the new and existing culvert pipe with grout in accordance with the plans and specifications.

General Construction Requirements: Handle and assemble all elements of the structure in accordance with the manufacturer's instructions, except as modified herein, on the plans or as ordered by the Resident in writing. The Contractor shall submit fabrication details including assembly drawings, pipe insertion methods, internal joint coupling and bracing details, to the Resident for approval. The Resident will be allowed a minimum of 10 working days to review the Contractor's submittal.

The Contractor will dewater, inspect, and clean the existing culvert. The Contractor shall provide strutting and bracing to ensure the stability of the existing culvert during this operation.

The Contractor may push or pull or use a combination of both to get the new pipe sections into place. When pushing is used, the jacking force must be uniformly distributed around the perimeter of the liner pipe to avoid the possibility of damaging the pipe due to a concentrated jacking load. The Contractor shall utilize skids in the existing culvert, to facilitate placement of the pipe sections. The displacement between adjacent pipe ends shall not exceed 13 mm [1/2 in].

The pipe sections shall be braced against the existing culvert so that the new pipe shall remain in place during grouting operations. The Contractor is responsible for assuring that the pipe does not "Float" during the grouting operation. A minimum 25 mm [1 in] of grout shall be between the new and existing culverts. Bracing material shall not significantly impede grout flow into the annular space between the culverts.

Seals: Place plywood or material of equivalent strength, in the annular space at each end of the culvert, to retain grout. Seals may be left in place providing they do not interfere with bank protection and/or fish passage.

Material:

Pipe and Fittings - Reference Specifications:

ASTM F-894: Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.

CSA B 137.1: Polyethylene Pipe, Tubing and Fittings for Cold Water Pressure Services.

ASTM D-3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

ISO 9002: Model for Quality Assurance in Production and Installation.

- 1) The pipe shall be manufactured from polyethylene resin compound with a minimum cell classification of PE 345464C in accordance with ASTM D3350. This material shall have a long term hydrostatic strength of 1600 psi when tested and analyzed by ASTM D2837, and shall be a Plastic Pipe Institute (PPI) listed compound.
- 2) The raw material shall contain a minimum of 2%, well dispersed, carbon black. Additives, which can be conclusively proven not to be detrimental to the pipe may also be used, provided the pipe produces meets the requirements of this standard.
- 3) The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification and from the same raw material supplier.
- 4) Compliance with the requirements of this paragraph shall be certified in writing by the pipe supplier.
- 5) Manufacturer's Quality System shall be certified by an appropriate independent body to meet the requirements of the ISO 9002 Quality Management Program.

Pipe Design

The pipe shall be designed as a stand alone direct burial pipe. The pipe shall be able to support the earth and live load by itself with no additional capacity from the existing pipe or the annular space grout.

1. The pipe shall be designed in accordance with the relationships of the ISO-modified formula (see ASTM F894).
2. The design pressure rating P shall be derived using the ISO modified formula and shall be its normal working pressuring in pounds per square inch at temperatures up to 73⁰F.
3. The Hydrostatic Design Stress shall be 800 psi for PE 3408 materials.

4. The pipe dimensions shall be as specified in manufacturer's literature.

Marking:

The following shall be continuously indent printed on the pipe or spaced at intervals not exceeding 1.5 m (5 feet).

1. Name and/or trademark of the pipe manufacturer.
2. Nominal pipe size
3. Dimension Ratio
4. The letters PE followed by the polyethylene grade per ASTM D3350, followed by the Hydrostatic Design basis in 100's of psi e.g. PE 3408.
5. Manufacturing Standard Reference e.g. ASTM F 894
6. A production code from which the date and place of manufacture can be determined.

Joining Methods:

The polyethylene pipe shall be joined by extrusion welding or other means in accordance with the manufacturer's recommendations and approved by the Resident.

The pipe manufacturer shall provide an outline of recommended field quality control procedures to be performed on the polyethylene system components.

Construction Requirements: The sections of pipe shall be assembled and joined together prior to insertion into the existing culvert. Assembly shall be accomplished above ground, either at the job-site or at a remote location. The pipe shall be welded in accordance with the manufacturer's recommendations and approved by the Resident.

The polyethylene liner pipe may be inserted into the existing pipe with a power winch and steel cable connected to the end of the pipe in an appropriate manner. The pipe manufacturer's recommendations should be followed regarding the most appropriate method of attaching the cable to the liner pipe. If required, a special pulling head may be attached to the end of the liner pipe to facilitate easy connection of the pulling cable.

Basis of Payment:

Payment for culvert slip-lining will be paid for at the Contract unit price per linear foot, complete in place. Culvert slip-lining includes full compensation for furnishing all labor, materials, equipment necessary to manufacture, assemble and install the pipe complete and in place, including: but not limited to dewatering, cleaning, inspecting, strutting, bracing, skids, concrete grout filler, joint bands, seals, installing grout nipples, plugs, fittings, hardware, and damaged pipe repair. Grout used to fill the annular space and backfill voids will be completed according to Special Provision Section 502, Annular Space Grouting.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
509.201 Culvert Slip Lining	Linear Foot

SPECIAL PROVISION
SECTION 517
SHOTCRETE

Description This work shall include preparation of existing surfaces and the application of a shotcrete mix by pneumatic pressure as a means of filling the voids between riprap stones as indicated on the plans, filling the interior wall voids between the granite stones in the existing culvert, and in accordance with this Special Provision.

Shotcrete shall conform to all requirements of ACI 506.2 “Specifications for Materials, Proportioning, and Application of Shotcrete”, published by the American Concrete Institute, Detroit, Michigan, except as modified by the requirements of this project specification. Shotcrete shall consist of an application of one or more layers of mortar or concrete conveyed through a hose and pneumatically projected at a high velocity against a prepared surface.

Shotcrete shall be produced by either a dry-mix or a wet-mix process. The wet-mix process consists of thoroughly mixing all the ingredients except accelerating admixtures but including the mixing water, introducing the mixture into the delivery equipment and delivering it, by positive displacement, to the nozzle. The wet-mix shotcrete shall then be air jetted from the nozzle at high velocity onto the surface. Dry-mix process is shotcrete without mixing water which is conveyed through the hose pneumatically and the mixing water is introduced at the nozzle. For additional descriptive information, the Contractor’s attention is directed to the American Concrete Institute Standard “Guide to Shotcrete (ACI 506R-90)”.

Qualifications The work shall be performed by fully qualified personnel experienced in this type of work.

1. The foreman shall have at least five years of shotcrete experience and at least two years as a nozzleman.
2. The nozzleman shall have at least two years recent experience of satisfactory work as a nozzleman.
3. Evidence of the foreman and nozzleman’s experience of satisfactory work in similar capacities elsewhere shall be provided.

Materials All materials for shotcrete shall conform to the following requirements.

Cement	AASHTO M-85, ASTM C150, Type I, II, III or IV.
Fine Aggregate	AASHTO M-6, ASTM C33 clean, natural.
Coarse Aggregate	AASHTO M-80, Class B for quality.
Water	Potable, clean, and free from substances deleterious to concrete and steel or elements that would stain.
Chemical Admixtures	ASTM C1141 and the following:
Water-reducer	AASHTO M-194, Type A, D, F, G or
Superplasticizer	ASTM C494 Type A, D, F, G

Air-Entraining Agent	AASHTO M-194/ASTM C260
Plasticizers	AASHTO M-194 Type A, D, F, G or ASTM C494
Mineral Admixtures	
Fly Ash	AASHTO M-295, ASTM C618 Type F or C
Silica Fume	ASTM C1240, 90% minimum silicon dioxide solids content, not to exceed 12% by weight of cement. In addition, silica fume shall conform to the requirements of Section 502.
Polypropylene Fibers	ACI Standard, Polypropylene Fibers, 1 inches in length, 1½ lb/yd ³
Steel Fibers	ASTM A820 Type I, II, or III, Deformed, Steel Fibers, 1 in to 1 ¾ inches in length, minimum aspect ratio of 60.
Curing Compounds	AASHTO M-148 Type 1 D of Type 2
Pre-packaged Shotcrete	ASTM C928

The use of other admixtures shall not be used unless approved by the Resident. Admixtures used to entrain air, to reduce water-cement ratio, to retard or accelerate setting time, or to accelerate the development of strength, shall be thoroughly mixed into the shotcrete at the rate specified by the manufacturer unless specified otherwise. Accelerating additives shall be compatible with the cement used, be non-corrosive to steel and shall not promote other detrimental effects such as cracking or excessive shrinkage. The maximum allowable chloride ion content of all ingredients shall not exceed 0.10% when tested to AASHTO T260.

Premixed and pre-packaged concrete products specifically manufactured as a shotcrete product may be provided for on-site mixed shotcrete if approved by the Resident. The packages shall contain materials conforming to the materials portion of this specification.

Materials Storage and Handling Materials shall be delivered, stored, and handled to prevent contamination, segregation, corrosion, or damage. Liquid admixtures shall be stored to prevent evaporation and freezing.

Cement shall be adequately stored to prevent moisture degradation and partial hydration. Cement that has become caked or lumpy shall not be used.

Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 in of aggregate piles in contact with the ground shall not be used.

Submittals The following submittals shall be provided by the Contractor for the Resident's review and approval. The Contractor will not be allowed to begin culvert repairs until all submittal requirements are satisfied and found acceptable to the Resident. Changes or deviations from the approved submittals must be resubmitted for approval. Adjustments in contract time will not be allowed for incomplete submittals.

At least 21 calendar days prior to initiating the work, the Contractor shall submit to the Resident the following:

1. Written documentation of the foreman's and nozzleman's qualifications and the proposed method of shotcrete placement.
2. Shotcrete mix design including:
 - a) Brand and type of Portland Cement used.
 - b) Source, gradation, and quality of aggregates as specified herein.
 - c) Proportions of mix by weight.
 - d) Proposed admixture, manufacturer, dosage, technical literature (when admixture allowed).
 - e) Compressive strength test results from the manufacturer's records, no older than six months, verifying the 28 day compressive strength.

Shotcrete Mix Design Aggregate for shotcrete shall meet the strength and durability requirement of AASHTO M-80 and M-43 and shall meet the following gradation requirements.

<u>Sieve Size</u>	<u>% Passing by Weight</u>
3/8 in	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	10 – 30
No. 100	2 – 10
No. 200	0-5
FM	2.3 to 3.1

- A. Proportioning Shotcrete shall be proportioned and delivered with a minimum cement content of 650 lb/yd³.
- B. Strength Requirements Shotcrete shall be proportioned to produce a mix capable of attaining 5000 psi compressive strength in 28 days. The average compressive strength of each set of three cores extracted from the test panels shall equal or exceed the specified compressive strength, with no individual core less than 75 percent of the specified compressive strength, in accordance with ACI 506.2R-95.

Mixing and Batching Mixing equipment shall be capable of thoroughly mixing the materials in sufficient quantity to maintain the placing continuity. Shotcrete shall be batched, delivered and placed within 90 minutes of mixing.

Field Quality Control Production test panels shall be required. Qualified personnel shall perform shotcreting and coring of the test panels with the Department's personnel present. The contractor shall provide equipment, materials and personnel as necessary to obtain shotcrete cores for testing including construction of test panel boxes, field curing requirements and coring. The Department will perform compressive strength testing.

Shotcrete final acceptance will be based on obtaining the specified 28 day compressive strength.

Shotcreting may commence upon initial approval of the design mix and nozzle men.

Production Test Panels At least one production test panel shall be furnished during each day of production of shotcrete. The production test panels shall be constructed simultaneously with the shotcrete facing installation at times designated by the Resident. Production test panels shall be made with the minimum dimensions of 18 x 18 inch and at least 6 inch thick.

Test Panel Curing, Test Specimen Extraction and Testing Immediately after shooting, the test panels shall be field moist cured by covering and tightly wrapping with a sheet of material meeting the requirements of ASTM C 171 until delivered to the testing lab or test specimens are extracted. The test panels shall not be immersed in water. The test panels for the first 24 hours after shooting shall not be disturbed.

At least three 3 inch diameter core samples shall be cut from each unreinforced production test panel for compressive strength testing. The Contractor shall extract the test specimens from test panels in the field within 48 hours of shooting the panel. The panels shall be kept in their forms when transported.

Cores shall not be taken from the outer 6 inch of test panels measured in from the outside edges of the panel's form.

The cores and container shall be clearly marked to identify the core locations. For production testing, the production section of the unformed superstructure repair represented by the production test panel cores shall be marked on the cores and the container. Immediately wrap cores in wet burlap or material in accordance with the requirements of ASTM C 171 and seal in a plastic bag. The Department shall take possession of the cores immediately after extraction. The remainder of the panels shall become the property of the contractor. The Department will perform the compressive strength testing.

Upon delivery to the testing lab, samples will be placed in the moist room until the time of test. When the test length of a core is less than twice the diameter, the correction factors given in AASHTO T 24/ASTM C 42 will be applied to obtain the compressive strength of individual cores. Three cores will be tested at 28 days for compressive strength per AASHTO T 24/ASTM C 42.

Construction Requirements

The construction sequence shall be in accordance with the approved submittal, unless otherwise approved by the Resident.

A. Equipment

1. The shotcreting equipment selected must be capable of metering the mix through a hose to the nozzle for projecting at high velocity onto the surface to be shotcreted.
2. The gun shall be either the double chamber or the rotary type capable of continuous delivery of material. Gaskets in the equipment must be kept in good condition to avoid reduced pressure and consequent reduced velocity of material through the hose.
3. The air compressor may be any standard type capable of sufficient pressures and volume of air to convey the material through the longest hose delivery. The air compressor capacity must have allowance for air used in removing rebound and other incidental work. The air hose shall be equipped with filters to prevent any oil or grease from contaminating the shotcrete.
4. Water pressure shall be maintained at a minimum 15 psi higher than the highest air pressure required for placing the material. Both air and water pressure shall be uniformly steady.

B. Surface Preparation: The Contractor shall trim vegetation and remove loose foreign materials from within the stone voids of which shotcrete will be applied. Care shall be taken not to disturb existing stones in place. When necessary, earth surfaces to which shotcrete is to be applied shall be firmly compacted. All surfaces shall be moistened before application of shotcrete. Shotcrete shall not be applied to mud, uncompacted earth, surfaces in standing water or frozen surfaces. All such prepared surfaces shall be inspected and accepted by the Resident prior to the application of shotcrete.

C. Placement: The Contractor shall have all equipment and materials required for curing available at the site and ready for use before placement of shotcrete begins. No shotcrete shall be placed except in the presence of the MaineDOT Resident. The Contractor shall give reasonable notice to the Resident each time a shotcrete placement is scheduled. Such notice shall be far enough in advance to give the Resident adequate time to inspect the surfaces of which the shotcrete is to be applied.

Shotcrete shall be delivered to the holes between stones by any means that will insure uniformity and prevent segregation.

The nozzle shall be held at an angle approximately perpendicular to the working face and at a distance so that rebound will be minimal and compaction will be maximized. Thickness, methods of support, air pressure, and rate of placement of shotcrete shall be controlled to prevent sagging or sloughing of freshly applied shotcrete.

The approximate depth of the finished grade of shotcrete between the stones shall be established prior to placement and must be accepted by the Resident. Approximately 75% of the voids or spaces between stones shall be filled with shotcrete.

The Resident may require more or less shotcrete to be applied in areas requiring special attention. The areas requiring special attention are to be identified prior to placement of shotcrete.

The shotcreting procedure may be corrected by adjusting the nozzle distance and orientation perpendicular to the surface, adjusting the water content of the shotcrete mix or other means acceptable to the Resident. Retempering of the mix will not be permitted. The shotcreted surface shall be broomed and roughened to insure proper bond of subsequent layers.

- D. Defective Shotcrete Surface defects shall be repaired as soon as possible after initial placement of the shotcrete. All shotcrete which lacks uniformity, which exhibits segregation, sagging, honeycombing, or lamination, or which contains any voids or sand pockets shall be removed and replaced with fresh shotcrete by the Contractor in accordance with this specification and to the satisfaction of the Resident.

A clearly defined pattern of continuous horizontal or vertical ridges or depressions at the reinforcing elements after they are covered will be considered an indication of insufficient cover of reinforcement or poor application and probable void. In this case, the application of shotcrete shall be immediately suspended and the work carefully inspected by the Resident. The Contractor shall implement and complete corrective measures prior to resuming the shotcrete operations.

- E. Finish Shotcrete Finish in riprap area shall be a natural gun finish and roughened before curing. Scraping or cutting to remove high spots shall not be done until the shotcrete has become stiff enough to withstand the pull of the cutting device.
- F. Weather Limitations Shotcrete shall not be placed without cold weather protection when the ambient temperature is below 40° F and falling and/or when the shotcrete is likely to be subjected to freezing temperatures before a minimum strength of 700 psi. Cold weather protection shall be maintained until the strength of the in-place shotcrete is greater than 750 psi. Cold weather protection shall include heating under tents, blankets, or other means acceptable to the Resident. The temperature of the shotcrete, when deposited, shall be above 50° F but less than 90° F.

Shotcrete application shall also be suspended during high winds and heavy rains when, in the opinion of the Resident, the quality of the application is not acceptable. Newly placed shotcrete exposed to rain that washes out cement or otherwise makes the shotcrete unacceptable to the Resident shall be removed and replaced. The Contractor shall provide adequately secured polyethylene sheeting or equivalent when adverse exposure to weather is anticipated.

G. Curing An approved curing cover (or compound) shall be applied within 18 hours after finishing. After surface water has evaporated from the finished surface, shotcrete exposed to sunlight shall be immediately treated for curing. Finished shotcrete shall be cured for a minimum of 48 hours before flushed with water, unless otherwise directed by the Resident, and flush water must be collected as per Section 656.

Safety Requirements Appropriate eye and dust protection equipment shall be used during shotcrete application. Cement and other admixtures are caustic and may cause eye, skin, and respiratory irritation unless safety measures are taken. Adequate ventilation shall be required. Nozzlemen and helpers shall as a minimum be equipped with gloves, respirators, eye protection and adequate protective clothing during the application of shotcrete. The Contractor is responsible for meeting all Federal, State, and Local Safety Code Requirements.

Method of Measurement The shotcrete used for the filling of voids between stones applied and accepted in accordance with the plans, will be measured by the cubic yard as determined from the theoretical yield of the design mix or in the case of transit mixed shotcrete, by delivery ticket as directed by the Resident.

Basis of Payment The accepted quantity of shotcrete used for the filling of voids between stones will be paid for at the Contract unit price per cubic yard for shotcrete. Payment for the unit price will be full compensation for preparing surfaces, applying shotcrete, constructing test panels, extracting cores, and furnishing all materials, equipment, labor, and incidentals necessary to complete the work.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
517.60 Shotcrete	Cubic Yard