

STATE OF DELAWARE

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YOU MUST PURCHASE  
THE PROPOSAL IN ORDER  
TO SUBMIT A BID.



DEPARTMENT OF TRANSPORTATION

BID PROPOSAL

for

CONTRACT T200809003.01

FEDERAL AID PROJECT NO. IM-N056(35)

SR1/I-95 INTERCHANGE  
NEW CASTLE COUNTY

PROSPECTIVE BIDDERS ARE ADVISED THAT THERE WILL BE A MANDATORY PRE-BID MEETING FOR THIS CONTRACT ON JANUARY 12 **14**, 2011 at 10:30 A.M. IN THE ~~DelDOT ADMINISTRATION CENTER, 800 BAY ROAD, U.S. ROUTE 113 SOUTH, DOVER, DELAWARE, 19903~~ **DELAWARE TECHNICAL AND COMMUNITY COLLEGE, STANTON CAMPUS CONFERENCE CENTER, 400 STANTON-CHRISTIANA ROAD, NEWARK, DE 19713.**

Completion Date 763564 - SPECIAL BIDDING PROCEDURES

SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION  
DELAWARE DEPARTMENT OF TRANSPORTATION  
AUGUST 2001

Bids will be received in the Bidder's Room, Transportation Administration Center, 800 Bay Road, Dover, Delaware until 2:00 P.M. local time, **THURSDAY, MAY 26, 2011.**





STATE OF DELAWARE  
DEPARTMENT OF TRANSPORTATION  
PO BOX 778  
DOVER, DELAWARE 19903

JACK MARKELL  
GOVERNOR

CLEON L. CAULEY, SR  
ACTING SECRETARY

**VIA OVERNIGHT DELIVERY**

(302) 760-2030  
FAX (302) 739-2254

May 12, 2011

Contract No. T200809003.01  
Federal Aid Project No. IM-N056(35)  
SR1/I-95 INTERCHANGE  
New Castle County

Ladies and Gentlemen:

Enclosed is Addendum No. 4 for the referenced contract consisting of the following:

**NOTE: Technical questions concerning Addendum 4 will be entertained until noon on May 20, 2011.**

**The date for the receipt of bids remains THURSDAY, May 26, 2011. Bids will be received until 2:00 P.M., Local Time, the Bidder's Room (B1.11.01), in the DeIDOT Transportation Administration Center, 800 Bay Road, U.S. Route 113 South, Dover, DE.**

1. One (1) page, Bid Proposal Cover, revised, to be substituted for the same page in the Proposal.
2. One (1) page, Location/Description, page i, revised, to be substituted for the same page in the Proposal.
3. Six (6) pages, Table of Contents, pages iii through viii, revised, to be substituted for the same pages in the Proposal.
4. Item Number 623002 , **DELETED**, to be removed from the Proposal.
5. Two (2) pages, General Notices, pages 1 through 2, revised, to be substituted for the same

pages in the Proposal and one (1) page, page 2A, new, to be added to the Proposal..

6. One (1) page, Critical DBE Requirement, page 13, revised, to be substituted for the same page in the Proposal.
7. One (1) page, State of Delaware Prevailing Wages, page 33, revised, to be substituted for the same page in the Proposal.
8. Four (4) pages, Special Provisions, 602616 - Waterproofing PCC Masonry Surfaces, pages 89A through 89D, new, to be added to the Proposal.
9. Seven (7) pages, Special Provisions, 602772 - Mechanically Stabilized Earth Walls, pages 92 through 97A, revised, to be substituted for the same pages in the Proposal.
10. Nine (9) pages, Special Provisions, 602774 - Masonry For Light Pole Foundation (CY), pages 99 through 107, revised, to be substituted for the same pages in the Proposal.
11. Twelve (12) pages, Special Provisions, 605500 - Cantilever-Sign Support and Foundation, pages 128 through 139, revised, to be substituted for the same pages in the Proposal.
12. Twelve (12) pages, Special Provisions, 605523 - Box Truss Type Overhead Sign Supports and Foundations, pages 142 through 153, revised, to be substituted for the same pages in the Proposal.
13. One (1) page, Special Provisions, 619501 - Production Pile Restrike, page 184, new, to be added to the Proposal.
14. Four (4) pages, Special Provisions, 619519 - Dynamic Pile Testing By Contractor, pages 185 through 188, revised, to be substituted for the same pages in the Proposal.
15. One (1) page, Special Provisions, 720512 - P. C. C. Safety Barrier Permanent, Double Face, page 200, revised, to be substituted for the same page in the Proposal.
16. Two (2) pages, Special Provisions, 720532 - Install Portable Impact Attenuator, pages 205 through 206, revised, to be substituted for the same pages in the Proposal.
17. Two (2) pages, Special Provisions, 744520 - Conduit Junction Well, pages 227 through 228, revised, to be substituted for the same pages in the Proposal.
18. Four (4) pages, Special Provisions, 746519 - Aluminum Light Standard With Single Davit Arm, 40' Pole, pages 242 through 245, revised, to be substituted for the same pages in the Proposal.
19. One (1) page, Special Provisions, 746537 - Relocating Existing Light Standards, page 246, revised, to be substituted for the same page in the Proposal.
20. One (1) page, Special Provisions, 746592 - Replace/Adapt Existing Transformer Bases, page 248, revised, to be substituted for the same page in the Proposal.
21. Two (2) pages, Special Provisions, 746620 - Relocation of Existing Lighting Tower, pages

- 251 through 252, revised, to be substituted for the same pages in the Proposal.
22. Five (5) pages, Special Provisions, 746621 - Lighting Towers and Installation, pages 253 through 257, revised, to be substituted for the same pages in the Proposal.
  23. Three (3) pages, Special Provisions, 746717 - Electric Service on Pedestal with Service Riser, pages 260 through 262, revised, to be substituted for the same pages in the Proposal.
  24. Six (6) pages, Special Provisions, 759501 - Field Office, Special, pages 309 through 314, revised, to be substituted for the same pages in the Proposal.
  25. One (1) page, Special Provisions, 763564 - Special Bidding Procedure, page 340, revised, to be substituted for the same page in the Proposal.
  26. Five (5) pages, Utility Statement, revised, to be substituted for the same pages in the Proposal.
  27. Thirty-Two (32) pages, Bid Proposal Forms, pages 1 through 32, revised, to be substituted for the same pages in the Proposal.
  28. One (1) page, Bid Proposal Forms/Breakout Sheet 2A, Item 602772 - Mechanically Stabilized Earth Walls, revised, to be substituted for the same page in the Proposal.
  29. One (1) page, Bid Proposal Forms/Breakout Sheet 13, Item 605757 - High Performance Steel, revised, to be substituted for the same page in the Proposal.
  30. Three (3) items, Break-out Sheets, Bid Proposal Forms, items 207501, 720532, and 720534, **DELETED**, to be removed from the Proposal.
  31. Two (2) pages, Form Sheets, item 720532 - Install Portable Impact Attenuator and item 720534 - Furnish Portable Impact Attenuator, new, to be added to the Proposal.
  32. One (1) page, Diesel Fuel Cost Price Adjustment Option, revised, to be substituted for the same page in the Proposal.
  33. Ninety-five (95) sheets, Construction Plans, sheets 4, 5, 76, 77, 78, 79, 196, 198, 208, 210, 215, 219, 223, 226, 227, 255, 257, 267, 269, 271, 308, 310, 320, 322, 323, 350, 352, 363, 367, 369, 370, 373, 395, 397, 408, 410, 451, 452, 453, 454, 455, 456, 457, 458, 461, 461A, 465, 466, 467, 468, 469, 473, 474, 476, 477A, 478, 486, 487, 488, 493, 495, 504, 514, 518, 522, 525, 533, 537, 542, 546, 551, 555, 559, 570, 575, 583, 590, 596, 602, 610, 619, 624, 625, 670, 685, 699, 700, 700A, 701, 703, 704, 706, 707, 709A, and 710, **revised**, to be substituted for the same sheets in the Plan Set, two (2) sheets, sheets 462A and 477A1, **new**, to be added to the Plan Set, and two (2) sheets, sheets 462 and 477, **DELETED**, to be removed from the Plan Set.
  34. For proposal holders with the electronic bid option only, Amendment Disk No. 3.

Please note the revisions listed above and submit your bid based upon this information.

Sincerely,

A handwritten signature in black ink, appearing to read "Scott S. Gottfried". The signature is written in a cursive style with a horizontal line underlining the first part of the name.

Scott S. Gottfried  
Competitively Bid Contracts Coordinator  
:ssg  
Enclosures



STATE OF DELAWARE  
DEPARTMENT OF TRANSPORTATION  
PO BOX 778  
DOVER, DELAWARE 19903

JACK MARKELL  
GOVERNOR

CAROLANN WICKS  
SECRETARY

**VIA OVERNIGHT DELIVERY**

(302) 760-2030  
FAX (302) 739-2254

April 6, 2011

Contract No. T200809003.01  
Federal Aid Project No. IM-N056(35)  
SR1/I-95 INTERCHANGE  
New Castle County

Ladies and Gentlemen:

Enclosed is Addendum No. 3 for the referenced contract consisting of the following:

1. One (1) page, Bid Proposal Cover, revised, to be substituted for the same page in the Proposal.
2. One (1) page, Critical DBE Requirements, page 13, revised, to be substituted for the same page in the Proposal.
3. One (1) page, Special Provisions, 207501 - Sheeting and Shoring , page 56, DELETED, to be remove from the Proposal.
4. Six (6) pages, Special Provisions, 602772 - Mechanicallly Stabilized Earth Walls, pages 92 through 97, revised, to be substituted for the same pages in the Proposal and one (1) page, page 97A, new, to be added to the Proposal.
5. One (1) page, Special Provisions, 602773 - PCC Masonry for Mechanically Stabilized Earth Walls, page 98, revised, to be substituted for the same page in the Proposal.
6. Three (3) pages, Special Provisions, Post Tensioning Grout, pages 108-110, revised, to be substituted for the same pages in the Proposal.
7. One (1) page, Special Provisions, 602785 - Portland Cement Concrete Masonry, 6000 PSI, page 111, revised, to be substituted for the same page in the Proposal and one (1) page, page 111A, new, to be added to the Proposal.
8. One (1) page, Special Provisions, 602786 - Portland Cement Concrete Masonry, 8000

PSI, page 112, revised, to be substituted for the same page in the Proposal and one (1) page, page 112A, new, to be added to the Proposal..

9. Fourteen (14) pages, Special Provisions, 602787 - Post Tensioned Pier Cap Bonded System, pages 113-126, revised, to be substituted for the same pages in the Proposal and three (3) pages, pages 126A, 126B, and 126C, new, to be added to the Proposal.
10. Five (5) pages, Special Provisions, 605537 - Urethane Paint System, New Steel, pages 154 through 158, revised, to be substituted for the same pages in the Proposal.
11. Three (3) pages, Special Provisions, 605757 - High Performance Steel, pages 169 through 171, revised, to be substituted for the same pages in the Proposal.
12. One (1) page, Special Provisions, 720612 - Impact Attenuator, Special, page 213, revised, to be substituted for the same page in the Proposal.
13. Two (2) pages, Special Provisions, 746507 - Installation of Steel Pole (Equal to or Greater than 17' and less than 40') and 746528 - Installation of Steel Pole (Equal to or Greater than 40'), pages 238-239, DELETED, to be removed from the Proposal.
14. One (1) page, Special Provisions, 746733 - Removal of Steel Pole (Equal to or Greater than 17' and less than 40') and 746734 - Removal of Steel Pole (Equal to or Greater than 40'), page 262, DELETED, to be removed from the Proposal.
15. Five (5) pages, Special Provisions, 748547 - Retroreflective Preformed Patterned Contract Markings 9", pages 287 through 291, revised, to be substituted for the same pages in the Proposal.
16. Two (2) pages, Special Provisions, 763626 - Diesel Fuel Cost Price Adjustment, pages 341 through 342, revised, to be substituted for the same pages in the Proposal.
17. Four (4) pages, Special Provisions, 763655 - Steel Cost Price Adjustment, pages 343A, 343B, 343C, and 343D, new, to be added to the Proposal.
18. One (0) pages, Special Provisions, , pages through , revised, to be substituted for the same pages in the Proposal.
19. Thirty-one (31) pages, Bid Proposal Forms, pages 1-32, revised, to be substituted for the same pages in the Proposal.
20. Five (5) items, Break-out Sheets, Bid Proposal Forms, items 602772, 602773, 602787, 605523, and 737527, revised, to be substituted for the same items in the Proposal.
21. One (1) page, Diesel Fuel Cost Price Adjustment Option Form, new, to be added to the Proposal.
22. One hundred fifty-four (154) sheets, Construction Plans, sheets 4, 6-48, 63-65, 68-69, 71, 73, 74-78, 143,182-185, 194a, 196, 202, 208, 209, 211-213, 231, 255, 261, 267, 268, 271, 273, 279, 281, 282, 308, 314, 320, 321, 350, 356, 361, 363, 366, 395, 401, 408, 409, 414, 416, 418, 420, 421, 448, 449, 453, 456, 464-466, 470-473, 475-479, 483, 484, 486,

493,494, 503, 514, 516, 519,523, 525, 526, 528, 531, 533, 534, 537, 538, 542, 543, 546, 551, 555, 559, 564, 565, 570, 575, 583, 586, 587, 590, 596, 602, 610, 619, 636, 638, 681a, 682 and 704, revised, to be substituted for the same sheets in the Plan Set, Fifteen (15) sheets, sheets 711a, 713a, 716a, 717a, 718a, 719a, 720a, 721a, 722a, 723a, 724a, 725a, 726a, 727a, and 728a, new, added to the Plans Set and Fifteen (15) sheets, sheets 711, 713, 716-728, DELETED, to be removed from the Plan Set.

23. For proposal holders with the electronic bid option only, Amendment Disk No. 2.

Please note the revisions listed above and submit your bid based upon this information.

Sincerely,

A handwritten signature in black ink, appearing to read "Scott S. Gottfried". The signature is fluid and cursive, with a prominent initial "S" and a long, sweeping underline.

Scott S. Gottfried  
Competitively Bid Contracts Coordinator  
:ssg  
Enclosures





STATE OF DELAWARE  
DEPARTMENT OF TRANSPORTATION  
PO BOX 778  
DOVER, DELAWARE 19903

JACK MARKELL  
GOVERNOR

CAROLANN WICKS  
SECRETARY

**VIA OVERNIGHT DELIVERY**

(302) 760-2030  
FAX (302) 739-2254

February 24, 2011

Contract No. T200809003.01  
Federal Aid Project No. IM-N056(35)  
SR1/I-95 INTERCHANGE  
New Castle County

Ladies and Gentlemen:

Enclosed is Addendum No. 2 for the referenced contract consisting of the following:

**NOTE: The original bid date of March 3, 2011 will be extended approximately 6 – 8 weeks. We have begun preparing addendum 3 which will include the revised bid date and required changes to specifications and plan sheets. Technical questions concerning Addendum 2 will be entertained until noon on March 11, 2011**

1. Six (6) pages, Table of Contents, pages iii - viii , revised, to be substituted for the same page in the Proposal.
2. Standard Specification, Item Numbers 604000, 612021, 612022, 612023, 612025, 612529 and 612030 quantities have been revised.
3. Special Provision 202505 - Settlement Platform's unit of measurement has change from LF to EACH.
4. One (1) page, Special Provisions, 619501 - Production Pile Restrike, page 184, revised, to be substituted for the same page in the Proposal.
5. Four (4) pages, Special Provisions, 614508 - Water Main & Accessories, pages 176 through 179, **DELETED**, to be removed from the Proposal.
6. Thirty-one (31) pages, Bid Proposal Forms, pages 1 through 31, revised, to be substituted for the same pages in the Proposal.
7. One (1) page, Bid Proposal Forms, Breakout Sheet 14, 614508 - Water Main & Accessories, **DELETED**, to be removed from the Proposal.

8. Fifty-one (51) sheets, Construction Plans, sheets 7, 14, 37, 130, 141, 182, 183, 184, 185, 194A, 196, 198, 208, 214, 218, 222, 257, 267, 271, 310, 320, 323, 350, 352, 363, 397, 408, 453, 461, 464, 465, 468, 469, 473, 474, 493, 494, 533, 537, 542, 546, 551, 555, 570, 575, 583, 590, 596, 602, 610, and 619, revised, to be substituted for the same sheets in the Plan Set.
9. One (1) sheet, Construction Plans, sheet 461A, new, to be added to the Plan Set.
10. For proposal holders with the electronic bid option only, Amendment Disk No. 1.

Please note the revisions listed above and submit your bid based upon this information.

Sincerely,

A handwritten signature in black ink, appearing to read "Scott S. Gottfried". The signature is fluid and cursive, with the first name "Scott" and last name "Gottfried" clearly legible.

Scott S. Gottfried  
Competitively Bid Contracts Coordinator  
:ssg  
Enclosures



STATE OF DELAWARE  
DEPARTMENT OF TRANSPORTATION  
PO BOX 778  
DOVER, DELAWARE 19903

JACK MARKELL  
GOVERNOR

CAROLANN WICKS  
SECRETARY

**VIA E-MAIL DELIVERY**

(302) 760-2030  
FAX (302) 739-2254

January 10, 2011

Contract No. T200809003.01  
Federal Aid Project No. IM-N056(35)  
SR1/I-95 INTERCHANGE  
New Castle County

Ladies and Gentlemen:

Enclosed is Addendum No. 1 for the referenced contract consisting of the following:

1. One (1) page, Bid Proposal Cover, revised, to be substituted for the same page in the Proposal.

**NOTE THE MANDATORY PRE-BID MEETING DATE AND LOCATION HAS CHANGED TO FRIDAY JANUARY 14, 2011 AT THE DELAWARE TECHNICAL AND COMMUNITY COLLEGE, STANTON CAMPUS CONFERENCE CENTER :**

**PROSPECTIVE BIDDERS ARE ADVISED THAT THERE WILL BE A MANDATORY PRE-BID MEETING FOR THIS CONTRACT ON JANUARY 12 *14*, 2011 at 10:30 A.M. IN THE ~~DelDOT ADMINISTRATION CENTER, 800 BAY ROAD, U.S. ROUTE 113 SOUTH, DOVER, DELAWARE, 19903~~ *DELAWARE TECHNICAL AND COMMUNITY COLLEGE, STANTON CAMPUS CONFERENCE CENTER, 400 STANTON-CHRISTIANA ROAD, NEWARK, DE 19713.***

Please note the revisions listed above.

Sincerely,

A handwritten signature in black ink, appearing to read "Scott S. Gottfried", is written over a faint, larger version of the same signature.

Scott S. Gottfried  
Competitively Bid Contracts Coordinator  
:ssg  
Enclosures



**Contract No.T200809003.01**

**Federal Aid Project No. IM-N056(35)**

**SR1/I-95 INTERCHANGE  
NEW CASTLE COUNTY**

**LOCATION**

These improvements are located in NEW CASTLE County more specifically shown on the Location Map(s) of the enclosed Plans.

**DESCRIPTION**

The improvements consist of furnishing all labor and materials. This project is part of an overall turnpike improvement program to reduce congestion at the SR 1 / I-95 interchange. Construction of a new multiple-lane interchange will reduce the traffic weaving around the Christiana Mall, SR 1, and I-95 areas. The project will separate out local traffic movements from high speed movements., and other incidental construction in accordance with the location, notes and details shown on the plans and as directed by the Engineer.

**COMPLETION DATE**

All work on this contract must be complete in accordance with the date as determined by **Special Provision 763564 - SPECIAL BIDDING PROCEDURES.**

**It is the Department's intent to issue a Notice to Proceed such that work starts on or about September 12, 2011.**

**ELECTRONIC BIDDING**

This project incorporates the electronic bidding system Expedite 5.2b. Bidders wishing to use the electronic bidding option will find a bid file on the CD.

**PROSPECTIVE BIDDERS NOTES:**

1. No retainage will be withheld on this contract.
2. The Department has adopted an External Complaint Procedure. The procedure can be viewed on our website at: [www.deldot.gov/information/business/](http://www.deldot.gov/information/business/), or you may request a copy by calling (302) 760-2555.
3. Please note the Special Provision titled **Changes to Project Documents During Advertisement**. The Department is using an alternative method of providing bid documents for this contract.
4. Please note there are **TRAINEES** required for this project, and proposed Trainee Plans must be submitted as required. Number of required programs is listed in the Training Special Provisions within Contract General Notices. The program(s) must be submitted within 10 Calendar Days of notification of apparent low bidder status. Contract Award will not take place until acceptable On-the-Job (OJT) program plans are received by the Civil Rights Group of the Department. **Failure of the apparent low bidder to present copies of acceptable OJT Trainee Programs within 10 Calendar Days of notification of apparent low bidder status shall create a non-rebuttable presumption that the bid is non-responsive.**
5. **SUBMISSION REMINDER:**
  - a. Copy(ies) of the American Traffic Safety Services Association (ATSSA) Certification(s) when listed in the applicable plan notes.
  - b. Standard Specification Section 110.08 Site Reviewer requires that the name and DNREC certification number of each Site Reviewer if required shall be submitted to the Department. The level of certification and number required are listed in the applicable plan notes.

Note: Items a. and b. above require copies of the current certifications for those individuals proposed for use on this Contract.

Failure of the apparent low bidder to present copies of the required certifications within ten (10) calendar days after the bid opening shall create a non-rebuttable presumption that the bid is non-responsive.

**STATE OF DELAWARE  
CONSTRUCTION ITEMS UNITS OF MEASURE**

<b>English Code</b>	<b>English Description</b>	<b>Multiply By</b>	<b>Metric Code</b>	<b>Metric Description</b>	<b>Suggested CEC Metric Code</b>
ACRE	Acre	0.4047	ha	Hectare	HECTARE
BAG	Bag	N/A	Bag	Bag	BAG
C.F.	Cubic Foot	0.02832	m <sup>3</sup>	Cubic Meter	M3
C.Y.	Cubic Yard	0.7646	m <sup>3</sup>	Cubic Meter	M3
EA-DY	Each Day	N/A	EA-DY	Each Day	EA-DY
EA-MO	Each Month	N/A	EA-MO	Each Month	EA-MO
EA/NT	Each Night	N/A	EA-NT	Each Night	EA/NT
EACH	Each	N/A	EA	Each	EACH
GAL	Gallon	3.785	L	Liter	L
HOUR	Hour	N/A	h	Hour	HOUR
INCH	Inch	25.4	mm	Millimeter	MM
L.F.	Linear Foot	0.3048	m	Linear Meter	L.M.
L.S.	Lump Sum	N/A	L.S.	Lump Sum	L.S.
LA-MI	Lane Mile	1.609	LA-km	Lane-Kilometer	LA-KM
LB	Pound	0.4536	kg	Kilogram	KG
MFBM	Thousand Feet of Board Measure	2.3597	m <sup>3</sup>	Cubic Meter	M3
MGAL	Thousand Gallons	3.785	kL	Kiloliter	KL
MILE	Mile	1.609	km	Kilometer	KM
S.F.	Square Foot	0.0929	m <sup>2</sup>	Square Meter	M2
S.Y.	Square Yard	0.8361	m <sup>2</sup>	Square Meter	M2
SY-IN	Square Yard-Inch	0.8495	m <sup>2</sup> -25 mm	Square Meter-25 Millimeter	M2-25 MM
TON	Ton	.9072	t	Metric Ton (1000kg)	TON
N.A.*	Kip	4.448	kN	Kilonewton	N.A.*
N.A.*	Thousand Pounds per Square Inch	6.895	MPa	Megapascal	N.A.*

\*Not used for units of measurement for payment.

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**CERTIFICATION**

**BID BOND**

**GENERAL NOTICES**

**CONTRACT LIQUIDATED DAMAGES**

The contract drawings and notes provide a sequence of construction for this contract.

**FAILURE TO OPEN PROJECT TO UNRESTRICTED HIGHWAY TRAFFIC ON TIME**

The total number of calendar days proposed by the bidder shall become the contract time for this project and shall be the basis for the determination of any contract time related adjustments to the contract.

Road User Costs of \$35,000.00/calendar day have been established for this project.

Interim Road User costs for delays in opening lanes along both SR1 and I95 will be enforced according to the below charts:

<b>Northbound I-95</b>			
<b>Contractor Penalties for Failure to Reopen Lanes</b>			
<b>Time All Lanes Reopened ("Verizon" time)</b>	<b>One Lane Closure</b>	<b>Two Lane Closure</b>	<b>Three Lane Closure / Full Closure with Detour</b>
5:00 AM to 5:14 AM	No Penalty	No Penalty	No Penalty
5:15 AM to 5:29 AM	\$2,000	\$2,000	\$2,000
5:30 AM to 5:44 AM	\$2,500	\$2,500	\$3,000
5:45 AM to 5:59 AM	\$3,000	\$3,000	\$4,000
6:00 AM to 6:14 AM	\$4,000	\$5,000	\$5,000
6:15 AM to 6:29 AM	\$5,000	\$8,000	\$12,000
6:30 AM to 6:44 AM	\$6,000	\$10,000	\$18,000
6:45 AM to 6:59 AM	\$8,000	\$15,000	\$25,000
Not Open by 7:00 AM	\$10,000	\$20,000	\$35,000
<b>For every hour, or portion thereof, after 7:00 AM, \$5,000 will be assessed up to a Day Total of \$80,000.</b>			
<b>Southbound I-95</b>			
<b>Contractor Penalties for Failure to Reopen Lanes</b>			
<b>Time All Lanes Reopened ("Verizon" time)</b>	<b>One Lane Closure</b>	<b>Two Lane Closure</b>	<b>Three Lane Closure / Full Closure with Detour</b>
5:00 AM to 5:14 AM	No Penalty	No Penalty	No Penalty
5:15 AM to 5:29 AM	No Penalty	\$1,000	\$2,000
5:30 AM to 5:44 AM	No Penalty	\$1,250	\$2,500
5:45 AM to 5:59 AM	No Penalty	\$1,500	\$3,000
6:00 AM to 6:14 AM	No Penalty	\$2,000	\$4,000
6:15 AM to 6:29 AM	No Penalty	\$2,500	\$5,000
6:30 AM to 6:44 AM	No Penalty	\$3,000	\$6,000
6:45 AM to 6:59 AM	No Penalty	\$4,000	\$8,000
Not Open by 7:00 AM	\$5,000	\$5,000	\$10,000
<b>For every hour, or portion thereof, after 7:00 AM, \$2,000 will be assessed up to a Day Total of \$35,000.</b>			

<b>Northbound SR 1</b>	
<b>Contractor Penalties for Failure to Reopen Lanes</b>	
Time All Lanes Reopened ("Verizon" time)	One Lane Closure / Full Closure with Detour
5:00 AM to 5:14 AM	No Penalty
5:15 AM to 5:29 AM	\$2,000
5:30 AM to 5:44 AM	\$2,500
5:45 AM to 5:59 AM	\$3,000
6:00 AM to 6:14 AM	\$4,000
6:15 AM to 6:29 AM	\$5,000
6:30 AM to 6:44 AM	\$6,000
6:45 AM to 6:59 AM	\$8,000
Not Open by 7:00 AM	\$10,000
<b>For every hour, or portion thereof, after 7:00 AM, \$2,000 will be assessed up to a Day Total of \$35,000.</b>	

<b>Southbound SR 1</b>	
<b>Contractor Penalties for Failure to Reopen Lanes</b>	
Time All Lanes Reopened ("Verizon" time)	One Lane Closure / Full Closure with Detour
6:00 AM to 6:14 AM	No Penalty
6:15 AM to 6:29 AM	\$2,000
6:30 AM to 6:44 AM	\$2,500
6:45 AM to 6:59 AM	\$3,000
7:00 AM to 7:14 AM	\$4,000
7:15 AM to 7:29 AM	\$5,000
7:30 AM to 7:44 AM	\$6,000
7:45 AM to 7:59 AM	\$8,000
Not Open by 8:00 AM	\$10,000
<b>For every hour, or portion thereof, after 8:00 AM, \$2,000 will be assessed up to a Day Total of \$35,000.</b>	

Examples of calculations for assessment of Road User Cost:

Failure to have all lanes of traffic open (Two Lane Closure) to I-95 Northbound until 6:12 AM, local time:

A RUC of \$5,000.00 will be assessed.

Failure to have all lanes of traffic open (Three Lane Closure) to I-95 Northbound until 9:10 AM, local time:

7:00 AM through 7:01 AM = \$35,000.00;  
 7:02 AM through 7:59 AM = \$5,000.00;  
 8:00 AM through 8:59 AM = \$5,000.00;  
 9:00 AM through 9:10 AM = \$5,000.00;

A RUC of \$50,000 will be assessed.

Liquidated Damages of \$6,400/calendar day have been established for this project.

Both the Road User Costs and Liquidated Damages will be assessed for each calendar day over the established calendar days proposed in the bid when the contractor's work activities require lane width and shoulder width restrictions. There is no limit on the amount that can be assessed. Assessment of Road User Costs and /or Liquidated Damages will be made by change order.

Liquidated Damages will be assessed for each calendar day over the established calendar days proposed in the bid when the contractor's work activities do not require lane width or shoulder width restrictions. There is no limit on the amount that can be assessed. Assessment of Liquidated Damages will be made by change order.

The Engineer will be the sole approving authority as to when the project is complete after traffic is returned to the ultimate alignment and when the contractors work activities will permit highway traffic ultimate lane width and shoulder widths.

The Contractor is advised that in order to complete the project on or before the number of calendar days proposed in his bid, it may be necessary to provide multiple crews, work overtime and/or weekends and holidays.

CONSTRUCTION PHASING

**If the contractor desires to revise the construction phasing** presented in the contract documents in order to affect the project's completion schedule and base their calendar days on this revision, the contractor must submit an official revised construction phasing plan for the Department's review no later than forty - two (42) calendar days prior to the bid opening. The Department will review the contractor's revised phasing and respond on whether this phasing is acceptable within fourteen (14) calendar days. During this time the Department will determine whether the Contractor's revised proposals for the construction phasing conforms to the project requirements.

After receiving the Department's comments, the contractor has the option to schedule a one-on-one review meeting with the Department within seven (7) calendar days to discuss their proposal and the Department's comments. At that review meeting, documented by a court reporter, all comments and discussion will be held confidential. During the bidding process, all potential ideas presented by the Contractor will be kept confidential. The contractor's revised phasing plan should show in detail the following (but not limited to):

- All appropriate schedule information in order for the Department to make a determination of whether the revised phasing plan is viable.
- A written statement that no additional environmental impacts are incurred due to the phasing changes.

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- A written statement that all of the traffic restrictions and lane closure parameters shown on the Department's plans and contract documents are not affected by the phasing changes.

After receiving the Department's comments and/or the contractor's requested review meeting, the Contractor shall bid the job at their own risk; in conjunction with the plans, specification, parameters, complete contract documents and all comments received on their proposed revised phasing plan.

Should a revised construction phasing plan be submitted by the Contractor within forty-two (42) calendar days prior to bid opening, it shall not be reviewed and should the contractor submit a bid based on a revised proposal that has not been accepted by the Department, it shall be at the contractor's risk.

SPECIFICATIONS:

The specifications entitled "Delaware Standard Specifications, for Road and Bridge Construction, August, 2001", hereinafter referred to as the Standard Specifications, Supplemental Specifications, the Special Provisions, notes on the Plans, this Bid Proposal, and any addenda thereto shall govern the work to be performed under this contract.

CLARIFICATIONS:

Under any Section or Item included in the Contract, the Contractor shall be aware that when requirements, responsibilities, and furnishing of materials are outlined in the details and notes on the Plans and in the paragraphs preceding the "Basis of Payment" paragraph in the Standard Specifications or Special Provisions, no interpretation shall be made that such stipulations are excluded because reiteration is not made in the "Basis of Payment" paragraph.

ATTESTING TO NON-COLLUSION:

The Department requires as a condition precedent to acceptance of bids a sworn statement executed by, or on behalf of, the person, firm, association, or corporation to whom such contract is to be awarded, certifying that such person, firm, association, or corporation has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with such contract. The form for this sworn statement is included in the proposal and must be properly executed in order to have the bid considered.

QUANTITIES:

The quantities shown are for comparison of bids only. The Department may increase or decrease any quantity or quantities without penalty or change in the bid price.

REQUIREMENT BY DEPARTMENT OF LABOR FOR SWORN PAYROLL INFORMATION

Delaware Code, Title 29, Chapter 69, Section 6960, Paragraph

"Every contract based upon these specifications shall contain a stipulation that certified sworn payroll reports be maintained by every contractor and subcontractor performing work upon the site of construction. The contractor and subcontractor shall keep and maintain the sworn payroll information for a period of two (2) years from the last day of the work week covered by the payroll. A certified copy of these payroll reports shall be made available:

1. For inspection or furnished upon request to a representative of the Department of Labor;
2. Upon request by the public or for copies thereof. However, a request by the public must be made through the Department of Labor. The requesting party shall, prior to being provided the records, reimburse the costs of preparation by the Department of Labor in accordance with the Department's copying fee policy. The public shall not be given access to the records at the principal office of the contractor or subcontractor; and
3. The certified payroll records shall be on a form provided by the Department of Labor or shall contain the same information as the form provided by the Department and shall be provided within ten (10) days from receipt of notice requesting the records from the Department of Labor."

Contractor may contact:

Department of Labor  
Division of Industrial Affairs  
4425 No. Market Street  
Wilmington, DE 19802

Telephone (302) 761-8200

PREFERENCE FOR DELAWARE LABOR:

Delaware Code, Title 29, Chapter 69, Section 6962, Paragraph (d), Subsection (4)b

"In the construction of all public works for the State or any political subdivision thereof, or by firms contracting with the State or any political subdivision thereof, preference in employment of laborers, workmen or mechanics shall be given to bona fide legal citizens of the State who have established citizenship by residence of at least 90 days in the State. Each public works contract for the construction of public works for the State or any political subdivision thereof shall contain a stipulation that any person, company or corporation who violates this section shall pay a penalty to the Secretary of Finance equal to the amount of compensation paid to any person in violation of this section."

CONFLICT WITH FEDERAL STATUTES OR REGULATIONS:

Delaware Code, Title 29, Chapter 69, Section 6904, Paragraph (a)

"If any provision of this subchapter conflicts or is inconsistent with any statute, rule or regulation of the federal government applicable to a project or activity, the cost of which is to be paid or reimbursed in whole or in part by the federal government, and due to such conflict or inconsistency the availability of federal funds may be jeopardized, such provision shall not apply to such project or activity."

For all contracts which are identified as Federal-aid projects by having a Federal-aid number inserted in the appropriate space on the cover sheet of the proposal, if there is a conflict between the above Section 6962 and Federal law ~~and~~ the requirements of the above Section 6962 shall not apply.

FEDERAL LABOR AND EMPLOYMENT REQUIREMENTS

Federal Regulation 23 CFR § 635.117(b) Labor and employment, states:

"No procedures or requirement shall be imposed by any State which will operate to discriminate against the employment of labor from any other State, possession or territory of the United States, in the construction of a Federal-aid project."

EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS:

Delaware Code, Title 29, Chapter 69, Section 6962, Paragraph (d), Subsection (7)

"a. As a condition of the awarding of any contract for public works financed in whole or in part by State appropriation, such contracts shall include the following provisions:

During the performance of this contract, the contractor agrees as follows:

I. The contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex or natural origin. The contractor will take positive steps to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting agency setting forth this nondiscrimination clause.

ii. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, sex or national origin.'

TAX CLEARANCE:

As payments to each vendor or contractor aggregate \$2,000, the Division of Accounting will report such vendor or contractor to the Division of Revenue, who will then check the vendor or contractor's compliance with tax requirements and take such further action as may be necessary to insure compliance.

LICENSE:

A person desiring to engage in business in this State as a contractor shall obtain a license upon making application to the Division of Revenue. Proof of said license compliance to be made prior to, or in conjunction with, the execution of a contract to which he has been named.

TO REPORT BID RIGGING ACTIVITIES:

CALL 1-800-424-9071

The U. S. Department of Transportation (DOT) operates the above toll-free "hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m. eastern time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report such activities.

The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

CONVICT PRODUCED MATERIALS:

(a) Materials produced after July 1, 1991, by convict labor may only be incorporated in a Federal-aid highway construction project if such materials have been:

- (1) Produced by convicts who are on parole, supervised release, or probation from a prison or
- (2) Produced in a qualified prison facility and the cumulative annual production amount of such materials for use in Federal-aid highway construction does not exceed the amount of such materials produced in such facility for use in Federal-aid highway construction during the 12-month period ending July 1, 1987.

(b) Qualified prison facility means any prison facility in which convicts, during the 12-month period ending July 1, 1987, produced materials for use in Federal-aid highway construction projects.

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION  
TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY  
(EXECUTIVE ORDER 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

<u>Goals for Minority Participation In Each Trade</u>	<u>Goals for Female Participation In Each Trade</u>
12.3% (New Castle County)	6.9% (Entire State)
14.5% (Kent & Sussex Counties)	

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for

both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the Executive Order and the regulations in CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is NEW CASTLE County.

REV. 11-3-80

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT  
SPECIFICATIONS (EXECUTIVE ORDER 11246)

1. As used in these specifications:

- a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
- b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
- c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
- d. "Minority" includes:
  - i. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
  - ii. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
  - iii. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
  - iv. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which

it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through 7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Program Office or from the Federal procurement contracting offices. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

- a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
- b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
- c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.
- d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
- e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

- f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
  - g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foreman, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
  - h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.
  - i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
  - j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.
  - k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
  - l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
  - m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
  - n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
  - o. Document and maintain a record of all solicitations of offers for subcontractors from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
  - p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work force participating, makes

a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is under utilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Order of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment-related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

\* \* \* \* \*

### TRAINING SPECIAL PROVISIONS

This Training Special Provision supersedes subparagraph 7b of the Special Provision entitled "Specific Equal Employment Opportunity Responsibilities", (Attachment 1), and is in implementation of 23 U.S.C. 140(a).

As part of the contractor's equal employment opportunity affirmative action program, training shall be provided as follows:

The contractor shall provide on-the-job training aimed at developing full journeyman in the type of trade or job classification involved. **The number of trainees to be trained under the special provision will be Six (6).** In the event the contractor subcontracts a portion of the contract work, he shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided however, that the contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The contractor shall also insure that this Training Special Provision is made applicable to such subcontract.

Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year apprenticeship or training.

The number of trainees shall be distributed among the work classification on the basis of the contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment. Prior to commencing construction, the contractor shall submit to the Department of Highways and Transportation for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the contractor shall specify the starting time for training in each of the classifications. The contractor will be credited for each trainee employed by him on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeyman status is a primary objective of this Training Special Provision. Accordingly, the contractor shall make every effort to enroll minority trainees and women (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The contractor will be responsible for demonstrating the steps that he has taken in pursuance thereof, prior to a determination as to whether the contractor is in compliance with this Training Special Provision. This training commitment is not intended, and not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which he has successfully completed a training course leading to journeyman status or in which he has been employed as a journeyman. The contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used the contractor's records should document the findings in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the contractor and approved by the Department of Highways and Transportation and the Federal Highway Administration. The Department of Highways and Transportation and the Federal Highway Administration shall approve a program if it is reasonably calculated to meet the equal employment opportunity obligations of the contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved but not necessarily sponsored by the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work the classification covered by the program. It is the intention of these provisions that the training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the division office. Some off-site training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the contractor will be reimbursed 80 cents per hour of training given an employee on this contract in accordance with an approved training program. As approved by the engineer, reimbursement will be made for training persons in excess of the number specified herein. This reimbursement will be made even though the contractor receives additional training program funds from other sources, provided such other sources does not specifically prohibit the contractor from receiving other reimbursement. Reimbursement for off-site training indicated above may only be made to the contractor where he does one or more of the following and the trainees are concurrently employed on a Federal-aid project; contributes to the cost of the training; provides the instruction of the trainee; or pays the trainee's wages during the off-site training period.

No payment shall be made to the contractor if either the failure to provide the required training, or the failure to hire the trainees as a journeyman, is caused by the contractor and evidences a lack of good faith on the part of the contractor in meeting the requirements of this Training Special Provision. It is normally expected that a trainee will begin his training on the project as soon as feasible after start of work utilizing the skill involved

and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program. It is not required that all trainees be on board for the entire length of the contract. A contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Trainees will be paid a least 60 percent of the appropriate minimum journeymen's rate specified in the contract for the first half of the of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees is an approved existing program are enrolled as trainees on this project. In fact case, the appropriate rates approved by the Department of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provisions.

The contractor shall furnish the trainee a copy of the program he will follow in providing the training.

The contractor shall provide each trainee with a certification showing the type and length of training satisfactorily completed.

The contractor will provided for the maintenance of records and furnish periodic reports documenting his performance under this Training Special Provision.

\* \* \* \* \*

INTERMODAL SURFACE TRANSPORTATION EFFICIENCY ACT & TRANSPORTATION EQUITY ACT

Recipients of Federal-aid highway funds authorized under Titles I (other than Part B) and V of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), or Titles I, III, and V of the Transportation Equity Act for the 21st Century (TEA-21) are required to comply with the regulations of 49 Code of Federal Regulations (CFR) Part 26 - Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs.

\* \* \* \* \*

DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM SPECIFICATION

The U.S. Department of Transportation (DOT) requires that the Delaware Department of Transportation continue the established Disadvantaged Business Enterprise (DBE) Program for participation in U.S. DOT programs and that the program follow the final rules as stated in 49 CFR Part 26 and the Department's approved DBE Program plan.

The following definitions apply to this subpart:

Disadvantaged Business Enterprise or DBE means a for-profit small business concern (1) that is at least 51 percent owned by one or more individuals who are both socially and economically disadvantaged or, in the case of a corporation, in which 51 percent of the stock is owned by one or more such individuals; and, (2) whose management and daily business operations are controlled by one or more of the socially and economically disadvantaged individuals who own it.

DOT-assisted contract means any contract between a recipient and a contractor (at any tier) funded in whole or in part with DOT financial assistance, including letters of credit or loan guarantees, except a contract solely for the purchase of land.

Good Faith Efforts means efforts to achieve a DBE goal or other requirement of this part which, by their scope, intensity, and appropriateness to the objective, can reasonably be expected to fulfill the program requirement.

Joint Venture means an association of a DBE firm and one or more other firms to carry out a single, for-profit business enterprise, for which the parties combine their property, capital, efforts, skills and knowledge, and in which the DBE is responsible for a distinct, clearly defined portion of the work of the contract and whose share in the capital contribution, control, management, risks, and profits of the joint venture are commensurate with its ownership interest.

Race-conscious measure or program is one that is focused specifically on assisting only DBEs, including women-owned DBEs.

Race-neutral measure or program is one that is, or can be, used to assist all small businesses. For the purposes of this part, race-neutral includes gender neutrality.

Small Business concern means, with respect to firms seeking to participate as DBEs in DOT-assisted contracts, a small business concern as defined pursuant to section 3 of the Small Business Act and Small Business Administration regulations implementing it (13 CFR part 121) that also does not exceed the cap on average annual gross receipts specified in 49 CFR §26.65(b).

Socially and economically disadvantaged individuals means any individual who is a citizen (or lawfully admitted permanent resident) of the United States and who is - (1) any individual who a recipient finds to be a socially and economically disadvantaged individual on a case-by-case basis; (2) any individual in the following groups, members of which are rebuttably presumed to be socially and economically disadvantaged:

- (i) Black Americans which includes persons having origins in any of the Black racial groups of Africa;
- (ii) Hispanic Americans which includes persons of Mexican, Puerto Rican, Cuban, Dominican, Central or South American, or other Spanish or Portuguese culture or origin, regardless of race;
- (iii) Native Americans which includes persons who are American Indians, Eskimos, Aluets, or Native Hawaiians;
- (iv) Asian-Pacific Americans which includes persons whose origins are from Japan, China, Taiwan, Korea, Burma (Myanmar), Vietnam, Laos, Cambodia (Kampuchea), Thailand, Malaysia, Indonesia, the Philippines, Brunei, Samoa, Guam, the U.S. Trust Territories of the Pacific Islands (Republic of Palau), the Commonwealth of the Northern Marianas Islands, Macao, Fiji, Tonga, Kiribati, Juvalu, Nauru, Federated States of Micronesia, or Hong Kong;
- (v) Subcontinent Asian Americans which includes persons whose origins are from India, Pakistan, Bangladesh, Bhutan, the Maldives Islands, Nepal or Sri Lanka;
- (vi) Women;
- (vii) Any additional groups whose members are designated as socially and economically disadvantaged by the SBA, at such time as the SBA designation becomes effective.

DelDOT will establish specific goals for each particular DOT-assisted project which will be expressed as a percentage of the total dollar amount of contract bid.

The specific contract goals for this contract are:

**Disadvantaged Business Enterprise 10 % Percent**

DelDOT continues to reserve the right to approve DBE subcontractors and all substitutions of DBE subcontractors prior to award and during the time of the contract.

Bidders are required to submit with their bids the completed DBE Program Assurance portion of the Certification document which will state the bidders intent of meeting the goals established for this contract; or in the instance where a contractor cannot meet the assigned DBE Goals for this contract, he/she shall at the time of bid submit documentation required to verify that he/she has made a Good Faith Effort to meet the DBE Goals. Guidance for submitting a Good Faith Effort is identified in the next section and in the DBE Program Plan. Further, the apparent low bidder must submit to DelDOT within ten (10) calendar days after the bid opening, executed originals of each and every DBE subcontract to satisfy contract goals consistent with the DBE Program Assurance submitted as part of the bid package.

No contract work shall be performed by a DBE subcontractor until the executed DBE subcontract is approved in writing by DelDOT and the Department has issued the required Notice to Proceed. Any DBE subcontract relating to work to be performed pursuant to this contract, which is submitted to DelDOT for approval, must contain all DBE subcontractor information, the requirements contained in this contract, and must be fully executed by the contractor and DBE subcontractor.

Each contract between the prime contractor and each DBE subcontractor shall at the minimum include the

following:

1. All pertinent provisions and requirements of the prime contract.
2. Description of the work to be performed by the DBE subcontractor.
3. The dollar value of each item of work to be completed by the DBE subcontractor and the bid price of each item of work to be completed by the DBE subcontractor.

\* \* \* \* \*

### CRITICAL DBE REQUIREMENTS

A bid may be held to be non-responsive and not considered if the required DBE information is not provided. In addition, the bidder may lose its bidding capability on Department projects and such other sanctions as the Department may impose. It is critical that the bidder understands:

1. In the event that the bidder cannot meet the DBE goal as set forth in this specification, he/she shall at the time of bid submit to the Department that percentage of the DBE Goal that will be met, if any, on the written and notarized assurance made a part of this contract. The contractor shall also at the time of bid submit all documentation that the contractor wishes to have the Department consider in determining that the contractor made a Good Faith Effort to meet contract DBE Goals. The Department will not accept Good Faith Effort documentation other than on the scheduled date and time of the bid opening. However, the Department may ask for clarification of information submitted should the need arise.
2. A bid which does not contain either a completely executed DBE Program Assurance and/or Good Faith Effort documentation, where appropriate, shall be declared non-responsive and shall not be considered by the Department.
3. ~~Bidders shall submit with their bid the name, address, age of the firm, and the gross annual receipts of each DBE and non-DBE subcontractor that supplied a quote or a bid to the prime on this project. The Department has attached this document following the Certification document at the end of the Proposal. Failure to submit this information will result in the bid being declared non-responsive and will be rejected.~~
4. Failure of the apparent low bidder to present originals of all DBE subcontracts to substantiate the volume of work to be performed by DBE's as indicated in the bid within ten (10) calendar days after the bid opening shall create a **non-rebuttable** presumption that the bid is not responsive.
5. Bidders are advised that failure to meet DBE Goals during the term of the contract may subject them to Department sanctions as identified in the DBE Program Plan.
6. In the execution of this contract, the successful bidder agrees to comply with the following contract clauses:

**Prompt Payment:** The prime contractor/consultant receiving payments shall, within 30 days of receipt of any payment, file a statement with the Department on a form to be determined by the Department that all subcontractors furnishing labor or material have been paid the full sum due them at the stage of the contract, except any funds withheld under the terms of the contract as required by Chapter 8, Title 17 of the Delaware Code, annotated and as amended. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of DelDOT. This clause applies to both DBE and non-DBE subcontractors.

**Retainage:** The prime contractor agrees to return retainage to each subcontractor within 15 calendar days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of DelDOT. This clause covers both DBE and non-DBE subcontractors. As guidance, once a subcontractor has satisfactorily completed the physical work, and has given to the prime contractor a certified statement that all laborers, lower tier contractors, and materialmen who have furnished labor and materials to the subcontractor have been paid all monies due them, the prime contractor shall return retainage to the subcontractor within 15 calendar days.

7. In the execution of this contract, the successful bidder agrees to comply with the following contract

assurance and will include this same language in each subcontractor contract:

"The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such remedy as the recipient deems appropriate." 49 CFR Section 26.13

8. In addition to this specification, bidders must comply with all provisions of the rules and regulations adopted by the U.S. Department of Transportation for DBE participation in U.S. DOT and DeIDOT Programs (49 CFR Part 26) and the Delaware Department of Transportation Disadvantaged Business Enterprise Program Plan; each of which is hereby incorporated and made part of this specification. Bidders are also reminded that they must be responsible and responsive bidders in all other aspects aside from the DBE Program in order to be awarded the contract.

\* \* \* \* \*

GUIDANCE FOR GOOD FAITH EFFORT

When the DBE Goals established for a contract by DeIDOT are not met, the contractor shall demonstrate good faith efforts to meet the DBE contract goals. The contractor shall demonstrate that the efforts made were those that a contractor actively and aggressively seeking to meet the goals established by DeIDOT would make, given all relevant circumstances. Evidence of this good faith effort will be submitted with the bid at the time of the bid opening.

The contractor is expected to demonstrate good faith efforts by actively and aggressively seeking out DBE participation in the project to the maximum extent, given all relevant circumstances. Following are the kinds of efforts that may be taken but are not deemed to be exclusive or exhaustive and DeIDOT will consider other factors and types of efforts that may be relevant:

1. Efforts made to select portions of the work proposed to be performed by DBEs in order to increase the likelihood of achieving the stated goal. Selection of portions of work are required to at least equal the goal for DBE utilization specified in this contract.
2. Written notification at least ten (10) calendar days prior to the opening of a bid soliciting DBE interest in participating in the contract as a subcontractor or supplier and for specific items of work.
3. Efforts made to obtain and negotiate with DBE firms for specific items of work:
  - a. Description of the means by which firms were solicited (i.e. by telephone, e-mail, written notice, advertisement).
  - b. The names, addresses, telephone numbers of DBE's contacted, the dates of initial contact; and whether initial solicitations of interest were followed-up by contacting the DBEs to determine with certainty whether the DBEs were interested.
  - c. A description of the information provided to DBE firms regarding the plans, specifications and estimated quantities for portions of the work to be performed.
  - d. A statement of why additional agreements with DBE's were not reached in order to meet the projected goal.
  - e. Listing of each DBE contacted but not contracted and the reasons for not entering a contract.
4. Efforts made to assist DBEs that need assistance in obtaining bonding, insurance, or lines of credit required by the contractor.
5. Reasons why certified DBEs are not available or not interested.
6. Efforts to effectively use the services of available disadvantaged community organizations; disadvantaged contractor's groups; local, state and federal DBE assistance offices; and other organizations that provide assistance in recruitment and placement of DBEs.

The following are examples of actions that may not be used as justification by the contractor for failure to meet DBE contract goals:

1. Failure to contract with a DBE solely because the DBE was unable to provide performance and/or payment bonds.
2. Rejection of a DBE bid or quotation based on price alone.
3. Rejection of a DBE because of its union or non-union status.
4. Failure to contract with a DBE because the contractor normally would perform all or most of the work in the contract.

Administrative reconsideration:

Within five (5) days of being informed by DelDOT that it is not responsive because it has not documented sufficient good faith efforts, a bidder may request administrative reconsideration. Bidder should make this request in writing to the following reconsideration official: Director of Administration, DelDOT, P. O. Box 778, Dover, Delaware 19903. The reconsideration official will not have played any role in the original determination that the bidder did not document sufficient good faith efforts.

As part of this reconsideration, the bidder will have the opportunity to provide written documentation or argument concerning the issue of whether it met the goal or made adequate good faith efforts to do so. The bidder will have the opportunity to meet in person with the reconsideration official, explaining the basis for finding that the bidder did or did not meet the goal or make adequate good faith efforts to do so. The final decision made by the reconsideration official will be communicated to the bidder in writing. The result of the reconsideration process is not administratively appealable to the U.S. Department of Transportation.

\* \* \* \* \*

**REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS**

(Exclusive of Appalachian Contracts)

**I. GENERAL**

1. These contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.
2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.
3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.
4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:

Section I, paragraph 2;  
Section IV, paragraphs 1, 2, 3, 4, and 7;  
Section V, paragraphs 1 and 2a through 2g.

5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the DOL, or the contractor's employees or their representatives.

6. **Selection of Labor:** During the performance of this contract, the contractor shall not:

- a. discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as

specified in Attachment A), or

- b. employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

## II. NONDISCRIMINATION

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

**1. Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630 and 41 CFR 60) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

- a. The contractor will work with the State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.
- b. The contractor will accept as his operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job training."

**2. EEO Officer:** The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of EEO and who must be assigned adequate authority and responsibility to do so.

**3. Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

- a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.
- b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.
- c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minority group

employees.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

**4. Recruitment:** When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minority groups in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)

c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group applicants will be discussed with employees.

**5. Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.

**6. Training and Promotion:**

a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.

**7. Unions:** If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent will include the procedures set forth below:

a. The contractor will use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.

b. The contractor will use best efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the SHA and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the SHA.

**8. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:** The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.

a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.

b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of DBE construction firms from SHA personnel.

c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.

**9. Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.

a. The records kept by the contractor shall document the following:

- (1) The number of minority and non-minority group members and women employed in each work classification on the project;
- (2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women;
- (3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and
- (4) The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.

b. The contractors will submit an annual report to the SHA each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. If on-the job training is being required by special provision, the contractor will be required to collect and report training data.

### III. NONSEGREGATED FACILITIES

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.

b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, timeclocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of \$10,000 or more and that it will retain such certifications in its files.

### IV. PAYMENT OF PREDETERMINED MINIMUM WAGE

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural minor collectors, which are

exempt.)

**1. General:**

a. All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account [except such payroll deductions as are permitted by regulations (29 CFR 3) issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c)] the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in paragraphs 4 and 5 of this Section IV.

b. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

**2. Classification:**

a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.

b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:

(1) the work to be performed by the additional classification requested is not performed by a classification in the wage determination;

(2) the additional classification is utilized in the area by the construction industry;

(3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and

(4) with respect to helpers, when such a classification prevails in the area in which the work is performed.

c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe

benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage and Hour Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary

e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.

### **3. Payment of Fringe Benefits:**

a. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.

b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

### **4. Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:**

#### **a. Apprentices:**

(1) Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.

(2) The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the

registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

(3) Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator for the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

(4) In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

(1) Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration.

(2) The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(3) Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which case such trainees shall receive the same fringe benefits as apprentices.

(4) In the event the Employment and Training Administration withdraws approval of a training program, the contractor or subcontractor will no

longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. **Helpers:**

Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV.2. Any worker listed on a payroll at a helper wage rate, who is not a helper under an approved definition, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

**5. Apprentices and Trainees (Programs of the U.S. DOT):**

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

**6. Withholding:**

The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the SHA contracting officer may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

**7. Overtime Requirements:**

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

**8. Violation:**

**Liability for Unpaid Wages; Liquidated Damages:** In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of \$10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

**9. Withholding for Unpaid Wages and Liquidated Damages:**

The SHA shall upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 8 above.

**V. STATEMENTS AND PAYROLLS**

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

**1. Compliance with Copeland Regulations (29 CFR 3):**

The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

**2. Payrolls and Payroll Records:**

a. Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.

b. The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.

c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely all of the information required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

d. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his/her agent who pays or supervises the payment of the

persons employed under the contract and shall certify the following:

(1) that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V, and that such information is correct and complete;

(2) that such laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR 3;

(3) that each laborer or mechanic has been paid not less than the applicable wage rate and fringe benefits or cash equivalent for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

e. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 2d of this Section V.

f. The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.

g. The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

## **VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR**

1. On all Federal-aid contracts on the National Highway System, except those which provide solely for the installation of protective devices at railroad grade crossings, those which are constructed on a force account or direct labor basis, highway beautification contracts, and contracts for which the total final construction cost for roadway and bridge is less than \$1,000,000 (23 CFR 635) the contractor shall:

a. Become familiar with the list of specific materials and supplies contained in Form FHWA-47, "Statement of Materials and Labor Used by Contractor of Highway Construction Involving Federal Funds," prior to the commencement of work under this contract.

b. Maintain a record of the total cost of all materials and supplies purchased for and incorporated in the work, and also of the quantities of those specific materials and supplies listed on Form FHWA-47, and in the units shown on Form FHWA-47.

c. Furnish, upon the completion of the contract, to the SHA resident engineer on Form FHWA-47 together with the data required in paragraph 1b relative to materials and supplies, a final labor summary of all contract work indicating the total hours worked and the total amount earned.

2. At the prime contractor's option, either a single report covering all contract work or separate reports for the contractor and for each subcontract shall be submitted.

**VII. SUBLETTING OR ASSIGNING THE CONTRACT**

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the State. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635).

a. "Its own organization" shall be construed to include only workers employed and paid directly by the prime contractor and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor, assignee, or agent of the prime contractor.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph 1 of Section VII is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the SHA contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the SHA contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

**VIII. SAFETY: ACCIDENT PREVENTION**

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the SHA contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

**IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS**

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons

concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

**NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS**

18 U.S.C. 1020 reads as follows:

*"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or*

*Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or*

*Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;*

*Shall be fined not more than \$10,000 or imprisoned not more than 5 years or both."*

**X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT**

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$100,000 or more.)

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.
2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.
3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.
4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

**XI. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION**

**1. Instructions for Certification - Primary Covered Transactions:**

(Applicable to all Federal-aid contracts - 49 CFR 29)

- a. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.
- b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.
- c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause of default.
- d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- e. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is submitted for assistance in obtaining a copy of those regulations.
- f. The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.
- g. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
- h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the nonprocurement portion of the "Lists of Parties Excluded From Federal Procurement or Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.
- i. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- j. Except for transactions authorized under paragraph f of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

\* \* \* \* \*

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Primary Covered Transactions**

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
  - a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
  - b. Have not within a 3-year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
  - c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph 1b of this certification; and
  - d. Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

\* \* \* \* \*

**2. Instructions for Certification - Lower Tier Covered Transactions:**

(Applicable to all subcontracts, purchase orders and other lower tier transactions of \$25,000 or more - 49 CFR 29)

- a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.
- b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
- c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.
- d. The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
- e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
- f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower

tier covered transactions and in all solicitations for lower tier covered transactions.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

\* \* \* \* \*

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Covered Transactions:**

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

\* \* \* \* \*

**XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING**

(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 - 49 CFR 20)

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:
  - a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
  - b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for

each such failure.

3. The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

Form FHWA-1273 (Rev. 3-94)

DIFFERING SITE CONDITIONS,

SUSPENSIONS OF WORK and SIGNIFICANT CHANGES IN THE CHARACTER OF WORK:

Differing site conditions: During the progress of the work, if subsurface or latent physical conditions are encountered at the site differing materially from those indicated in the contract or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract are encountered at the site, the party discovering such conditions shall promptly notify the other party in writing of the specific differing conditions before they are disturbed and before the affected work is performed.

Upon written notification, the engineer will investigate the conditions, and if he/she determines that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any work under the contract, an adjustment, excluding loss of anticipated profits, will be made and the contract modified in writing accordingly. The engineer will notify the contractor of his/her determination whether or not an adjustment of the contract is warranted.

No contract adjustment which results in a benefit to the contractor will be allowed unless the contractor has provided the required written notice.

No contract adjustment will be allowed under their clause for any effects caused on unchanged work.

Suspensions of work ordered by the engineer: If the performance of all or any portion of the work is suspended or delayed by the engineer in writing for an unreasonable period of time (not originally anticipated, customary or inherent to the construction industry) and the contractor believes that additional compensation and/or contract time is due as a result of such suspension or delay, the contractor shall submit to the engineer in writing a request for adjustment within 7 calendar days of receipt of the notice to resume work. The request shall set forth the reasons and support for such adjustment.

Upon receipt, the engineer will evaluate the contractor's request. If the engineer agrees that the cost and/or time required for the performance of the contract has increased as a result of such suspension and the suspension was caused by conditions beyond the control of and not the fault of the contractor, its suppliers, or subcontractors at any approved tier, and not caused by weather, the engineer will make an adjustment (excluding profit) and modify the contract in writing accordingly. The engineer will notify the contractor of his/her determination whether or not an adjustment of the contract is warranted.

No contract adjustment will be allowed unless the contractor has submitted the request for adjustment within the time prescribed.

No contract adjustment will be allowed under this clause to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided for or excluded under any other term or condition of this contract.

Significant changes in the character of work: The engineer reserves the right to make, in writing, at any time during the work, such changes in quantities and such alterations in the work as are necessary to satisfactorily complete the project. Such changes in quantities and alterations shall not invalidate the contract nor release the surety, and the contractor agrees to perform the work as altered.

If the alterations or changes in quantities significantly change the character of the work under the contract, whether or not changed by any such different quantities or alterations, an adjustment, excluding loss of anticipated profits, will be made to the contract. The basis for the adjustment shall be agreed upon prior to the performance of the work. If a basis cannot be agreed upon, then an adjustment will be made either for or against the contractor in such amount as the engineer may determine to be fair and equitable.

The term "significant change" shall be construed to apply only to the following circumstances:

- (A) When the character of the work as altered differs materially in kind or nature from that involved or included in the original proposed construction or
- (B) When a major item of work, as defined elsewhere in the contract, is increased in excess of 125 percent or decreased below 75 percent of the original contract quantity. Any allowance for an increase in quantity shall apply only to that portion in excess of 125 percent of original contract item quantity, or in case of a decrease below 75 percent, to the actual amount of work performed.

PREVAILING WAGES

Included in this proposal are the minimum wages to be paid various classes of laborers and mechanics as determined by the Department of Labor of the State of Delaware in accordance with Title 29 Del.C. §6960, relating to wages and the regulations implementing that Section.

Title 29 Del.C. §6960 relating to wages further stipulates "that the employer shall pay all mechanics and laborers employed directly upon the site of the work, unconditionally and not less often than once a week and without subsequent deduction or rebate on any account, the full amounts accrued at time of payment, computed at wage rates not less than those stated in the specifications, regardless of any contractual relationship which may be alleged to exist between the employer and such laborers and mechanics", and ... "that the scale of wages to be paid shall be posted by the employer in a prominent and easily accessible place at the site of the work, and that there may be withheld from the employer so much of accrued payments as may be considered necessary by the Department of Labor to pay to laborers and mechanics employed by the employer the difference between the rates of wages required by the contract to be paid laborers and mechanics on the work and rates of wages received by such laborers and mechanics to be remitted to the Department of Labor for distribution upon resolution of any claims."

Bidders are specifically directed to note the Department of Labor's regulations implementing §6960 relating to the effective date of the wage rates, at Part VI., Section C., which in relevant part states:

"Public agencies (covered by the provisions of 29 Del.C. §6960) are required to use the rates which are in effect on the date of the publication of specifications for a given project. In the event that a contract is not executed within one hundred twenty (120) days from the date the specifications were published, the rates in effect at the time of the execution of the contract shall be the applicable rates for the project."

**PREVAILING WAGE REQUIREMENTS**

It is DelDOT's understanding that the Davis-Bacon Act is not a preemptive statute in the broad sense, and does not preempt or displace State of Delaware prevailing wage requirements.

When a contract for a project contains both Federal Davis-Bacon and State of Delaware prevailing wage standards because of concurrent Federal and State coverage, the employer's minimum wage obligations are determined by whichever standards are higher.

**STATE OF DELAWARE PREVAILING WAGES**

PREVAILING WAGE DETERMINATION - Highway Construction

Delaware Department of Labor  
Division of Industrial Affairs  
Office of Labor Law Enforcement  
Phone: 302 451-3423

Mailing Address:  
225 Corporate Boulevard  
Suite 104  
Newark, DE 19702

Located at:  
225 Corporate Boulevard  
Suite 104  
Newark, DE 19702

Prevailing Wages for **HIGHWAY CONSTRUCTION** Effective March 15, 2011

<u>Classification</u>	<u>New Castle County</u>	<u>Kent County</u>	<u>Sussex County</u>
Bricklayers	\$44.98	\$44.98	\$14.51
Carpenters	\$40.86	\$48.31	\$38.62
Cement Finishers	\$28.11	\$24.68	\$23.29
Electrical Line Workers	\$22.50	\$54.05	\$54.05
Electricians	\$57.10	\$57.10	\$57.10
Iron workers	\$42.20	\$22.98	\$25.35
Laborers	\$25.44	\$23.33	\$24.00
Millwrights	\$16.11	\$15.63	\$13.49
Painters	\$41.42	\$41.42	\$41.42
Piledrivers	\$59.23	\$23.75	\$26.95
Power Equip. Operators	\$31.46	\$26.00	\$26.31
Sheetmetal Workers	\$22.75	\$20.31	\$18.40
Truck Drivers	\$26.54	\$21.68	\$19.96

CERTIFIED: May 5, 2011

BY: Signature on file

ANTHONY J DELUCA, ADMINISTRATOR  
LABOR LAW ENFORCEMENT SECTION

**NOTICE TO CONTRACTORS**

1. These rates are promulgated and enforced pursuant to the Prevailing Wage Regulations adopted by the Department of Labor on April 3, 1992.
2. Classifications of workers are determined by the Department of Labor. For assistance in classifying workers, or for a copy of the regulations or classifications, phone (302)451-3423.
3. Nonregistered apprentices must be paid the mechanic's rate.

**GENERAL DECISION: DE100013 5/21/2010 DE13**

General Decision Number: DE100013

State: DELAWARE

Construction Type: HIGHWAY

COUNTY: New Castle County in Delaware

HIGHWAY CONSTRUCTION PROJECTS: (excluding tunnels, building structures in rest area projects and railroad construction; bascule, suspension and spandrel arch bridges designed for commercial navigation, bridges involving marine construction; and other major bridges).

Modification Number	Publication Date
0	05/21/2010

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SUDE2010-001	05/01/2009
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	Rates	Fringes
Bricklayer	43.48	
Carpenter	40.35	
Cement Mason/Concrete Finisher	31.04	
ELECTRICIAN		
Electrician	55.35	
Line Worker	34.29	
Ironworker	42.20	
Laborer	23.81	
Millwright	16.11	
Painter	51.47	
Piledriverman	59.23	
Power Equipment Operation	33.37	
Truck Driver	26.19	

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U.S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

APPLICABILITY OF DAVIS-BACON LABOR STANDARD PROVISIONS TO FLAGGERS

The U.S. Department of Labor has established that the duties of flaggers working on contracts covered by the Davis-Bacon Act, are manual and physical in nature. Accordingly, all employees performing the work of flaggers on Davis-Bacon covered contracts shall be entitled to receive applicable prevailing wage rates.

\* \* \* \* \*

ALL AGENCY MEMORANDUM NO. 130  
U.S. DEPARTMENT OF LABOR  
EMPLOYMENT STANDARDS ADMINISTRATION  
WAGE AND HOUR DIVISION  
WASHINGTON, DC 20210

GUIDELINES

HIGHWAY CONSTRUCTION

Highway projects include the construction, alteration, or repair of roads, streets, highways, runways, taxiways, alleys, trails, paths, parking areas, and other similar projects not incidental to building or heavy construction.

EXAMPLES: Alleys, Base Courses, Bituminous treatments, Bridle Paths, Concrete pavement, Curbs, Excavation and embankment (for road construction), Fencing (highway), Grade crossing elimination (overpasses and underpasses), Guard rails on highway, Highway signs, Highway bridges (overpasses, underpasses, grade separation), Medians, Parking lots, Parkways, Resurfacing streets and highways, Roadbeds, Roadways, Runways, Shoulders, Stabilizing courses, Storm sewers incidental to road construction, Street paving, Surface courses, Taxiways, and Trails.

ANY QUESTIONS REGARDING THE APPLICATION OF THE GUIDELINES ABOVE TO A PARTICULAR PROJECT OR ANY DISPUTES REGARDING THE APPLICATION OF THE WAGE SCHEDULES ARE TO BE REFERRED TO THE WAGE AND HOUR DIVISION, U.S. DEPARTMENT OF LABOR FOR RESOLUTION, AND THE INSTRUCTIONS OF THE WAGE AND HOUR DIVISION ARE TO BE OBSERVED IN ALL INSTANCES.

\* ALL AGENCY MEMORANDUM NO. 130  
U.S. DEPARTMENT OF LABOR  
EMPLOYMENT STANDARDS ADMINISTRATION  
WAGE AND HOUR DIVISION  
WASHINGTON, DC 20210

**SUPPLEMENTAL SPECIFICATIONS  
TO THE  
AUGUST 2001  
STANDARD SPECIFICATIONS**

**EFFECTIVE AS OF THE ADVERTISEMENT  
DATE OF THIS PROPOSAL  
AND INCLUDED BY REFERENCE**

**The Supplemental Specifications can be viewed and printed from the  
Department's Website.**

To access the Website;

- in your internet browser, enter; <http://www.deldot.gov>
- on the left side of the page under 'INFORMATION', Click; 'Publications'
- scroll down under 'MANUALS' and Click; "Standard Specifications 2001"

The full Website Link is;

[http://www.deldot.gov/information/pubs\\_forms/manuals/standard\\_specifications/index.shtml](http://www.deldot.gov/information/pubs_forms/manuals/standard_specifications/index.shtml)

Printed copies of the Supplemental Specifications are available upon request. A printed copy of the above referenced Supplemental Specifications will be included in the final contract documents upon award.

**The Contractor shall make himself aware of these revisions and corrections (Supplemental Specifications), and apply them to the applicable item(s) of this contract.**

Contract No. T200809003.01

# **SPECIAL PROVISIONS**



**CONSTRUCTION ITEM NUMBERS**

All construction pay items are assigned a six (6) digit number, shown as Item Number on the Plans and/or in the Special Provisions, and shall be interpreted in accordance with the following:

**Standard Item Number:**

The first three digits of the construction item numbers indicates the Section number as described in the Standard Specifications, and all applicable requirements of the Section shall remain effective unless otherwise modified by the Special Provisions. The last three digits of the construction item identifies the item by sequential number under that Section. Sequential numbers for all items covered under Standard Specifications range from 000 to 499. A comprehensive list of construction item numbers begins on page 421 of the Standard Specifications. Additions to this list will be made as required.

**Special Provisions Item Number:**

The first three digits of the construction items, covered under Special Provisions, indicates the applicable Section number of the Standard Specifications, and shall be governed fully by the requirements of the Special Provisions. The last three digit of the items covered under Special Provisions identifies the item by sequential number. Sequential numbers for Special Provision items, range from 500 to 999.

Examples

**Standard Item Number - 202000 Excavation and Embankment**

202 Indicates Section Number

000 Indicates Sequential Number

**Special Provision Item Number - 202500 Grading and Reshaping Roadway**

202 Indicates Section Number

500 Indicates Sequential Number

**CHANGES TO PROJECT DOCUMENTS DURING ADVERTISEMENT**

**1. PRINTED PLANS AND SPECIFICATIONS NOT AVAILABLE FROM DELDOT.**

The Department is not providing printed plans or specifications for this project. Bidders must contact the Department in order to receive a CD that contains all bid documents. Bidders are able to use the CD to print the plans and specifications, or have them printed from the Website. While the plans and specifications are available on-line at DelDOT's Website, the Website bid documents are not authorized for submitting bids, and the Website documents are marked as such. To receive required bid Documents on a CD, contact:

Contract Administration  
Delaware Department of Transportation  
P.O. Box 778, Dover, DE 19903  
e-mail: [dot-ask@state.de.us](mailto:dot-ask@state.de.us)  
Phone: (302) 760-2030  
FAX: (302) 739-2254

The Department is providing a printed set of plans and specifications available for viewing in the Bidder's Room, Transportation Administration Center, 800 Bay Road, Dover, Delaware, Monday through Friday excluding holidays from 8:00A.M. through 4:15 P.M..

**2. QUESTIONS AND ANSWERS**

All questions pertaining to this project are to be submitted to the following e-mail address:

[dot-ask@state.de.us](mailto:dot-ask@state.de.us)

Questions and Answers will be dated and posted periodically on DelDOT'S Website located at:

<http://www.deldot.gov/public.ejs?command=PublicBusinessBidCal>

The final Questions and Answers will be posted no later than the end of the day, two working days prior to the bid date.

All Questions and Answers posted by the Department on the above Website are included by reference and become part of the contract documents. The awarded bidder will receive a hard copy of the final posted Questions and Answers.

Potential bidders that do not have access to the internet may contact Jim Hoagland, Contract Services Administrator, by telephone at (302) 760-2036 to make other arrangements.

**NOTE:** There is space provided on the CERTIFICATION page to insert the Posted Date of the final Questions and Answers. The Final Posted Date is the latest Posted Date of the Questions and Answers one day prior to Bid Date. This final Posted Date must be submitted on the Certification page or your bid will be considered **Non-responsive** and not considered for award.

**3. ADDENDA**

The Department is not providing printed Addendums, if issued, for this project. All addendums will be posted on the Department's Website, and are included by reference and become part of the contract documents. It is the responsibility of the bidder to check the Website as needed. If there are Addendums issued, the final Addendum will be posted no later than the end of the day, two working days prior to the bid date.

**NOTE:** There is space provided on the CERTIFICATION page to insert each issued Addendum and the date you acknowledge receipt of the addendum. Each Addendum number and date acknowledged must be submitted on the Certification page or your bid will be considered **Non-responsive** and not considered for award.

**MODIFICATIONS TO REQUIRED FEDERAL CONTRACT PROVISIONS**

The following modifications to the enclosed REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS (located elsewhere in this document) are effective January 18, 2009. Modifications are shown below. Old language is shown crossed out, new language is shown underlined. The full text is not shown, only portions that were modified.

**V. STATEMENTS AND PAYROLLS**

**2. Payrolls and Payroll Records:**

b. The payroll records shall contain the name, ~~social security number~~, and ~~address~~ an individually identifying number for each employee (e.g., the last four digits of the employee's social security number) of each such employee . . .

c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely all of the information required to be maintained under ~~paragraph 2b of this Section V~~: 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). ~~This~~ The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the FHWA, if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the FHWA the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

d. (1) that the payroll for the payroll period contains the information required to be ~~maintained under paragraph 2b of this Section V~~ provided under Sec. 5.5(a)(3)(i) of Regulations, 29 CFR part 5, the appropriate information is being maintained under Sec. 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

- end -

**401502 - ASPHALT CEMENT COST ADJUSTMENT**

For Sections 304, 401, 402, 403, 404, and 405, payments to the Contractor shall be adjusted to reflect increases or decreases in the Delaware Posted Asphalt Cement Price when compared to the Project Asphalt Cement Base Price, as defined in these Special Provisions.

The Delaware Posted Asphalt Cement Price will be issued monthly by the Department and will be the industry posted price for Asphalt Cement, F.O.B. Philadelphia, Pennsylvania.

The Project Asphalt Cement Base Price will be the anticipated Delaware Posted Asphalt Cement Price expected to be in effect at the time of receipt of bids.

All deviations of the Delaware Posted Asphalt Cement Price from the Project Asphalt Cement Base Price are eligible for cost adjustment. No minimum increases or decreases or corresponding percentages are required to qualify for cost adjustment.

Actual quantity of asphalt cement qualifying for any Asphalt Cement Cost Adjustment will be computed on the basis of weight tickets and asphalt percentage from the approved job mix formula.

For Recycled Hot-Mix the asphalt percentage eligible for cost adjustment shall be only the new asphalt cement added to the mix.

There shall be no separate payment per ton (metric ton) cost of asphalt cement. That cost shall be included in the various unit prices bid per ton (metric ton) for those bid items that contain asphalt cement (mentioned above).

The Asphalt cement cost adjustment will be calculated on grade PG 64-22 asphalt regardless of the actual grade of asphalt used. The Project Asphalt Cement Base Price for the project will be \$470.00 per ton (\$518.09 per metric ton).

If the Contractor exceeds the authorized allotted completion time, the price of asphalt cement on the last authorized allotted work day, shall be the prices used for cost adjustment during the time liquidated damages are assessed. However, if the industry posted price for asphalt cement goes down, the asphalt-cement cost shall be adjusted downward accordingly.

**NOTE**

Application of Asphalt Cement Cost Adjustment requirements as indicated above shall apply only to those contracts involving items related to bituminous base and pavements, and with bitumen, having a total of 1,000 tons (1,000 metric tons) or more of hot-mix bid quantity in case of Sections 401, 402 and 403; and 15,000 gallons (60 000 liters) or more in case of Sections 304, 404 and 405.

**202505 – SETTLEMENT PLATFORM**  
**202518 – SETTLEMENT MONUMENT**

**Description:**

The work of this section includes furnishing, installing, protecting and maintaining settlement monitoring plates (SMP), pipe extensions, and monument settlement points conforming to the design and at the locations shown on the Plans or as directed by the Department. All labor, materials, equipment and incidentals necessary to complete this work shall be considered part of this item required to provide devices to observe ground movement during and after construction. The Contractor shall perform the monitoring, recording and reporting of the settlement.

**Submittals:**

1. Qualifying Experience

The Contractor shall submit proof of three or more projects of similar size and complexity on which the firm and personnel assigned to the project have successfully installed similar instrumentation within the last three years. The Contractor shall present the following information for each project listed as a reference at or prior to any preconstruction meetings:

1. Project Name, Location, Project Description, and Completion Date.
  2. Surface and Subsurface Conditions.
  3. Type and number of instruments installed.
  4. Installation equipment and techniques utilized when applicable.
  5. Provide names, current phone numbers, and current business addresses for the owner/designer, geotechnical consultant, and contract manager.
2. Settlement surveying and monitoring plan for review prior to construction. The plan shall identify the detailed location of settlement monitoring points, reference benchmarks, survey schedules and procedures and reporting formats.
3. Description of the surveying equipment to be used.
4. Settlement Plate Layout and Installation Details: Within two days after the installation of each settlement plate, the Contractor shall submit an installation record sheet including appropriate items from the following list.
- i. Project name.
  - ii. Contract name and number.
  - iii. Settlement plate number.
  - iv. Material sizes and compositions.
  - v. Planned location in horizontal position and elevation.
  - vi. Planned orientation.
  - vii. Personnel responsible for installation.
  - viii. Date and time of start and completion.
  - ix. Weather conditions at the time of installation.
  - x. Notes of importance on the installation including problems encountered, delays, unusual features of the installation, and details of any events that may have a bearing on settlement plate behavior.

**Schedule for Settlement Platform Installations and Readings:**

The Contractor shall provide settlement monitoring plates, pipe extensions and monument settlement points to monitor settlement of new fill embankments. The Contractor shall make regular readings of the settlement as indicated on the plans.

Settlement monitoring plates shall be installed as shown on the plans. Settlement monitoring plates shall be located by repeatable survey (locations and elevations) and referenced to permanent benchmarks. Locations of benchmarks are to be determined by the Contractor and approved by the Engineer, and shall be located outside the zone of influence of the construction activity. Settlement monitoring plates shall be placed level and the risers shall be plumb.

The approximate locations of each instrument to be installed by the Contractor are shown on the project plans and include the following types: settlement plates and settlement monuments. Other locations may need to be added as directed by the Engineer.

**Protection of Instrumentation and Repair of Damage**

- a. The Contractor shall protect all instruments and appurtenant fixtures, leads, connections, and other components of instrumentation systems from damage due to construction operations.
- b. If an instrument is damaged or made inoperative due to the Contractor's operations or the operation of subcontractors under the direction of the Contractor, the Contractor shall notify the Engineer immediately. The Engineer will be the sole judge of whether repair or replacement is required. For each instrument that is abandoned for these reasons, the Contractor shall replace that instrument at no additional cost to the Department.
- c. Should any instrument become damaged or inoperative through no fault of the Contractor, the damaged or inoperative instrument shall be repaired or replaced at the contract unit prices for that instrument.
- d. The Engineer will advise the Contractor immediately upon discovery of damage to instruments as to the necessary schedule for replacement and the times of required access. Damaged instruments shall be repaired or replaced within 24 hours of initial damage. The Contractor's construction operations in the area of a damaged instrument(s) may be halted during repair or replacement of each damaged instrument at the request of the Department.

**Materials:**

**Settlement Plates**

- a. Settlement plates are sub-surface displacement reference platforms placed on the prepared ground surface prior to embankment fill placement. Risers are extended from the settlement plate as the fill is placed. A casing is placed around the riser for protection. Settlement plates are monitored by optical survey methods to determine vertical displacements occurring during and after embankment construction.
- b. The base plate shall be made from steel conforming to the requirements of ASTM A36. The riser pipe and outer casing shall be steel pipe conforming to the requirements of ASTM A53, Grade B, standard weight. The casing and the risers shall be as shown on the plan. The casing pipe shall have a minimum wall thickness of 0.375 inches. The riser pipe shall be galvanized and have a minimum wall thickness of 0.25 inches. Couplings, pipe caps, etc. shall conform to the requirements of ASTM A865. Threaded pipes shall be used for riser and casing pipe extensions.
- c. Sand shall conform to the requirements of ASTM C33.

**Settlement Monuments**

- a. Materials for the construction of the Settlement Monument shall conform to the applicable sections of Section 812 for the Concrete, Class C of the Standard Specifications.

- b. The Reinforcement Bar shall conform to Section 824 of the Standard Specifications.

**Construction Methods:**

1. Readings on the settlement platforms and settlement monuments shall be performed by the Contractor. The Contractor is fully responsible for establishing benchmarks, submittals, and furnishing, installing and maintaining the settlement platforms.
2. The settlement monuments shall be installed at locations indicated on the plans or as directed by the Department.
3. The settlement plates shall be installed as indicated on the plans after all clearing and grubbing and topsoil removal has been completed. The sand base shall be tamped to provide a firm, level, and unyielding bearing surface for the base plate. The riser pipe shall be marked in 1-foot increments and labeled at 5-foot increments to indicate the distances above the plate extending up through the embankment fill. Settlement plates shall be fabricated as shown on the plans.
4. The initial casing and riser pipes shall have a maximum length of 4 feet for each section. Spacers shall be provided between the riser pipe and the casing at a minimum of 4-foot intervals to ensure concentricity. The spacers shall not be directly attached to the riser pipe or otherwise installed that would impede the independent movement of the riser pipe.
5. As the height of fill above the settlement plate changes, the casing and riser pipes shall be increased or decreased in a maximum of 4-foot intervals to maintain the top of the riser pipe and casing above the embankment. As each additional length of pipe is added or removed, the pipe cap on the casing shall be immediately transferred to the top section on the settlement plate so as to prevent fill material from entering the casing. At other times, the cap shall only be removed to check settlement.
6. The casing pipe shall be marked by flags or other approved method to clearly show its location and to warn equipment operators and others of its location. The Contractor shall maintain the flags during the entire length of the Contract and replace those flags that are missing. At no time shall the settlement plate risers and casings extend higher than 5 feet above the ground surface elevation. Sections shall be added or removed as necessary during embankment construction to maintain the tops of the risers and casings at least 1-foot above the surface of the embankment.
7. The Contractor is responsible for maintaining the settlement plates in working order during the length of the Contract. Settlement Plates which are to be abandoned at the completion of the project shall have their riser pipes cut off two feet below roadway subgrade level and capped. If an instrument is damaged, moved, or disturbed due to causes other than settlement, the Contractor shall repair, reset, or replace the damaged instrument at no additional cost to the Department within three days after being damaged. The Engineer will be the sole judge of whether repair, resetting, or replacement is required. No additional fills shall be placed within fifty (50) feet of a damaged settlement platform until the damage has been corrected to the satisfaction of the Engineer. The Engineer may impose a work stoppage in the vicinity of the damaged instrument until it is again operational at no additional cost to the Department. Any repairs or replacements required will be at the Contractor's expense.
8. By the end of the first work day in each week, the Contractor shall submit to the Engineer a description of the work performed during the previous week. This description shall include at a minimum: a plan view location of the placed embankment, the volume of embankment placed, and in-situ density test results in accordance with Standard Specification sections 202 and 209.
9. The use of the settlement platforms for collecting data related to embankment foundation response will extend beyond the time of completion of the Contractor's embankment placement operations. The Contractor shall be responsible for assuring that all platforms are in working order until the time of completion of the Contract.

10. Instrumentation shall be read as indicated on the plans.
11. For vertical deformation monitoring, runs shall be performed by a single run beginning and ending on two different benchmarks installed in accordance with NGS standards. Settlement monitoring points shall be used as turning points or as intermediate foresights from two different turning points, allowing elevations to be adjusted and eliminating significant observational errors. The maximum length of line of sight shall be 150 feet, and the imbalance between backsight and foresight shall not exceed 30 feet. Allowable level loop misclosure shall not exceed  $\pm 0.033$  times the square root of M feet (where M is the distance of the level run in miles) for a single run between two benchmarks. A formal initial reading on a settlement monitoring point will consist of the average of three elevations, from three independent level runs, which meet the closure specified herein. Elevations established subsequent to a formal initial reading shall be determined by a single run as specified herein. The least count (without estimation) of the rod and level combination shall read to 0.003 foot or less, such that the accuracy of an elevation measurement shall be  $\pm 0.01$  foot (at 95 percent level of confidence).
12. Data shall be recorded in U.S. survey feet or inches.
13. Instruments used for vertical deformation monitoring shall have a minimum accuracy of plus or minus 0.005 of a foot (standard deviation for 3300 feet of double run leveling) and a minimum setting accuracy of plus or minus 1.0 arc seconds. Leveling rods shall be non-telescopic in design (i.e. "Chicago" style leveling rod). A bull's eye bubble shall be used to plumb the leveling rod. The use of fiberglass rods will need approval of Engineer prior to use.
14. All data recorded by the Contractor shall be of the following form:
  - a. Raw and reduced data shall be on summary tables in printed tabular format on 8-1/2 inch x 11 inch sheets of paper.
  - b. Reduced data for up to six like instruments that are located in the same geographical area shall be plotted on the same graphical plot. Each plot shall be submitted on an 8-1/2 inch x 11 inch sheet or 11 inch by 17 inch sheet.
  - c. Plots of deformation data at Settlement Monitoring Plates shall show absolute vertical deformation versus time with height or elevation of fill placed at time of reading. Plots of settlement plate data shall show absolute vertical deformation versus time and shall show the height or elevation of fill placed at the time of reading. Deformation plots shall also be provided in electronic data file format.
  - d. Survey data reports prepared by the Contractor shall be signed and sealed by either a Professional Engineer or Professional Land Surveyor licensed in the State of Delaware.

**Method of Measurement:**

The number of Settlement Platforms measured will be the actual number of platforms set in place and/or maintained as shown on the Plans or as directed by the Engineer. No measurement for payment will be made for pipe extensions. The number of Settlement Monuments measured will be the actual number of monuments set in place and/or maintained as shown on the Plans or as directed by the Engineer.

**Basis of Payment:**

Settlement Platforms and Settlement Monuments will be paid for at the Contract unit price per Each, complete in place, which price shall be full compensation for all materials, tools, labor, and work incidental thereto including pipe extensions, steel plate, sand, couplings, spacers, welding, protection of the plate and pipe extensions during construction, all labor tools, equipment, and necessary incidentals to complete the work.

10/16/10

**202514 – PIEZOMETER**

**Description:**

The work covered by this section includes furnishing all necessary plant, labor, equipment, and materials to install Vibrating Wire Piezometers, providing safe access for the Engineer and others for data collection, protecting instrumentation from damage, repairing certain types of instruments, and replacement costs for other instruments. The Contractor shall implement required remedial and precautionary measures based on the instrumentation data collected and evaluated by the Engineer.

**Project Conditions**

- a. Prior to bidding, the Contractor shall visit and examine the work site and all conditions thereon and take into consideration all such conditions that may affect this work, in accordance with Section 102.05 of the Specifications. Subsurface data collected from the site is available in geotechnical reports upon request from the Department.
- b. Protection of Existing Structures: Protect existing structures, underground utilities, and other construction from any possible or potential damage during drilling operations.

**Submittals:**

- a. Qualifying Experience

The Contractor shall submit proof of three or more projects of similar size and complexity on which the firm and personnel assigned to the project have successfully installed similar instrumentation within the last three years. The Contractor shall present the following information for each project listed as a reference at or prior to any preconstruction meetings:

1. Project Name, Location, Project Description, and Completion Date.
  2. Surface and Subsurface Conditions.
  3. Type and number of instruments installed.
  4. Installation equipment and techniques utilized when applicable.
  5. Provide names, current phone numbers, and current business addresses for the owner/designer, geotechnical consultant, and contract manager.
- b. No instrumentation shall be delivered or installed on the site prior to the review and approval by the Department of the materials, products, and installation procedures. At least 45 calendar days prior to proceeding with the installation work, the Contractor shall submit to the Engineer for review the following:
    1. Schedule and Procedures: Proposed schedule and procedures for instrumentation installation and performance of initial reading monitoring for the instruments. Detailed step-by-step procedure for installation, together with a sample installation record sheet. The procedures shall be bound and indexed. The installation procedures shall include:
      - The method to be used for cleaning the inside of casing.
      - The methods to be used for drilling of holes.
      - Drill casing type and size.
      - Depth increments for backfilling boreholes with sand and grout.
      - Method for overcoming buoyancy of instrumentation components

during grouting.

- Method for sealing of joints in pipes and inclinometer casing to prevent ingress of grout.
  - Detailed step-by-step procedures developed in conjunction with the Department for conducting all survey measurements to obtain initial readings to the specified accuracy, including types of surveying equipment.
2. Product Data: Manufacturer's catalog cuts, shop drawings, material specifications, installation and maintenance instructions, and other data pertinent to the work of this Section.
  3. Within 2 workdays of receipt of each instrument at the site, the Contractor shall submit to the Engineer a copy of factory calibration, manufacturer's test equipment certification, completed copy of quality assurance checklist, and warranty for each portable readout unit.
  4. Grout Mix: Material specifications and mix design for grout required for piezometer installations along with verification from a certified testing laboratory that this mix is in accordance with the requirements specified. The information shall include specifications for proposed grout mixes, including commercial names, proportions of admixtures and water, mixing sequence, mixing methods and duration, pumping methods and tremie pipe type, size and quantity.
  5. Certifications: Manufacturer's certifications that products, materials, and equipment furnished meet the specified requirements.
  6. Instrumentation layout and installation details: Within 5 days of installing each instrument the Contractor shall submit the following:
    - Instrument type, identification numbers and locations, with initial elevations, stations and offsets, and coordinates, as applicable for each instrument.
    - As-built installation details of each instrument, including depths, lengths, elevations, materials used, and dimensions of key elements.
    - A separate statement describing the procedure used for the installation of each instrument.
    - A log of subsurface data indicating the elevations of strata changes encountered in the borehole. Soil strata nomenclature shall conform to ASTM D3282 and D2488.
    - Other data pertinent to instrument installation.

**Schedule for Installations and Readings:**

Prior to installation of the instruments, the Contractor shall submit an installation schedule as described in this specification. The installation of all instruments shall generally precede the placement of embankment material by at least 14 days so that neutral, or initial, readings can be obtained. The Contractor shall notify the Department within 24 hours of successful installation of each instrument.

The Contractor will make neutral readings on each of the instruments within 72 hours of successful installation of the instrument and again 24 to 72 hours afterwards to verify the initial data. During fill placement and the first 30 days thereafter, readings shall be taken at least weekly, and at least monthly for the next 6 months or as directed by the Department.

**Protection of Instrumentation and Repair of Damage**

The Contractor shall take the following measures to protect the installed instrumentation and repair any damages which occur.

- a. The Contractor shall protect all instruments and appurtenant fixtures, leads, connections, and other components of instrumentation systems from damage due to construction operations.
- b. If an instrument is damaged or made inoperative due to the Contractor's operations or the operation of subcontractors under the direction of the Contractor, the Contractor shall notify the Department immediately. The Department will be the sole judge of whether repair or replacement is required. For each instrument that is abandoned for these reasons, the Contractor shall replace that instrument at no additional cost to the Department.
- c. Should any instrument become damaged or inoperative through no fault of the Contractor, the damaged or inoperative instrument shall be repaired or replaced at the contract unit prices for that instrument.
- d. The Department will advise the Contractor immediately upon discovery of damage to instruments as to the necessary schedule for replacement and the times of required access. Damaged instruments shall be repaired or replaced within 24 hours of initial damage. The Contractor's construction operations in the area of a damaged instrument(s) may be halted during repair or replacement of each damaged instrument at the request of the Department.

**Interpretation of Data and Implementation of Plans of Action:**

The Engineer may require a temporary delay from planned construction schedules before a stage of fill placement is commenced and/or completed in a given area if the fill instrumentation readings indicate the potential for unstable conditions or if settlement is substantially more than predicted. Resumption of fill placement shall be at the direction of the Engineer when instrumentation readings indicate sufficient stability has been achieved to allow such continuation of filling.

All data recorded by the Contractor shall be of the following form:

- a. Raw and reduced data shall be on summary tables in printed tabular format on 8-1/2-inch x 11-inch sheets of paper.
- b. Reduced data for up to six like instruments that are located in the same geographical area shall be plotted on the same graphical plot. Each plot shall be submitted on an 8-1/2-inch x 11-inch sheet or 11-inch by 17-inch sheet.
- c. Plots for Vibrating Wire Piezometers shall present piezometer data versus time with height or elevation of fill placed at time of reading.
- d. Data reports prepared by the Contractor shall be signed and sealed by either a Professional Engineer or Professional Land Surveyor licensed in the State of Delaware.

**Quality Control:**

The following measures shall be followed prior to and during the installation of the piezometers to ensure proper installation and operation:

- a. Control of Materials
  - 1. The materials to be used in fulfilling the requirements of instrumentation work are subject to the approval of the Engineer. Approval of the materials to be used for instrumentation shall not relieve the contractor of the responsibility to provide instrumentation in accordance with these Specifications.
  - 2. The Engineer will inspect, test, and approve the workmanship of the

instrumentation equipment, prior to, and/or after installation.

b. Field Monitoring

1. The Engineer will approve the method of installation and maintenance of monitoring devices. Approval of the method of installation and maintenance of monitoring devices shall not relieve the Contractor of the responsibility to install and maintain the instruments in conformance with the Specifications.
2. Measurements and readings of the monitoring devices shall be performed by the Contractor.
3. The Engineer shall be notified of monitoring devices which become damaged or inoperable immediately after the time the Contractor becomes aware of such conditions.
4. The Contractor shall engage qualified technicians with at least three years' previous experience in the installation of the instruments specified herein. The Contractor shall provide the Engineer, for his approval, a description of the applicable experience of such personnel. Approval of the personnel shall be received prior to commencing with the installation.

c. Factory Calibration

A factory calibration shall be conducted on all instruments at the manufacturer's facility prior to shipment. Each factory calibration shall include a calibration curve with data points clearly indicated, and a tabulation of the data. Each instrument shall be marked with a unique identification number.

Factory calibrations of piezometers shall be made against a pressure gage traceable to the National Institute of Standards and Technology. The accuracy of the pressure gage shall not be less than twice the specified accuracy of the piezometers. Calibrations shall be made to full scale in two complete cycles, recording the reading in 10 equal increments during two loading and two unloading cycles.

d. Field Calibration

Upon receipt of the instruments at the project site the Contractor shall check all instruments and perform field calibrations to ensure that they are functioning properly.

**Materials:**

Materials for the installation of the vibrating wire piezometers shall be in accordance with the following:

- a. Vibrating wire piezometers shall be placed within the compressible soil layer(s) to monitor pore pressures during and after construction of the embankments. The piezometer's cable housing shall be extended as the fill is placed or the cable shall be extended outside the embankment area.
- b. The piezometers shall be vibrating wire transducer type capable of measuring pore water pressures up to 100 psi. The piezometers shall be Model 4500 produced by Geokon, Inc., West Lebanon, New Hampshire; Model VW2100 produced by RST Instruments Ltd, Coquitlam, B.C., Canada; or an approved equal. Piezometers shall be supplied with thermistors built into the transducers to measure the temperature at the transducer location. A readout box shall be used to obtain pore pressure readings as required. This readout box shall be a Model GK-401 produced by Geokon, Inc., West Lebanon, New Hampshire; a Model VW2104; produced by RST Instruments Ltd, Coquitlam, B.C., Canada; or an approved equal.
- c. Vibrating wire transducers shall have factory-attached cables of sufficient length to route to

the terminal box without splicing. Cable shall be of same commercial source as the piezometers, and shall be 4-conductor, 22 gauge, with two (2) shielded twisted pairs, a common drain wire. Cable shall be attached to the piezometers through an integral bulkhead seal, consisting of an interior waterstop seal and cable entry seal. Seals shall be either O-rings or hermetic seals and must be tested and certified for water-tightness over the specified pressure range of the transducer.

- d. The terminal box shall be a Model 4999-16VT as manufactured by Geokon Inc., Lebanon, New Hampshire; a Geomation 2300 produced by RST Instruments Ltd, Coquitlam, B.C., Canada; or an approved equal.
- e. Surge protection circuit boards shall be installed on every lead wire connected into the terminal box to protect the vibrating wire piezometers. The surge protection circuit boards shall contain a combination of gas tube discharge rectifiers, solid state diode circuits, and coils to suppress electrical transients.
- f. Grounding rods: 3/4-inch diameter by 10-feet long, copper clad steel as manufactured by copperweld; Blackburn; or approved substitute.
- g. Ground cable: ASTM B8 copper, No. 4 AWG bare wire.
- h. Cable identifications tags: Black Natvar 400 tubing with labels deeply embedded using Kingsley White Stamping Foil; Raychem thermofit marker; Alliance Industrial Products Co. white plastic marker with black code marking; Marked Flexrite Shrinkdown HT-105 tubing; Actioncraft heat-shrinkable polyolefin marker; or approved substitute.
- i. The piezometers shall be installed with steel casing over the cable where traffic is likely to run over the casing. PVC casing may be used elsewhere.

**Construction Methods:**

Equipment

The Contractor shall provide all necessary plant, labor, material, and equipment, and perform all operations required for the installation of the instrumentation. Upon completion of the project, all instruments will become property of the Department.

Installation

The vibrating wire piezometers shall be installed in boreholes at the locations and depths as specified on the project plans.

Piezometers can be installed in boreholes in single or multiple installations per hole, in cased or uncased holes. At locations requiring multiple installations per hole, one piezometer should be installed above the groundwater table and one below the groundwater table. Careful attention must be paid to borehole sealing techniques if pore pressures in a particular zone are to be monitored.

Boreholes should be drilled either without drilling mud or with a material that degrades rapidly with time, such as RevertJ. The hole should extend from 12 to 24 inches below the proposed piezometer location and should be washed clean of drill cuttings. The bottom of the boreholes should then be backfilled with clean fine sand to a point one foot below the piezometer tip. The piezometer can then be lowered into position. If applicable, any porous elements shall be saturated, and the piezometer filled with water prior to installation. The piezometer shall then be encapsulated in a canvas cloth bag containing clean, saturated silica sand, and having the diaphragm facing upwards prior to being lowered into position. While holding the instrument in position (a mark on the cable is helpful), clean sand should be placed around the piezometer and to a point one foot above it. The sand placed before and after the placement of the piezometer forms the collection zone.

Immediately above the sand layer (collection zone), the hole shall be grouted to a point no less than three feet above the collection zone using a special grout consisting of Portland cement, bentonite and water. The special grout shall be a non-shrink and non-metallic material and shall not contain calcium chloride or other salts, aluminum, or other harmful metals. When tested in accordance with ASTM C 827, the material shall

show no shrinkage in the plastic state. When tested in accordance with ASTM C 109, the material shall show a seven-day strength of not less than 3.5 pounds per square inch (psi) and a 28-day strength of between 5.0 and 7.0 psi as measured on 2 inch cubes. The water used in the special grout shall be potable.

The cables for the vibrating wire piezometers shall be routed up through the boreholes and placed in trenches leading to the readout boxes. These trenches shall be a minimum of one foot deep and one foot wide. The cables shall be snaked in the trenches to include a minimum of 10 feet of additional cable length for every 100 feet of cable.

The Contractor is responsible for maintaining the vibrating wire piezometers in working order during the length of the Contract. Maintenance of vibrating wire piezometers which are to remain operational after completion of the project will be the responsibility of the Department.

**Method of Measurement:**

The Vibrating Wire Piezometers will be measured per Each satisfactorily installed. Drilling of holes, temporary casing, terminal boxes and covers, and incidental items necessary for installation of the instruments and abandonment of instruments no longer required, including filling of holes with grout, will not be measured separately for payment. These costs will be considered incidental to these items.

**Basis of Payment:**

Vibrating Wire Piezometers will be paid for at the Contract unit price per Each, complete in place, which price shall be full compensation for all materials, tools, labor, and work incidental thereto including all labor, tools, equipment, and necessary incidentals to complete the work.

9/16/10

**202555 - SUBSOIL TILLAGE**

**Description:**

Subsoil Tillage shall consist of conducting deep tillage in areas designated on the plans or as directed by the Engineer. Unless indicated on the plans, the depth of tillage shall be twenty-four inches vertical.

**Materials:**

The subsoiler used in the work shall be specially designed for subsoil tillage. All subsoilers and tractors utilized are subject to approval by the Department. Within thirty days of the award of the Contract, the Contractor shall supply the Department with the name and model number of the subsoiler and tractor, and the subsoiler and tractor manufacturer's guidelines related to equipment size, power and drawbar pounds pull. Plows or disks shall not be utilized for this work.

The subsoiler shall have a minimum net weight of 6500 pounds. Unless specified on the plans, the subsoiler shall have the capability of operating with a minimum of five steel shanks, and the distance between adjacent shanks shall not exceed thirty (30) inches. Unless specified on the plans or directed by the Engineer, the maximum number of shanks as designed for the subsoiler shall be utilized when conducting this work. Each steel shank shall have the minimum dimensions of one and one-half inches by seven and one-half inches by thirty inches (1½ x 7½ x 30 ). Larger shanks are acceptable. The minimum vertical tillage depth shall be twenty-four (24) inches as measured by field performance, as determined solely by the Engineer. Each shank shall be equipped with replaceable steel points.

A crawler-tracked tractor shall be utilized for the subsoiling operations. The tractor shall conform to the subsoiler and tractor manufacturer's recommendations as to minimum size, power and drawbar pounds pull for the subsoiler with reference to specified tillage depth, soil texture and soil conditions. The tractor shall have the hydraulic lines and characteristics necessary for proper operation of the subsoiler as designed and recommended by the manufacturer. It shall be the Contractor's responsibility to ensure that all equipment possesses sufficient power and is of appropriate design and weight distribution to complete the subsoiling operations.

**Construction Methods:**

Subsoil tillage shall be performed within the areas shown on the plans. Unless directed by the Engineer or indicated on the plans, the subsoiling operation shall be conducted in two series of passes, with the second series of passes being made perpendicular to the first series or as directed by the Engineer. The distance between parallel passes of the same series shall not exceed the distance between the individual shanks. Unless directed by the Engineer, the subsoiler shall be operated at a speed of four to five (4-5) miles per hour. If shown on the plans, the subsoil tillage shall be conducted during the specified period. Commencement of the subsoiling operations shall begin within seven (7) days of the direction by the Engineer and completed within fourteen (14) days.

**Method of Measurement:**

The quantity of Subsoil Tillage will be measured by the number of square yards accepted to the limits shown on the Plans, conforming to all the requirements of these specifications, complete and accepted.

**Basis of Payment:**

The item Subsoil Tillage will be paid for at the Contract unit price per square yard and accepted, which price and payment shall constitute full compensation for all labor, equipment, tools and incidentals necessary to complete the work.

3/11/10

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**208500 - FLOWABLE FILL**

**Description:**

This work consists of furnishing and placing flowable fill material at locations as specified in the Plans and as directed by the Engineer.

**Materials:**

Flowable fill shall consist of a combination of the following materials: Portland cement, ground granulated blast furnace slag, fly ash, fine aggregate, water, and chemical admixtures. The exact mixture design, including chemical admixtures, shall be submitted by the Contractor showing the proportions of the above referenced materials that will meet the Specifications.

**Portland Cement** shall meet the requirements of Section 801 of the Standard Specifications.

**Ground Granulated Blast Furnace Slag** shall meet the requirements of AASHTO M302, Grade 100 or Grade 120.

**Fly Ash** shall meet the requirements of Section 822 of the Standard Specifications. The fly ash shall be free of lumps, dirt, debris, and other contamination. Material test data of fly ash representative of the source shall be submitted to the Engineer a minimum of 30 days prior to use. Test data shall include characteristics of the ash leachate as determined by the Toxicity Characteristics Leaching Procedure (TCLP) in accordance with EPA SW-846, with respect to leachate metals.

**Fine Aggregates** shall meet the requirements of Section 804 of the Standard Specifications.

**Water** shall meet the requirements of Section 803 of the Standard Specifications.

**Chemical Admixtures** shall meet the requirements and be used according to the manufacturers recommendations.

The sources of all materials and the mix design shall be submitted to the Engineer a minimum of 30 days prior to use, in order to allow testing of the mix design (using representative material samples) by the Engineer. The design shall produce a material with a 28-day compressive strength of 50 to 200 psi. Flowable fill is not intended to be used where a quick strength development is required, although the addition of an accelerator may be allowed where an early gain in strength is desirable.

Compliance with compressive strength requirements shall be tested in accordance with the following AASHTO test methods:

T106 Compressive Strength of Hydraulic Cement Mortars (Using 50-mm or 2-in Cube Specimens)  
T-23, Making and Curing Concrete Test Specimens in the Field.

**Construction Methods:**

Materials for this item shall be central mixed, truck mixed, or as approved by the Engineer.

Flowable fill shall be transported to the project in ready-mix trucks or as approved by the Engineer. The elapsed time between introduction of water and placement of the fill shall not exceed three hours.

The ambient temperature shall be a minimum of 40 degrees Fahrenheit and rising to begin placement of flowable fill. The temperature of the flowable fill shall be a minimum of 50 degrees Fahrenheit at time of placement. Flowable fill shall not be placed against frozen surfaces and shall be protected from freezing for at least 36 hours using insulation.

Prior to placement, the Contractor shall provide positive containment of the fill material to prevent flow beyond the desired placement location. Flowable backfill shall be discharged at a rate that will allow the material to flow into the placement location, fill all voids, and not dislodge the existing containment or interior items. Relief holes shall be made wherever necessary to ensure that all voids are filled. Any interior items

shall be capable of withstanding lateral hydraulic pressures of the flowable fill. Lift thickness shall not exceed 5 feet in depth. Prior to placement of successive lifts or other loadings, fill shall be allowed to cure until it is self-supporting.

Care shall be taken to prevent pipes from floating. Straps, soil anchors, or other approved means of restraint may be required to ensure proper alignment when flowable fill is used as backfill for pipes. Ensuring proper alignment is the sole responsibility of the Contractor.

The backfill shall be placed to the final lines and grades as shown on the Plans. All confining and supporting structures, protective covers, and barriers shall be maintained by the contractor until the backfill is self-supporting. The Contractor should be aware that shrinkage of the flowable fill as it cures may require additional backfill with another material.

Backfill shall be protected from direct contact with vehicular traffic and shall be protected from prolonged exposure to rain and or running water.

**Method of Measurement:**

The quantity of flowable fill will be the measured number of cubic yards of material accepted and placed within the approved limits of the fill location. For pipe trenches, this measurement shall be in accordance with Section 208.05. When requested by the Contractor and approved by the Engineer in writing, the component materials may be weighed and such weights converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be made by the Engineer and shall be agreed upon by the Contractor before such method of measurement is used.

**Basis of Payment:**

The quantity of flowable fill will be paid for at the Contract unit price per cubic yard. Price and payment will constitute full compensation for furnishing component materials, designing, mixing, and hauling the fill material; preparing the fill location for containment of the fill material; anchoring of items within the fill location; protecting and curing the material after placement; and all labor, tools, equipment and incidentals necessary to complete this work.

2/13/08

**209510 - CONTROLLED LOW STRENGTH MATERIAL (CLSM)**

**Description:**

This work shall consist of furnishing and placing controlled low strength material (CLSM) of the appropriate type at the locations indicated on the plans and where directed by the Engineer. The work shall be done in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical sections shown on the plans or established by the Engineer in writing.

**Definitions:**

- (a) **CLSM:** A self-leveling and self-compacting, cementitious material with an unconfined compressive strength of 1,200-psi or less.
- (b) **Density:** Material property that relates to the unit weight or mass of the materials.
- (c) **Strength:** Material property that relates to the ability of the hardened material to support gravity loads or stresses at a given age.
- (d) **CLSM Air Generating Admixture:** A chemical admixture specially formulated to entrain air into CLSM.
- (e) **Hardening Time:** Period of time for a CLSM mixture to reach a state in which it will support a specific load.

**Materials:**

Materials shall meet the requirements of the following:

- (a) **Portland Cement:** Portland cement shall comply with ASTM C150, Type I, II, or III.
- (b) **Fly Ash:** Fly ash shall conform to AASHTO M 295.
- (c) **Granulated Blast Furnace Slag:** Granulated blast furnace slag shall comply with AASHTO M 302.
- (d) **Fine Aggregate:** Fine aggregate shall comply with AASHTO M 6.
- (e) **Coarse Aggregate:** Coarse aggregate shall comply with AASHTO M 80.
- (f) **Lightweight Aggregate:** Lightweight aggregate shall comply with AASHTO M 195.
- (g) **Water:** Mixing water shall be potable and free of deleterious amounts of acids, alkali, salts, oils, and organic materials that would adversely affect the setting or strength of the concrete.
- (h) **Chemical Admixtures:** Chemical admixtures shall comply with AASHTO M 194 and may be used in accordance with the manufacturer's recommendations as applicable for job conditions.
- (i) **Foaming Agent:** The foaming agent shall conform to the requirements of ASTM C-869.
- (j) **CLSM:** The CLSM shall conform to ACI Committee Report 229R-94, Class IV, with an on-service density of 36-42-pcf and a minimum compressive strength after 28-days of 120-psi.

The Contractor shall be responsible for designing the mix so that each type of CLSM meets the corresponding criteria listed above. The Contractor shall verify the CLSM will have no environmental impacts and will not have any negative impacts to the reinforcement materials and facing components. The Contractor shall submit reports documenting the physical properties of the CLSM to the Engineer for approval at least 30-working days prior to the placement of the CLSM.

**Sampling and Testing:**

During the initial placement of the CLSM, the density will be determined at the point of placement and the mix shall be adjusted by the Contractor, as required, to obtain the specified on-service density. Thereafter, the density will be monitored by the Engineer at 30-minute intervals during placing. The Contractor shall adjust his operations as necessary to maintain the specified on-service density.

Specimens for determination of the compressive strength will be taken by the Engineer at the point of placement. Sampling will be in accordance with the procedures as follows:

- (a) Four representative samples (6-inch x 12-inch cylinders) shall be taken at the point of placement for each day's pour for each lift, or every 3,500-cubic feet, whichever is more frequent. Samples shall be marked for clear identification, and all pertinent field information will be recorded on the field report, including the station limits and elevation limits of the placement. Slump and air content shall not be measured.
- (b) Samples shall be obtained by overfilling the cylinders by pouring concrete down the insides of the cylinders, allowing air to escape during filling. **DO NOT ROD THE SAMPLES.** The sides and bottom of the cylinder molds shall be tapped to close any accidentally entrained air voids. Strike off the top of the cylinder (not more than three times) and cover.
- (c) Samples shall be placed in a location where they will not be disturbed nor subjected to temperatures below 44 °F or above 84 °F. Excessive handling may damage the test cylinders.
- (d) After 24-hours, the Engineer will ship the cylinders along with the corresponding field test reports to the testing facility for storage. At 28-days, the cylinders will be compression tested in accordance with ASTM D 4832.
- (e) Failure to meet the on-service density or the strength criterion specified for the CLSM may require removal and replacement of that entire lift and all overlying lifts at the Contractor's expense, based on an engineering evaluation performed by the Engineer.

**Construction Methods:**

Mixing and placing operations shall be under the supervision of the representative of the supplier. The CLSM shall be placed in lifts not to exceed 2-feet unless otherwise approved by the Engineer. Subsequent lifts shall be placed only after a minimum 12-hour waiting period has been observed. The CLSM should not be driven on by any vehicle or construction equipment for at least 48-hours after placement.

The CLSM shall be placed on supporting surfaces which have been cleaned of loose debris, sand, dust, or other foreign materials to the satisfaction of the Engineer. Surfaces against which the CLSM is to be placed shall not be frozen and shall be free of ice and snow. The ambient temperature shall be at least 35 °F and rising at the time of placement.

**Qualifications:**

The Contractor shall procure the services of a representative of the supplier to be on site full time during the placement of the CLSM. The representative of the supplier shall be regularly engaged in the placement of the CLSM including the placement of mass fills having a minimum of 5,000-cubic yards in the past three years. CLSM shall have been successfully applied on three projects, which have demonstrated satisfactory performance for at least three years. The Contractor shall submit a project list to the Engineer complying with the above requirements a minimum of 30 working days prior to the start of the work.

**Method of Measurement:**

This work shall not be measured and shall be incidental to the construction of the pertinent Retaining Wall or Abutment Wall.

**Basis of Payment:**

CLSM including the cost of furnishing all equipment, labor, representative of the supplier, and material necessary to complete the required work will not be paid for separately, but will be included in the Contract lump sum price for the pertinent Retaining Wall or Abutment Wall.

9/16/10

**211521 – ABANDONMENT OF WELLS**

**Description:**

This work shall consist of furnishing equipment, materials, and labor to seal geotechnical monitoring wells previously installed within the limits of the construction included in this contract. This item shall only be used when specified in the Contract Documents or as directed by the Department. The wells to be removed in this contract are designated on the Construction Plans. The location of the wells shown on the drawings is approximate and must be verified by the Contractor.

**Submittals:**

- (a) **Master Well Driller's Certificate.** Twenty (20) working days prior to abandoning the monitoring well the Contractor will submit to the Department the Master Well Driller's Certificate for review.
- (b) **Abandoned Well Report.** When the well has been abandoned, the person abandoning it, shall notify the Approving Authority of this action by completing an Abandoned Well Report form provided by the Approving Authority. This report shall be submitted not later than 30 days after abandonment of the well or test hole. A copy of the Abandoned Well Report and the transmittal shall be submitted to the Engineer within 30 days after abandonment.

**Materials:**

Materials for well sealing including concrete, Portland cement grout, sodium-based bentonite clay grout, and other materials approved by the Department shall be in accordance with the Delaware Regulations Governing the Construction and Use of Wells, 1997.

Drill cuttings, clay, silt, sand, gravel, and crusher run are considered fill material and may only be used in the abandonment of wells in accordance with Section 9.03 of the Regulations.

Portland cement grout and sodium-base bentonite clay grout shall meet the requirements of 4.07(J) (1) and (2) of the Regulations.

**Construction Methods:**

Abandonment of Wells shall be in accordance with the Delaware Regulations Governing the Construction and Use of Wells, 1997. Prior to the well abandonment, the Contractor shall verify the location, diameter, depth, and condition of the well and the type of construction. Well abandonment shall be performed by a master well driller licensed by the Delaware State Board of Well Drillers.

**Method of Measurement:**

Abandonment of Wells will be measured per Each well abandoned, including sealing the monitoring well and furnishing all material, labor, equipment, tools, and incidentals necessary to complete the work.

**Basis of Payment:**

Abandonment of Wells will be paid for at the Contract unit price per Each well abandoned. The payment will be full compensation for furnishing and sealing the monitoring well and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

9/16/10

**211523 – REMOVAL OF P.C.C. BARRIER**

**Description:**

This work consists of the removal and acceptable disposal of existing P.C.C. barrier and median overhead sign foundations that interfere with the completion of new construction in accordance with the notes and details on the Plans and as directed by the Engineer, except such barrier that is designated to remain or is to be removed in accordance with other pay items.

**Construction Methods:**

Extreme care shall be used during the removal of existing P.C.C. barrier and median overhead sign foundations to avoid damage to existing P.C.C. barrier, drainage pipes, and surrounding pavement that is to remain in place. Care shall also be exercised by the Contractor in the operation to ensure that no damage occurs to any existing buried, surface, or aerial utility. The broken P.C.C. barrier and median overhead sign foundations shall become the property of the Contractor and shall be removed from the Project or otherwise disposed of as specified in Standard Specification Subsection 106.09.

**Method of Measurement:**

The quantity of P.C.C. barrier removed will be measured by the linear feet (linear meters) of existing P.C.C. barrier and median overhead sign foundations removed.

**Basis of Payment:**

The quantity of P.C.C. barrier removed will be paid for at the Contract unit price per linear foot (linear meter). Price and payment shall include full compensation for the removal and disposal of the existing P.C.C. barrier and median overhead sign foundations, and for all labor, equipment, tools, and all necessary incidentals required to complete the work.

11/15/06

401644 - SUPERPAVE, TYPE C HOT-MIX, 115 GYRATIONS, PG 64-22 (CARBONATE STONE)  
401645 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 64-22 (CARBONATE STONE)  
401646 - SUPERPAVE, TYPE C HOT-MIX, 205 GYRATIONS, PG 64-22 (CARBONATE STONE)

401647 - SUPERPAVE, TYPE B HOT-MIX, 115 GYRATIONS, PG 64-22  
401648 - SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 64-22  
401649 - SUPERPAVE, TYPE B HOT-MIX, 205 GYRATIONS, PG 64-22

401650 - SUPERPAVE, TYPE C HOT-MIX, 115 GYRATIONS, PG 70-22 (CARBONATE STONE)  
401651 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 70-22 (CARBONATE STONE)  
401652 - SUPERPAVE, TYPE C HOT-MIX, 205 GYRATIONS, PG 70-22 (CARBONATE STONE)

401653 - SUPERPAVE, TYPE B HOT-MIX, 115 GYRATIONS, PG 70-22  
401654 - SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 70-22  
401655 - SUPERPAVE, TYPE B HOT-MIX, 205 GYRATIONS, PG 70-22

401656 - SUPERPAVE, TYPE C HOT-MIX, 115 GYRATIONS, PG 76-22 (CARBONATE STONE)  
401657 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 76-22 (CARBONATE STONE)  
401658 - SUPERPAVE, TYPE C HOT-MIX, 205 GYRATIONS, PG 76-22 (CARBONATE STONE)

401659 - SUPERPAVE, TYPE B HOT-MIX, 115 GYRATIONS, PG 76-22  
401660 - SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 76-22  
401661 - SUPERPAVE, TYPE B HOT-MIX, 205 GYRATIONS, PG 76-22

401662 - SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 115 GYRATIONS, PG 64-22  
401663 - SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 160 GYRATIONS, PG 64-22  
401664 - SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 205 GYRATIONS, PG 64-22

401665 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 64-22, PATCHING  
401666 - SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 64-22, PATCHING  
401667 - SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 160 GYRATIONS, PG-64-22, PATCHING

401668 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG-64-22, WEDGE  
401669 - SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG-64-22, WEDGE

401704 - SUPERPAVE, TYPE C HOT-MIX, 115 GYRATIONS, PG 64-22, (NON-CARBONATE STONE)  
401705 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 64-22, (NON-CARBONATE STONE)  
401706 - SUPERPAVE, TYPE C HOT-MIX, 205 GYRATIONS, PG 64-22, (NON-CARBONATE STONE)

401707 - SUPERPAVE, TYPE C HOT-MIX, 115 GYRATIONS, PG 70-22, (NON-CARBONATE STONE)  
401708 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 70-22, (NON-CARBONATE STONE)  
401709 - SUPERPAVE, TYPE C HOT-MIX, 205 GYRATIONS, PG 70-22, (NON-CARBONATE STONE)

401710 - SUPERPAVE, TYPE C HOT-MIX, 115 GYRATIONS, PG 76-22, (NON-CARBONATE STONE)  
401711 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 76-22, (NON-CARBONATE STONE)  
401712 - SUPERPAVE, TYPE C HOT-MIX, 205 GYRATIONS, PG 76-22, (NON-CARBONATE STONE)

**Description:**

The following Subsections of the Standard Specifications shall be applicable: 401.01, 401.03 - 401.10, 401.12, and 401.13. All other subsections have been modified herein.

The Contractor shall read and thoroughly understand the requirements of the QA/QC specification as defined in item 401699. It is the responsibility of the Contractor to determine all costs associated with meeting these requirements and to include them in the per ton bids for the various Superpave bituminous concrete items. The Contractor shall also be aware that the pay adjustment factors in item 401699 will be applied to the Superpave bituminous concrete payments to determine the bonus or penalty for the item.

**Materials:**

Materials for hot-mix, hot-laid bituminous concrete shall conform to the requirements of Subsections 823.01, 823.05- 823.17, and 823.25 - 823.28 of the Standard Specifications and the following.

**Asphalt Binder:**

The asphalt binder shall meet the requirements of Superpave PG 64-22, PG 70-22, or PG 76-22 performance grade asphalt, as referenced in the Plans, according to M-320, Table 1 and tested according to AASHTO PP6 with the following test ranges:

TEST PROCEDURE	AASHTO REFERENCE	SPECIFICATION LIMITS
Temperature, °C	M-320	Per Grade
Original DSR, G*/sin (δ)	T-315	1.00 - 2.00 kPa
RTFO DSR, G*/sin (δ)	T-315	2.20 - 5.00 kPa
PAV DSR, G*/sin (δ)	T-315	1400 - 5000 kPa
BBR Creep Stiffness	T-313	90.0 - 300.0 kPa
BBR — value	T-313	0.300 - 0.440

Substitution of a higher temperature grade will require prior approval by the Engineer. If PG 76-22 is the specified binder, recycled asphalt pavement(RAP) and natural sand shall not be allowed in the mixture. If a producer would like to submit a mixture with natural sand, the Engineer will perform a deformation test using the Asphalt Pavement Analyzer (APA). The sample will be tested per AASHTO TP xxx “Determining Rutting Susceptibility of Asphalt Paving Mixtures Using the Asphalt Pavement Analyzer (APA).” If the depth of measured permanent deformation is 2 mm or less after 8000 strokes and a fatigue criteria of less than 1.0 mm/stroke after at least 50000 strokes, the mixture may be approved for use.

**Shingles:**

Only shingles reclaimed from shingle manufacturers such as tabs, punch-outs, and damaged new shingles shall be allowed in the mixture. Post-consumer shingles or used shingles shall not be permitted in the mixture and all shingles shall be free of all foreign material and moisture. Fiberglass-backed and organic felt-backed shingles shall be kept separately and both materials shall not be used in the same mixture at the same time. The shingles shall be broken down in the mixing process with 100% passing the ½ in (12.5 mm) sieve. Shipping, handling, and shredding costs are incidental to the price of Superpave bituminous concrete.

The overall percentage of RAP and recycled shingles (5% maximum) shall not exceed 20% of the mixture. The RAP and recycled shingles mixture are not permitted on wearing course.

**Mineral Aggregate:**

The mineral aggregate employed in the target gradation of the job mix formula (JMF) shall conform to Section 805 and the following criteria. These criteria apply to the combined aggregate blend.

DESIGN ESAL'S (MILLIONS)	COARSE AGGREGATE ANGULARITY <sup>1</sup> (% MIN)		FINE AGGREGATE ANGULARITY <sup>2</sup> (% MIN)		CLAY CONTENT <sup>3</sup> (% - MIN)	FLAT AND ELONGATED <sup>4</sup> (% - MAX)
	≤ 100 MM	> 100 MM	≤ 100 MM	> 100 MM		
< 0.3	55/-	-/-	-	-	40	-
0.3 to < 3	75/-	50/-	40	40	40	10
3 to <10	85/80 <sup>5</sup>	60/-	45	40	45	
10 < 30	95/90	80/75	45	40	45	
≥30	100/100	100/100	45	45	50	

<sup>1</sup>Coarse Aggregate Angularity is tested according to ASTM D5821.

<sup>2</sup>Fine Aggregate Angularity is tested according to AASHTO TP-33.

<sup>3</sup>Clay Content is tested according to AASHTO T176.

<sup>4</sup>Flat and Elongated is tested according to ASTM 4791 with a 5:1 aspect ratio.

<sup>5</sup> 85/80 denotes that 85% of the coarse aggregate has one fractured face and 80% has two or more fractured faces.

The following source properties apply to the individual aggregates in the aggregate blend for the proposed JMF.

TEST METHOD	SPECIFICATION LIMITS
<b>Toughness, AASHTO T96</b> Percent Loss, Maximum	40
<b>Soundness, AASHTO T104</b> Percent Loss, Maximum for five cycles	20
<b>Deleterious Materials, AASHTO T112</b> Percent, Maximum	10
<b>Moisture Sensitivity, AASHTO T283</b> Percent, Minimum	80

For any roadway with a minimum average daily traffic volume (ADT) of 8000 vehicles and a posted speed of 35 mph (60 kph) or greater, the polish value of the composite aggregate blend shall be greater than 8.0 when tested according to Maryland State Highway Administration MSMT 411 – “Laboratory Method of Predicting Frictional Resistance of Polished Aggregates and Pavement Surfaces.” RAP shall be assigned a value of 4.0. The contractor shall supply all polish values to the Engineer upon request.

**Mineral Filler:**

The mineral filler shall conform to AASHTO M17.

**Mixture Requirements:**

**Gradation:** The FHWA Superpave 0.45 Power Chart with the recommended restricted zone shall be used to define permissible gradations for the specified mixture. Type C shall be either a No.4 (4.75 mm), 3/8” (9.5 mm), or 1/2” (12.5 mm) Nominal Maximum Aggregate Size Hot-Mix. Unless otherwise noted in the Plans, the Type C shall meet the 3/8” (9.5 mm) Nominal Maximum Aggregate Size. Type B Hot-Mix shall be the 3/4” (19.0 mm) Nominal Maximum Aggregate Size and the Bituminous Concrete Base Course (BCBC) shall be the 1” (25.0 mm) Nominal Maximum Aggregate Size. Target values for percent passing each standard sieve for the design aggregate structure shall comply with the Superpave control points and should avoid the restricted zone. Percentages shall be based on the washed gradation of the aggregate according to AASHTO T11.

In addition to the results of the material requirements specified above, the following material properties shall be provided by the contractor: bulk specific gravity  $G_{sb}$ , apparent specific gravity  $G_{sa}$ , and the absorption of the individual aggregate stockpiles to be used, tested according to AASHTO T84 and AASHTO T85 and reported to three decimal places along with the specific gravity of the mineral filler to be used, tested according to AASHTO T100 and reported to three decimal places.

**Superpave Gyrotory Compactive (SGC) Effort:**

The Superpave Gyrotory Compaction effort employed throughout mixture design, field quality control, or field quality assurance shall be as indicated below. All mixture specimens tested in the SGC shall be compacted to  $N_M$  Height data provided by the SGC shall be employed to calculate volumetric properties at  $N_i$ ,  $N_D$ , and  $N_M$

**Superpave Gyrotory Compactive (SGC) Effort:**

DESIGN TRAFFIC LEVEL (MILLION ESAL'S)	$N_{INITIAL}$	$N_{DESIGN}$	$N_{MAXIMUM}$
0.3 to < 3	7	75	115
3 to < 30	8	100	160
$\geq 30$	9	125	205

**Volumetric Design Parameters.** The design aggregate structure at the target asphalt cement content shall satisfy the volumetric criteria below:

DESIGN ESAL'S (MILLION)	REQUIRED DENSITY (% OF THEORETICAL MAXIMUM SPECIFIC GRAVITY)			VOIDS-IN-MINERAL AGGREGATE (% - MINIMUM)					VOIDS FILLED WITH ASPHALT (% - MINIMUM)
	$N_{INITIAL}$	$N_{DESIGN}$	$N_{MAX}$	NOMINAL MAX. AGGREGATE (MM)					
				25.0	19.0	9.5	12.5	4.75	
0.3 to < 3	$\leq 90.5$	96.0	$\leq 98.0$						65.0 - 78.0
3 to < 10	$\leq 89.0$			12.0	13.0	15.0	14.0	16.0	65.0 - 75.0 <sup>1</sup>
10 < 30									
$\geq 30$									

Air voids ( $V_a$ ) at  $N_{design}$  shall be 4.0% for all ESAL designs. Air voids ( $V_a$ ) at  $N_{max}$  shall be a minimum of 2.0% for all ESAL designs

The dust to binder ratio for the mix having aggregate gradations above the PCS Control Points shall be 0.6-1.2. For aggregate gradations below the PCS Control Points, the dust to binder ratio shall be 0.8-1.6. For the No. 4 (4.75 mm) mix, the dust to binder ratio shall be 0.9-2.0 whether above or below the PCS Control Points.

For 3/8" (9.5 mm) Nominal Maximum Aggregate Size mixtures, the specified VFA range shall be 73.0% to 76.0% and for 4.75 mm Nominal Maximum Size mixtures, the range shall be 75 % to 78% for design traffic levels  $\geq 3$  million ESALs.

**Gradation Control Points:**

The combined aggregates shall conform to the gradation requirement specified in the following table when tested according to T-11 and T-27.

Nominal Maximum Aggregates Size Control Points, Percent Passing										
SIEVE SIZE	25.0 MM		19.0 MM		12.5 MM		9.5 MM		4.75 MM	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
37.5 MM	100	-	-	-	-	-	-	-	-	-
25.0 MM	90	100	100	-	-	-	-	-	-	-
19.0 MM	-	90	90	100	100	-	-	-	-	-
12.5 MM	-	-	-	90	90	100	100	-	100	-
9.5 MM	-	-	-	-	-	90	90	100	95	100
4.75 MM	-	-	-	-	-	-	-	90	90	100
2.36 MM	19	45	23	49	28	58	32	67	-	-
1.18 MM	-	-	-	-	-	-	-	-	30	60
0.075 MM	1	7	2	8	2	10	2	10	6	12

Note: The aggregate’s gradation for each sieve must fall within the minimum and maximum limits.

**Gradation Classification:**

The Primary Control Sieve (PCS) defines the break point of fine and coarse mixtures. The combined aggregates shall be classified as coarse graded when it passes below the Primary Control Sieve (PCS) control point as defined below. All other gradations shall be classified as fine graded.

PCS CONTROL POINT FOR MIXTURE NOMINAL MAXIMUM AGGREGATES SIZE (% PASSING)					
Nominal maximum Aggregates Size	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.5 mm
Primary Control Sieve	4.75 mm	4.75 mm	2.36 mm	2.36 mm	1.18 mm
PCS Control Point	40	47	39	47	30-60

**Plant Production Tolerances:**

Volumetric Property	Superpave Criteria
Air Voids ( $V_a$ ) at (%) $N_m$ Air Voids ( $V_a$ ) at $N_{design}$ (%)	2.0 (min) 5.5 (max)
Voids in Mineral Aggregate (VMA) at $N_{design}$ 25.0 mm Bituminous Concrete Base Course 19.0 mm Type B Hot-Mix 12.5 mm Type C Hot-Mix 9.5 mm Type C Hot-Mix 4.5 mm Type C Hot-Mix	-1.2 +2.0

**Design Evaluation:**

The contractor shall furnish a Job Mix Formula (JMF) for review and approval. The Engineer may elect to evaluate the proposed JMF and suitability of all materials. All materials requested by the Engineer shall be provided at the contractor’s expense to the Central Laboratory in Dover in a timely manner upon request. To verify the complete mixture design and evaluate the suitability of all materials, the following approximate quantities are required:

5.25 gal (20 liters) of the asphalt binder;  
0.13 gal (0.5 liters) sample of liquid heat-stable anti-strip additive;  
254 lb. (115 kg) of each coarse aggregate;  
154 lb. (70 kg) of each intermediate and fine aggregate;  
22 lb. (10 kg) of mineral filler; and  
254 lb. (115 kg) of RAP, when applicable.

**The proposed JMF shall include the following:**

Plot of the design aggregate structure on the FHWA Superpave 0.45 power chart showing the maximum density line, Superpave control points, and recommended restricted zone.

Plot of the three trial asphalt binder contents at +/- 0.5% gyratory compaction curves where the percent of maximum specific gravity (% of  $G_{mm}$ ) is plotted against the log base ten of the number of gyrations ( $\log(N)$ ) showing the applicable criteria for  $N_i$ ,  $N_d$ , and  $N_m$ .

Plot of the percent asphalt binder by total weight of the mix ( $P_b$ ) versus the following:

% of  $G_{mm}$  at  $N_d$ , VMA at  $N_d$ , VFA at  $N_d$ , Fines to effective asphalt binder ( $P_{be}$ ) ratio, and unit weight ( $\text{kg/m}^2$ ) at both  $N_d$  and  $N_m$ .

Summary of the consensus property standards test results for the design aggregate structure, summary of the source property standards test results for the individual aggregates in the design aggregate structure, target value of the asphalt binder content, and a table of  $G_{mm}$  of the asphalt mixture for the four trial asphalt binder contents determined according to AASHTO T209.

The JMF shall also include the NCAT Ignition Oven calibration for the specific materials utilized for this mix.

**Compaction:**

Compaction shall be tested and paid per Item 401699 - Quality Control/Quality Assurance of Bituminous Concrete .05 (b) Pavement Construction - Tests and Evaluations.

**Method of Measurement and Basis of Payment:**

Method of Measurement and Basis of Payment will be in accordance with Subsections 401.14 and 401.15 of the Standard Specifications.

The item 401699, will define adjustment factor to be applied to the bituminous concrete payments for bonus or penalty.

12/4/03

**401699 - QUALITY CONTROL/QUALITY ASSURANCE OF BITUMINOUS CONCRETE**

**.01 Description.**

This item shall govern the Quality Control/Quality Assurance Testing for supplying hot-mix asphalt plant materials and constructing hot-mix asphalt pavements.

The Contractor shall be responsible for providing the quality level of materials and construction incorporated into the Contract that will meet the requirements of the Contract. The Contractor shall perform all necessary quality control inspection, sampling, and testing. The Engineer will evaluate all materials and construction for acceptance. The procedures for Quality Control and Acceptance are described in this Section.

**.02 Definitions.**

- **Acceptable Quality Level (AQL):** That level of percent within limits (PWL) to which the Engineer will consider the work completely acceptable.
- **Acceptance Plan:** Factors that comprise the Engineer's determination of the degree of compliance with contract requirements and value of the product. These factors include the Engineer's sampling, testing, and inspection.
- **Delaware Asphalt Pavement Association (DAPA):** The organization representing the interests of hot-mix asphalt producers and Contractors. The Engineer has a copy of the DAPA officers' names and point(s) of contact.
- **Dispute Resolution:** The procedure used to resolve conflicts resulting from discrepancies between the Engineer's and the Contractor's results of sufficient magnitude to impact payment. The testing will take place at a location and time mutually agreeable by both the Engineer and the Contractor.
- **Full Depth Construction** – Construction of an adequate pavement box on a subgrade and subbase prepared by the contractor
- **Independent Assurance:** An unbiased and independent verification of the Quality Assurance system used, and the reliability of the test results obtained in regular sampling and testing activities. The results of Independent Assurance are not to be directly used as a basis of material acceptance.
- **Job Mix Formula (JMF)/Mixture Identification (ID):** The target values for individual aggregate size gradation percentages and the asphalt percentage, the sources of each of the component materials, the proposed proportions of component materials to be used to meet those target values, the asphalt proportion, and the mixing temperature. The Engineer will assign uniquely individual mixture identification for each JMF submitted and approved.
- **Lower Quality Index (QL):** The index reflecting the statistic related to the lower boundary to which a sample (or sample statistic) may deviate from the target value and still be considered acceptable.
- **Mean:** A statistical measure of the central tendency – the average value.
- **Operational Day:** A day in which the Engineer has approved a lane closure for the Contractor to perform work within an approved MOT plan.
- **Percent Within Limits (PWL):** That amount of material or workmanship that has been determined, by statistical method, to be within the pre-established characteristic boundary(ies).
- **Qualified Laboratory:** A laboratory mutually agreed upon by both DAPA and the Engineer as having proper test equipment that has been calibrated in accordance to AASHTO.
- **Qualified Technician:** Personnel mutually agreed upon by both DAPA and the Engineer as having adequate training, experience, and abilities to perform the necessary testing. The minimum qualifications are either a recognized nationally accredited or certified Superpave testing certificate or been working in hot-mix asphalt testing for at least one year.
- **Quality Assurance (QA):** All those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality.
- **Quality Control (QC):** The sum total of the activities performed by the Contractor in order to assure that the product meets contract requirements.
- **Quality Control (QC) Plan:** The detailed description of the type and frequency of inspection, sampling, and testing deemed necessary to measure and control the various properties governed by the Specifications. The QC Plan must address the actions needed to keep the process in control, detect when the process is going out of control, and responses to correct the situation(s).
- **Quality Level Analysis:** A statistical procedure that provides a method for estimating the percentage of each lot or subplot of material, product, item of construction, or completed construction that may be expected to be within specified tolerances.

- **Standard Deviation:** A term used in statistics to indicate the value calculated from the square root of the difference between the individual measurements in a group and their average. Standard deviation is calculated by taking the square root of the sum of the squares of the differences of each of n values and the mean value, this sum first divided by (n-1).
- **Target Value:** The acceptable value for a controlling characteristic of a product. The JMF will establish each of these values for the material.
- **Test Methods:** Shall be AASHTO test methods. Copies of these test methods shall be available at each qualified laboratory.
- **Upper Quality Index (QU):** The index reflecting the statistic related to the upper boundary to which a sample (or sample statistic) may deviate from the target value and still be considered acceptable.
- **Volumetric Properties:** Air voids, voids in mineral aggregates (VMA), voids filled with asphalt (VFA), and dust to effective asphalt.

### **.03 Equipment.**

#### **(a) Material Production Test Equipment.**

The Contractor shall establish, maintain, and operate a qualified testing laboratory at the production plant site of sufficient size and layout that will accommodate the testing operations of both the Contractor and the Engineer. The Contractor shall maintain all the equipment used for handling, preparing, and testing materials in proper operating condition. For any laboratory equipment malfunction, the Contractor shall remedy the situation within one working day or the Engineer may reject production. In the case of an equipment malfunction, and while waiting for repairs to equipment, the Engineer may elect to test the material at either another production facility or the Engineer's laboratory to obtain payment factors.

The following shall be the minimum calibrations for the referenced equipment:

- SUPERPAVE<sup>R</sup> Gyratory Compactor: once every year; verified once every month by the Engineer.
- Ovens: once every three months, verified once every month.
- Vacuum Container and Gauge (Rice Bowls): once every three months, verified once every month.
- Balances and Scales: once every year, verified once every month.
- Thermometers: once a year; verified once every month.
- Gyratory Compactor molds and base plates: once every year
- Mechanical Shakers: once every year
- Sieve Verifications: once every year

All calibrations shall be documented and on file for review by the Engineer at any time.

#### **(b) Pavement Construction Test Equipment.**

The Contractor shall furnish and use in-place density gauges, or coring equipment, or both, as necessary to meet the requirements of these Specifications.

### **.04 Quality Control (QC) Plan.**

#### **(a) Material Production QC.**

##### **(1) Job Mix Formula – Material Production.**

The Contractor shall submit for approval to the Engineer the job mix formula (JMF) design of the component materials and target characteristic values for each mixture proposed for use. Once the JMF is submitted to the Engineer, the Engineer will have up to three weeks to review the submitted information. However, a provision for a more timely approval is available to the Contractor; first, the Contractor shall submit the proper documentation on Pinepave mixture design software for the Engineer's approval. After that approval from the Engineer, the Contractor shall produce the new mixture for a non-Department project. The Engineer will test the material, by taking three series per the specifications. If the Engineer's test results are within the specifications, then the mixture will be approved by the Engineer for Department projects.

The component materials design shall include designating the source and the expected proportion (within 1 percent for the aggregate components, and within 0.1 percent for the other components) of each component to be used in order to produce workable hot-mix asphalt having the specified properties. For plant component

feed adjustments, RAP can be considered in the same manner as an individual aggregate component. The JMF target characteristic values include the mixing temperature range, core temperature range for gyration, the percentage of the asphalt cement component (both total and virgin), and the percentages of the aggregate amounts retained on the sieves to be addressed by the JMF as shown in Table 1.

The Contractor shall provide an ignition oven correction number for each JMF. The Contractor shall also supply to the Engineer weighed material of each JMF so correction numbers can be established for the Engineer’s equipment for Dispute Resolution samples.

Prior to starting production of a new mixture, the Contractor shall submit a JMF. For any mixture that has a 20% or greater failure rate on any combined volumetric criteria, the JMF will not be approved for use on Department contracts. In order to be approved, a re-design of the mixture will have to be completed by the Contractor for review and approval by the Engineer. The Contractor shall uniquely title each JMF. The Contractor shall submit test data with each JMF and tests performed by a Qualified Laboratory on representative materials, verifying the adequacy of the design. Refer to the specifications for each mix type in order to determine the design requirements. The JMF sieve percentage values shall conform to the ranges shown in Table 1.

If there is a change in the source of any of the component materials, other than asphalt, if there is a change in the proportions of the aggregate components or the percent passing for each sieve by more than 5 percent from the submitted JMF, or if there is a change in the percentage of the asphalt cement component by 0.2 percent or more, which causes the volumetrics to change from the originally submitted JMF, a new JMF is required. Also, if the asphalt cement target percentage is lowered, all volumetric criteria must still be achieved.

According to the Contractor’s QC Plan, the Contractor shall inform the Engineer of any proposed changes to an existing JMF. The Contractor shall notify the Engineer by electronic mail of the proposed changes. The Engineer will reply to the proposed changes within one operational day and notify the Contractor of the effective date of the changes.

Although a new JMF is not required, the Contractor must notify the Engineer of any change in the proportions of the components. This notification shall include the total change made from the approved JMF proportions, and the effective time of the change.

All submitted JMF’s shall correspond to the Pinepave mixture design software. The Engineer, for evaluation of the submitted JMF, will use the first three test samples. These test results acquired during production shall be within the following range compared to the submitted JMF on the Pinepave mixture design software:  $G_{mm}$ : + / -0.030 and  $G_{mb}$ : + / - 0.040

<b>Table 1 - Aggregate Gradation - JMF and Control Point Information</b>										
<b>Sieves to be addressed by JMF/Range values are percentages passing by weight</b>										
<b>Sieve Size mm (inch)</b>	<b>4.75 mm</b>	<b>4.75mm Range</b>	<b>9.5 mm</b>	<b>9.5mm Range</b>	<b>12.5 mm</b>	<b>12.5mm Range</b>	<b>19.0 mm</b>	<b>19.0mm Range</b>	<b>25.0 mm</b>	<b>25.0mm Range</b>
37.5(1.5)	No		No		No		No		Yes	100
25.0(1.0)	No		No		No		Yes	100	Yes	90-100
19.0 (3/4)	No		No		Yes	100	Yes	90-100	Yes	20-90
12.5(1/2)	Yes	100	Yes	100	Yes	90-100	Yes	23-90	Yes	
9.5 (3/8)	Yes	95-100	Yes	90-100	Yes	28-90	Yes		Yes	
4.75(#4)	Yes	90-100	Yes	32-90	Yes		Yes		Yes	
2.36(#8)	Yes		Yes	32-67	Yes	28-58	Yes	23-49	Yes	19-45
(#16)	Yes	30-60	Yes		Yes		Yes		Yes	
(#30)	Yes		Yes		Yes		Yes		Yes	

<b>Table 1 - Aggregate Gradation - JMF and Control Point Information</b>										
<b>Sieves to be addressed by JMF/Range values are percentages passing by weight</b>										
<b>Sieve Size mm (inch)</b>	<b>4.75 mm</b>	<b>4.75mm Range</b>	<b>9.5 mm</b>	<b>9.5mm Range</b>	<b>12.5 mm</b>	<b>12.5mm Range</b>	<b>19.0 mm</b>	<b>19.0mm Range</b>	<b>25.0 mm</b>	<b>25.0mm Range</b>
(#50)	Yes		Yes		Yes		Yes		Yes	
(#100)	Yes		Yes		Yes		Yes		Yes	
.075(#200)	Yes	6-12	Yes	2-10	Yes	2-10	Yes	2-8	Yes	1-7

**(2) Process Control – Material Production.**

The Contractor shall submit in writing (letter or electronic mail) a QC Plan from each proposed production plant to the Engineer; no hot-mix asphalt material will be accepted until the Engineer approves the QC Plan. This plan must be submitted to the Engineer on an annual basis for review and approval prior to material production. The Engineer will send a signed copy back to the Contractor stating that it is approved. The approved QC Plan shall govern contractor operations.

The following are considered significant violations to the Contractor’s QC Plan:

- Using testing equipment that is knowingly out of calibration or is not working properly.
- Reporting false information such as test data, JMF information, or any info requested by DeDOT
- When the Contractor fails to comply to their approved QC Plan in reference to materials testing
- Substantial deviations to AASHTO or DeDOT procedures when running tests, sampling stockpiles, or testing hot mix.
- The use of any material not listed in the JMF.
- The use of the wrong PG graded asphalt.
- If samples fall within the Contractors action points in the QC Plan but the Contractor fails to take the corrective action in the approved QC Plan

If a Contractor is found in violation of any of these items, they will receive a written warning for their first violation. If the Contractor is found in violation a second time on any of the criteria, they will forfeit any bonus from that day’s production. If the Contractor is found in violation a third time on any of the criteria, they will receive a five percent (5%) deduction for that day’s production. If the Contractor is found in violation a fourth time, the plant will not be approved for production until such time that the Contractor addresses the violation of the QC plan to the satisfaction of the Engineer. If the Engineer approves the changes in advance, the Contractor may make changes to the QC Plan. All changes shall be submitted and approved in writing by the Engineer.

The QC Plan shall include actions that will assure all materials and products will conform to the specifications, whether manufactured or processed by the Contractor, or procured from suppliers, subcontractors, or vendors. The Contractor shall perform the inspection and tests required to substantiate product conformance to contract requirements. The Contractor shall document QC inspections and tests, and provide copies to the Engineer when requested. The Contractor shall maintain records of all inspections and tests for at least one year. The records shall include the date, time, and nature of deficiency or deficiencies found; the quantities of material involved until the deficiency was corrected; and the date, time, and nature of corrective actions taken.

In the QC Plan, the Contractor shall detail the type and frequency of inspection, sampling, and testing deemed necessary to measure and control the various properties of material and construction governed by the Specifications. The QC Plan shall include the following elements as a minimum:

- Production Plant – make, type, capacity, and location.
- Production Plant Calibration – components and schedule; address documentation.
- Personnel – include name and telephone number for the following individuals:

- Person responsible for quality control.
- Qualified technician(s) responsible for performing the inspection, sampling, and testing.
- Person who has the authority to make corrective actions on behalf of the Contractor.
- Testing Laboratory – state the frequency of accuracy checks and calibrations of the equipment used for testing; address documentation.
- Locations where samples will be obtained and the sampling techniques for each test
- Load number of QC samples (1-10 if QA sample is not within trucks 1-10)
- Tests to be performed and their normal frequency; the following, at a minimum, shall be conducted:
  - Mixture Temperature: each of the first five trucks, and each load that is sampled for QC or acceptance testing.
  - Gradation analysis of aggregate (and RAP) stockpiles – one washed gradations per week for each aggregate stockpile; RAP: five gradations and asphalt cement contents for dedicated stockpiles where new material is not being added; one gradation and asphalt cement content test per week for stockpiles where material is continually being added to the stockpile.
  - Gradation analysis of non-payment sieves
  - Dust to effective asphalt calculation
  - Moisture content analysis of aggregates – daily.
  - Gradation analysis of the combined aggregate cold feed – one per year per mixture.
  - Bulk specific gravity and absorption of blended material – one per year per mixture.
  - Ignition Oven calibration – one per year per mixture.
  - Hot-Bins: one per year per mixture.
  - Others, as appropriate.
- Procedures for reporting the results of inspection and tests (include schedule).
- Procedures for dealing with non-compliant material or work.
- Presentation of control charts. The Contractor shall plot the results of testing on individual control charts for each characteristic. The control charts shall be updated within one working day as test results for each subplot become available. The control charts shall be easily and readily accessible at the plant laboratory. The following parameters shall be plotted from the testing:
  - Asphalt cement content.
  - Volumetrics (air voids, voids in mineral aggregates [VMA])
  - Gradation values for the following sieves:
    - 4.75 mm (#4).
    - 2.36 mm (#8).
    - 0.075 mm (#200).
- Operational guidelines (trigger points) to address times when the following actions would be considered:
  - Increased frequency of sampling and testing.
  - Plant control/settings/operations change.
  - JMF adjustment.
  - JMF change (See Section .04(a)(1)).
  - Change in the source of the component materials.
  - Calibration of material production equipment (asphalt pump, belt feeders, etc.).
  - Rejection of material.

When any point of non-compliance with the QC plan, or material not meeting the Specifications, comes to the attention of either the Contractor or the Engineer, the other party shall be notified immediately, and the Contractor shall take appropriate corrective actions. Failure to take corrective actions immediately shall be cause for rejection of material or work by the Engineer.

**(b) Pavement Construction – Process Control.**

The Contractor shall perform Quality Control of pavement compaction by testing in-place pavement with a density gauge or by testing cores extracted from the pavement. The use of the nuclear density gauge shall

conform to ASTM D2950; the use of other density gauges shall be as per the manufacturer's recommendations and approved by the Engineer. The Contractor may use any method to select locations for the Quality Control.

**.05 Acceptance Plan.**

**(a) Material Production – Tests and Evaluations.**

The Engineer will conduct acceptance tests. The Engineer will directly base acceptance on the acceptance test results, the asphalt cement quality, the Contractor's QC Plan work, and the comparisons of the acceptance test results to the QC test results. The Engineer may elect to utilize test results of the Contractor in some situations toward judging acceptance. All acceptance tests shall be performed by qualified technicians at qualified laboratories following AASHTO or DelDOT procedures, and shall be evaluated using Quality Level Analysis.

The Contractor shall supply, capture, and mark samples, as directed, from delivery trucks before the trucks leave the production plant. The sample shall represent the material produced by the Contractor, and shall be of sufficient size to allow the Engineer to complete all required acceptance tests. The Engineer will direct the Contractor when to capture these samples, on a statistically random, unbiased basis, established before production begins each day based upon the anticipated production tonnage. The captured sample shall be from the Engineer specified delivery truck; if the Contractor visually observes the specified delivery truck sample and does not want this sample to be sampled and tested for acceptance, that delivery truck will not be sent to a Department project. The next visually acceptable delivery truck to the Contractor shall be sampled for acceptance testing.

The first sample of the production day will be randomly generated by the Engineer between loads 0 and 12 (0-250 tons). Subsequent samples will be randomly generated by the Engineer on 500-ton sub-lots for the production day. Unacceptable samples may be a basis for rejection of material if the QC plan is not followed as approved for sample retrieval. If the Contractor wishes to perform parallel tests with the Engineer, or to capture samples to be retained for possible Dispute Resolution, each of the samples for these purposes shall be obtained at the same time and location as the acceptance test sample. Either splitting a large sample or getting multiple samples that equally represent the material is acceptable. The Engineer will perform all splitting and handling of samples after they are obtained by the Contractor.

The Engineer will evaluate and accept the material on a lot basis. All the material within a lot shall have the same JMF (mixture ID). The lot size shall be targeted for 2000 tons or a maximum period of three days, whichever is reached first. If the 2000<sup>th</sup> ton target lot size is achieved during a production day, the lot size shall extend to the end of that production day. The Contractor may interrupt the production of one JMF in order to produce different material; this type of interruption will not alter the determination of the size or limits of material represented by a lot. The Engineer will evaluate each lot on a subplot basis. The size for each subplot shall be 100 to 500 tons and testing for the sub lots will be completed on a daily basis. For each subplot, the Engineer will evaluate one sample.

The target size of sub-lots within each lot, except for the first sample of the production day, is equal-sized 500 ton sub lots and will be based upon anticipated production, however, more or fewer sublots, with differing sizes, may result due to the production schedule and conditions. If the actual production is less than anticipated, and it's determined a sample will not be obtained (based upon the anticipated tonnage), a new sample location will be determined on a statistically random, unbiased basis based upon the new actual production. If the actual production is going to be 50 tons or greater over the anticipated sub lot production, a new sample location will be determined on a statistically random, unbiased basis based upon the new actual production. The Engineer will combine the evaluation and test results for all of the applicable sublots in order to evaluate each individual lot.

If the Engineer is present, and the quantity exceeds 25 tons, a statistically random sample will be used for analysis. When the anticipated production is less than 100 tons and greater than 25 tons, and the Engineer is not present, the contractor shall randomly select a sample using the Engineer's random location program. The captured sample shall be placed in a suitable box, marked to the attention of the Engineer, and submitted to the Engineer for testing. A box sample shall also be obtained by the contractor at the same time and will be used as the Dispute Resolution sample if requested by the Engineer. The contractor shall also obtain one liquid asphalt sample (1 pint) per grade of asphalt used per day and properly label it with all pertinent information.

The Engineer will conduct the following tests in order to characterize the material for the pavement compaction quality, and to judge acceptance and the pay adjustment for the material:

- AASHTO T312 – Preparing a mixture samples using a gyratory compactor.
- AASHTO T166, Method C (Rapid Method) – Bulk specific gravity of compacted samples.
- AASHTO T308 – Asphalt cement content.
- AASHTO T30 – Aggregate gradations, using samples from the asphalt cement content test.
- AASHTO T209 – Theoretical maximum specific gravity.
- ASTM Provisional Test Method – Rapid Drying of Compacted and Loose Bituminous Asphalt Specimens using Vacuum Drying Method

**(b) Pavement Construction – Tests and Evaluations.**

The Engineer will directly base acceptance on the compaction acceptance test results, and on the inspection of the construction, the Contractor’s QC Plan work, ride smoothness as referenced in the contract documents, lift thickness as referenced in the contract documents, joint quality as referenced in the contract documents, surface texture as referenced in the contract documents, and possibly the comparisons of the acceptance test results to the independent test results. For the compaction acceptance testing, the Engineer will sample the work on a statistically random basis, and will test and evaluate the work using lots.

Prior to paving a road segment, the Contractor shall notify the Engineer of any locations within that road segment that may not be suitable to achieve minimum (93%) compaction due to existing conditions. The Contractor shall schedule and hold a meeting in the field with the Engineer in order to discuss all areas that may potentially be applicable to Table 5a before paving starts. Areas that will be considered for Table 5a will be investigated in accordance to the method described in Appendix B. If this meeting is not held prior to paving, no areas will be considered for Table 5a. Areas of allowable exemptions that will not be cored include the following: partial-depth patch areas, driveway entrances, paving locations of less than 100 tons, areas around manholes and driveway entrances, and areas of paving that are under 400 feet in continuous total length and/or 5 feet in width.

The exempt areas around manholes will be a maximum of 4 feet transversely on either side from the center of the manhole, and 20 feet longitudinally on either side from the center of the manhole. The exempt areas around driveway entrances shall be the entire width of the driveway, and 3 feet from the edge of the longitudinal joint next to the driveway. Areas of exemption that will be cored for informational purposes only shall include: areas where the mat thickness is less than three times the nominal maximum aggregate size as directed by the Engineer, violations of Section 401.08 in the Standard Specifications as directed by the Engineer, and areas shown to contain questionable subgrade properties as proven by substantial yielding under a fully legally loaded truck. Failure to obtain core samples in these areas will result in zero payment for compaction regardless of the exempt status.

The Engineer will evaluate and accept the compaction work on a daily basis. Payment for the compaction will be calculated by using the material production lots as referenced in **.05 Acceptance Plan (a) Material Production – Tests and Evaluation** and analyzing the compaction results over the individual days covered in the material production lot. The compaction results will be combined with the material results to obtain a payment for this item.

The minimum size of a compaction lot shall be 100 tons. If the compaction lot is between 101 and 1000 tons, the Engineer shall randomly determine four compaction acceptance test locations. If the compaction lot is between 1001 and 1500 tons, the Engineer shall randomly determine six compaction acceptance test locations. If the compaction lot is between 1501 and 2000 tons, the Engineer shall randomly determine eight compaction acceptance test locations. If the compaction lot is greater than 2000 tons, the Engineer shall randomly determine two compaction acceptance test locations per 500 tons.

If a randomly selected area falls within an Engineer approved exemption area, the Engineer will select one more randomly generated location to be tested per the requirements of this Specification. If that cannot be accomplished, or if an entire location has been declared exempt, the compaction testing shall be performed as per these Specifications but a note will be added to the results that the location was an Engineer approved exempt location.

Testing locations will be a minimum of 1.5 feet from the newly placed longitudinal joint and 50 feet from a new transverse joint. If the Contractor chooses to cut companion cores, they shall be located within one foot

of the Engineers cores along the longitudinal direction and in-line with the Engineers cores in the longitudinal plane.

Exactly at the locations marked by the Engineer, the Contractor shall cut a core, 6 inches in diameter, through the full lift depth. Cores submitted that are not from the location designated by the Engineer will not be tested and will be paid at zero pay.

The Contractor shall notify the Engineer prior to starting paving operations with approximations of the tonnage to be placed. The Contractor is then responsible for notifying the appropriate Engineer test personnel within 12 hours of material placement. The Engineer will then have 24 hours to mark the core locations. After determination of locations, the Contractor shall complete testing within two operational days of the locations being marked. If the cores are not cut within two operational days, the area in question will be paid at zero pay for compaction testing.

The Contractor shall provide any traffic control required for the structural number investigation, sampling, and testing work at no additional cost to the Department.

The Contractor shall cut each core with care in order to prevent damaging the core. The pavement shall have a maximum temperature of 140°F when cores are cut from it. Immediately upon removal of a core from the roadway, the Contractor shall adequately label it. The Contractor shall protect the core by supplying a 6-inch plastic concrete cylinder mold, or an approved substitute, and placing the core in it. If more than one core is in the same mold, the Contractor shall place paper between them. The Contractor shall attach a completed QC test record for the representative area to the corresponding core. The Engineer will also complete a test record for areas tested for the QA report and provide to Materials & Research. At the end of every production day, the Contractor shall deliver the cores to the Engineer for testing, processing, and report distribution.

The Contractor shall repair the core hole per Appendix A, Repairing Core Holes in Hot-Mix Asphalt Pavements. Core holes shall be filled immediately. Failure to repair core holes at the time of coring will result in zero pay for compaction testing for the area in question.

The Engineer will conduct the following tests on the applicable portion of the cores in order to evaluate their quality:

- AASHTO T166, Method C (Rapid Method) – to determine the bulk specific gravity of the cores.
- AASHTO T209 – to calculate the theoretical maximum specific gravity and the density of the non-compacted mixtures.
- ASTM Provisional Test Method – Rapid Drying of Compacted and Loose Bituminous Asphalt Specimens using Vacuum Drying Method.

The Engineer will use the average of the last five test values of the same JMF (mixture ID) material at the production plant in order to calculate the average theoretical maximum specific gravity of the cores. The average will be based on the production days test results and as many test results needed from previous days production to have an average of five samples. If there are less than five values available, the Engineer will use the JMF design value in addition to the available values to calculate the average theoretical maximum specific gravity.

#### **.06 Payment and Pay Adjustment Factors.**

The Contractor shall include the costs for all materials, labor, equipment, tools, and incidentals necessary to meet the requirements of this specification in the bid price per ton for the hot-mix asphalt. Payment to the Contractor for the hot-mix asphalt item(s) will be based on the Contract price per ton and the pay adjustments described in this specification. The Engineer will determine pay adjustments for the hot-mix asphalt item(s) based on the Acceptance Plan. The Engineer will determine both a pay adjustment for the material and a pay adjustment for the pavement construction. Note that the material portion of the total pay adjustment is 70 percent and the pavement construction portion is 30 percent. For replaced material or work, the Engineer will not apply the Pay Adjustment applicable to the material or work replaced; a new Pay Adjustment will be calculated based on the qualities of the new material. Even if one portion of the pay adjustment (material or construction) is not applied, the Engineer may apply the pay adjustment to the other portion. All adjustments (bonus or penalty) shall be paid under this item number in the contract.

**(a) Material Production – Pay Adjustment.**

The Engineer will determine the material pay adjustment by evaluating the production material based on the following parameters:

- Gradation of the 2.36 mm (#8) sieve.
- Gradation of the 0.075 mm (#200) sieve.
- Asphalt cement content.
- Air void content

Using the JMF target value, the single test tolerance (from Table 3), and the test values, the Engineer will use the following steps to determine the material pay adjustment factor for each lot of material:

1. For each parameter, calculate the mean value and the standard deviation of the test values for the lot to the nearest 0.1 unit.
2. For each parameter, calculate the Upper Quality Index (QU):  

$$QU = ((\text{JMF target}) + (\text{single test tolerance}) - (\text{mean value})) / (\text{standard deviation}).$$
3. For each parameter, calculate the Lower Quality Index (QL):  

$$QL = ((\text{mean value}) - (\text{JMF target}) + (\text{single test tolerance})) / (\text{standard deviation}).$$
4. For each parameter, locate the values for the Upper Payment Limit (PU) and the Lower Payment Limit (PL) from Table 2 – Quality Level Analysis by the Standard Deviation Method. (Use the column for “n” representing the number of sublots in the lot. Use the closest value on the table when the exact value is not listed).
5. Calculate the PWL for each parameter from the values located in the previous step:  

$$PWL = PU + PL - 100.$$
6. Calculate each parameter’s contribution to the payment adjustment by multiplying its PWL by the weight factor shown in Table 3 for that parameter.
7. Add the calculated adjustments of all the parameters together to determine the Composite PWL for the lot.
8. From Table 4, locate the value of the Pay Adjustment Factor corresponding to the calculated PWL.
9. For each lot, determine the final material price adjustment:

Final Pay Adjustment =

(Lot Quantity) x (Item Bid Price) x (Pay Adjustment Factor) x 70%. This final pay calculation will be paid to the tenth of a percent.

In lieu of being assessed a pay adjustment penalty, the Contractor may choose to remove and replace the material at no additional cost to the Department. If the PWL of any single material characteristic is below 60, the Engineer may require the removal and replacement of the material at no additional cost to the Department.

The test results from the Engineer on production that is less than 100 tons will be combined with the two most recently completed Engineer tests with the same Mixture ID to calculate payment for the lot encompassing the single test. If that cannot be accomplished, the approved JMF will be used to calculate payment for the lot encompassing the single test. Payment for previously closed lots will not be affected by the analysis.

When a sample is out of the acceptable tolerance for any Materials pay criteria, that sample will be isolated. For payment purposes, the test result of the out of acceptable tolerance sample will be combined with the two previous acceptable samples of the same JMF and analyzed per this specification. The material that is considered out of the acceptable tolerance will only include the material within the represented sub-lot (i.e., a maximum of 500 tons). If the previous acceptable test result is from the previous production day, only the material produced on the second production day will be considered out of tolerance. All future sub lots will not include the isolated test.

If, during production, a QA sample test result does not meet the acceptable tolerances and the Contractors QC sample duplicates the QA sample test result, the Contractor can make an appropriate change to the mixture (within the JMF boundaries), and request to have that sample further isolated. If this request is approved, and the Contractor has made a change, the third load after the change will be tested. If that sample test result shows compliance with the specifications, the material that is considered out of the acceptable

tolerance will include the material from the previous acceptable test result to the third load after the initially sampled and tested sample. If the sample does not meet the specification requirements, the Engineer will no longer accept material. Production may resume when changes have been made and an acceptable sample and test result is obtained.

<b>Table 2 – Quality Level Analysis by the Standard Deviation Method</b>							
<b>PU or PL</b>	<b>QU and QL for “n” Samples</b>						
	<b>n = 3</b>	<b>n = 4</b>	<b>n = 5</b>	<b>n = 6</b>	<b>n = 7</b>	<b>n = 8</b>	<b>n = 9</b>
100	1.16	1.50	1.79	2.03	2.23	2.39	2.53
99		1.47	1.67	1.80	1.89	1.95	2.00
98	1.15	1.44	1.60	1.70	1.76	1.81	1.84
97		1.41	1.54	1.62	1.67	1.70	1.72
96	1.14	1.38	1.49	1.55	1.59	1.61	1.63
95		1.35	1.44	1.49	1.52	1.54	1.55
94	1.13	1.32	1.39	1.43	1.46	1.47	1.48
93		1.29	1.35	1.38	1.40	1.41	1.42
92	1.12	1.26	1.31	1.33	1.35	1.36	1.36
91	1.11	1.23	1.27	1.29	1.30	1.30	1.31
90	1.10	1.20	1.23	1.24	1.25	1.25	1.26
89	1.09	1.17	1.19	1.20	1.20	1.21	1.21
88	1.07	1.14	1.15	1.16	1.16	1.16	1.17
87	1.06	1.11	1.12	1.12	1.12	1.12	1.12
86	1.04	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.04	1.04	1.04	1.04
84	1.01	1.02	1.01	1.01	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96
82	0.97	0.96	0.95	0.94	0.93	0.93	0.93
81	0.96	0.93	0.91	0.90	0.90	0.89	0.89
80	0.93	0.90	0.88	0.87	0.86	0.86	0.86
79	0.91	0.87	0.85	0.84	0.83	0.82	0.82
78	0.89	0.84	0.82	0.80	0.80	0.79	0.79
77	0.87	0.81	0.78	0.77	0.76	0.76	0.76
76	0.84	0.78	0.75	0.74	0.73	0.73	0.72
75	0.82	0.75	0.72	0.71	0.70	0.70	0.69
74	0.79	0.72	0.69	0.68	0.67	0.66	0.66
73	0.75	0.69	0.66	0.65	0.64	0.63	0.63
72	0.74	0.66	0.63	0.62	0.61	0.60	0.60
71	0.71	0.63	0.60	0.59	0.58	0.57	0.57
70	0.68	0.60	0.57	0.56	0.55	0.55	0.54

<b>Table 2 – Quality Level Analysis by the Standard Deviation Method</b>							
<b>PU or PL</b>	<b>QU and QL for “n” Samples</b>						
	<b>n = 3</b>	<b>n = 4</b>	<b>n = 5</b>	<b>n = 6</b>	<b>n = 7</b>	<b>n = 8</b>	<b>n = 9</b>
69	0.65	0.57	0.54	0.53	0.52	0.52	0.51
68	0.62	0.54	0.51	0.50	0.49	0.49	0.48
67	0.59	0.51	0.47	0.47	0.46	0.46	0.46
66	0.56	0.48	0.45	0.44	0.44	0.43	0.43
65	0.52	0.45	0.43	0.41	0.41	0.40	0.40
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35
62	0.43	0.36	0.34	0.33	0.32	0.32	0.32
61	0.39	0.33	0.31	0.30	0.30	0.29	0.29
60	0.36	0.30	0.28	0.27	0.27	0.27	0.26
59	0.32	0.27	0.25	0.25	0.24	0.24	0.24

<b>Table 3 - Material Parameter Weight Factors</b>		
<b>Material Parameter</b>	<b>Single Test Tolerance (+/-)</b>	<b>Weight Factor</b>
Asphalt Content	0.4	0.30
#8 Sive (19 mm or >)	7.0	0.30
#8 Sieve (12.5 mm or <)	5.0	0.30
#200 Sieve (0.075 mm) Sieve	2.0	0.30
Air Voids (4.0% Target)	1.5	0.10

<b>Table 4 - PWL Pay Adjustment Factors</b>	
<b>PWL</b>	<b>Pay Adjustment Factor (%)</b>
100	+5
99	+4
98	+3
97	+2
96	+1
95	0
94	(-1)
93	(-2)
92	(-3)
91	(-4)
PWL (when <91)	(PWL - 100)

**(b) Pavement Construction – Pay Adjustments.**

The Engineer will determine the pavement construction pay adjustment by evaluating the construction of the pavement, based on the following parameter:

- Degree of compaction of the in-place material

Using the test values for the cores, the Engineer will use the following steps to determine the pavement construction pay adjustment for each lot of work. Note that the material portion of the total pay adjustment is 70 percent and the pavement construction portion is 30 percent.

1. Calculate the average density values from the subplot tests values, to the nearest 0.1 unit.
2. Calculate the Degree of Compaction:  
Degree of Compaction =  
 $((\text{Core Bulk Specific Gravity}) / (\text{Theoretical Maximum Specific Gravity})) \times 100\%$ .
3. The average compaction for the sublots shall be averaged together for the compaction level of the lot. The lots compaction test level shall be averaged to the whole percent.
4. Locate the value of the Payment Adjustment Factor corresponding to the calculated degree of compaction from Table 5 or Table 5a.
5. Determine the pavement construction price adjustment by using the following formula:  
Pay adjustment = (Lot Quantity) x (Bid Price) x (Pay Adjustment Factor) x 30%.

Degree of Compaction (%)	Pay Adjustment Factor (%)
>97	-100*
96	-3
95	0
94	0
93	+5
92	0
91	-15
90	-25
89	-30
≤88	-100*

\* or remove and replace it at Engineer's discretion

Degree of Compaction (%)	Pay Adjustment Factor (%)
>96	-100*
95	-2
94	0
93	+3
92	0
91	0
90	0
89	-1

<b>Table 5a: Compaction Price Adjustment Other<sup>1</sup> Locations</b>	
<b>Degree of Compaction (%)</b>	<b>Pay Adjustment Factor (%)</b>
88	-5
87	-15
86	-25
85	-30
84	-100*

\* or remove and replace at Engineer's discretion

<sup>1</sup> This chart is to be used for areas where the structural value of the area to be paved is less than 1.75 as determined by the Engineer. See Appendix B – Method for Obtaining Cores for Determination of Roadway Structure. This chart is applicable to rehabilitation work only; full depth construction will not be considered for Table 5a.

**.07 Dispute Resolution.**

Disputes or questions about any test result shall be immediately brought to the attention of the Contractor and the Engineer. When there is a significant alleged discrepancy regarding the Engineer’s acceptance test results, the Contractor must claim a dispute within two operational days of the test date. The following dispute resolution procedures will be used.

The Engineer and the Contractor will review the sample quality, the test method, the laboratory equipment, and the laboratory technician. If these factors are not the cause of the dispute, a third party dispute resolution will be used.

For third party resolution testing, it can be either at another Contractor’s laboratory, the Engineer’s laboratory, or an independent accredited laboratory. Unless otherwise mutually agreed upon by DAPA and the Engineer, the Engineer’s qualified laboratory in Dover and qualified personnel shall conduct the necessary testing for third party Dispute Resolution after the Engineer has provided reasonable notice to allow the Contractor to witness this testing.

When disputes over production testing occur, the samples used for Dispute Resolution testing will be those samples the Contractor properly captured, labeled, and stored, as described in the second paragraph of the section of these specifications titled **.05 Acceptance Plan, (a) Material Production – Tests and Evaluations**. If no samples are available, the original testing results will be used for payment calculations.

Dispute Resolution samples for air void content will be heated by a microwave oven.

If there is a discrepancy between the Engineer’s acceptance test result and the Contractor’s test result, the Contractor may ask for the Dispute Resolution sample to be tested. If the Dispute Resolution sample substantiates the original acceptance test result, the Contractor, after two such Dispute Resolution samples, will be charged a fee of \$125 for all further Dispute Resolution cores that substantiate the acceptance test result. If the Dispute Resolution sample substantiates the Contractor’s test result, the Contractor will not be charged a fee.

When disputes over compaction core test results occur, the Engineer’s acceptance core will be used for the dispute resolution sample. The Contractor will be advised on when the testing will occur as referenced above to witness the testing.

The results of the dispute resolution testing shall replace all of the applicable disputed test results for payment purposes.

02/28/09

**Appendix A - Repairing Core Holes in Hot-Mix Asphalt Pavement**

**Description.**

This appendix describes the procedure required to acceptably repair core holes in a bituminous concrete pavement.

**Materials and Equipment.**

The following material shall be available to complete this work:

- Patch Material – A DelDOT approved High Performance Cold Patch material shall be used.

The following equipment shall be available to complete this work:

- Sponge or other absorbent material – Used to extract water from the hole.
- Compaction Hammer – Shall be mechanical, with a flat, circular tamping face smaller than 6 inches in diameter. The tamping head shall be connected to an electrical, pneumatic, or gasoline driven tamping device.

**Construction Method.**

After core removal from the hole, remove all excess water from within the hole, and prevent water from re-entering the hole.

Place the patch material in lifts no greater than 3 inches. If the hole is deeper than 3 inches, use two lifts of approximately equal depths so that optimum compaction is achieved. Make sure that the patch surface matches the grade of the existing roadway. Make every effort to achieve the greatest possible compaction

**Performance Requirements.**

The Engineer will judge the patch on the following basis:

- The patch shall be well compacted
- The patch surface shall match the grade of the surrounding roadway surface.

**Basis of Payment.**

No measurement or payment will be made for the patching work. The Contractor must gain the Engineer's acceptance of the patching work before the Engineer will accept the material represented by the core.

**Appendix B - Method for Obtaining Cores for Determination of Roadway Structure**

The Contractor is responsible for obtaining cores in areas that they propose are eligible for compaction price adjustments according to Table 5a in this specification. Table 5a is not applicable for new full-depth pavement box construction. Cores submitted for this process shall be obtained according to the following process.

1. Contact Materials & Research (M&R) personnel to determine if information about the area is already available. If M&R has already obtained cores in the location that is being investigated, the contractor may opt to use the laboratory information for the investigation and not core the area on their own.
2. If M&R does not have information concerning the section of the roadway, the contractor needs to contact M&R to arrange for verification of coring operations. Arrangements shall be made to allow for an individual from M&R to be on the site when the cores are obtained. Cores will be turned over to M&R for evaluation.
3. The contractor is responsible for providing all traffic control and repairing core holes in accordance to 401699 Appendix A – Repairing Core Holes in Hot-Mix Asphalt Pavements.
4. Cores are to be taken throughout the entire project for the area in question. Cores will be spaced, from the start of the project in increments determined based on field and project specifics. Cores will be evenly distributed throughout the project location. The cores will be taken in the center of the lane in question.
5. Additional cores may be taken at other locations, if surface conditions indicate that there may be a substantial difference in the underlying section. The location of these cores should be documented and submitted to M&R.
6. Cores shall be full depth and include underlying materials. If there is a stone base included in the pavement section, at a minimum 1 core must have information concerning the thickness of the base. This is determined by augering to the subgrade surface.
7. The calculations used to determine the structural capacity of the roadway is as follows. If the contractor finds, upon starting the coring process, that the areas are of greater thickness than applicable to Table 5a, they may terminate the coring process on their own and retract the request.

**Structural Number Calculations**

Each pavement box material is assigned a structural coefficient based upon AASHTO design guides. The structural coefficient is used to determine the total strength of the pavement section.

Materials used in older pavement sections are assigned lower structural coefficients to compensate for aging of the materials. The coefficients used to determine the structural number of an existing pavement are:

<b>Existing Material</b>	<b>Structural Coefficient</b>
HMA	0.32
Asphalt Treated Base	0.26
Soil Cement	0.16
Surface Treatment (Tar & Chip)	0.10
GABC	0.14
Concrete	0 - 0.7*

- \* The Structural Coefficient of Concrete is dependent upon the condition of the concrete. Compressive strengths & ASR analysis are used to determine condition – contact the Engineer if this situation arises.

Newly placed materials use a different set of structural coefficients. They are as follows:

New Material	Structural Coefficient
HMA	0.40
Asphalt Treated Base (BCBC)	0.32
Soil Cement	0.20
GABC	0.14

**Example:**

Location includes placement of a 1.25” Type C overlay on 2.25” Type B. Existing roadway is cored and is shown to consist of 2” HMA on 7” GABC.

Calculation:

For the Type B lift the calculation would be:

$$\begin{array}{rcl}
 \text{Existing HMA} & 2 * 0.32 & = & 0.64 \\
 \text{GABC} & 7 * 0.14 & = & \underline{0.98} \\
 & & & 1.62
 \end{array}$$

For the Type C lift the calculation would be:

$$\begin{array}{rcl}
 \text{Newly Placed B} & 2.25 * 0.4 & = & 0.90 \\
 \text{Existing HMA} & 2 * 0.32 & = & 0.64 \\
 \text{GABC} & 7 * 0.14 & = & \underline{0.98} \\
 & & & 2.52
 \end{array}$$

**601502 - TEMPORARY PROTECTIVE SHIELD**

**Description:**

This work consists of furnishing all materials and installing a temporary protective shield during the demolition of the existing Mall Access Road Bridge, as described in these Special Provisions, and/or as directed by the Engineer.

**Materials and Construction Methods:**

In order to protect vehicular traffic against damage from falling material, debris, and other demolition operations, while superstructure concrete is being removed, the Contractor shall furnish and erect temporary protective structures under the work area and 5' minimum beyond all sides of full depth concrete deck removed.

The Protective Structures shall meet with the following:

1. The shields shall be supplemented with such additional suitable enclosures of tarpaulins or wire mesh as may be necessary in order to insure against the dropping of materials, tools, equipment, and other objects below the level of the shield.
2. Broken concrete and other debris shall not be allowed to accumulate on the shields, but shall be removed promptly. The shields shall not be used for storing or stockpiling construction materials.
3. Timber shall have an allowable flexure stress of 1,600 psi and the shield must be designed for 100 lb/sq. ft. live load and 60 mph wind load.
4. All plywood shall be new and shall be not less than 3/4" (19 mm) thick.
5. Bolts, nuts, washers, structural steel, etc. shall conform to Section 601 of the Standard Specifications.
6. The shield shall be assembled by means of bolts and nails, all as approved by the Engineer.
7. The flooring and siding of the shield shall have no cracks or openings through which material particles may fall.
8. The Contractor shall submit shop drawings for the shields, including erection plans, to the Engineer for approval, prior to the start of the work.
9. All connections of the protective structures to the steel work of existing bridge shall be made by means of clamps or other approved devices. The drilling of holes in the existing steel work, or welding thereto, will not be permitted.
10. Unless otherwise noted on the Plans, the minimum underclearance over roadways (pavement and shoulder) shall be as follows:  
  
14.5' (4.42 m) for interstate and other controlled access highways  
  
No portion of the temporary shield (including connection devices) shall encroach on under clearances.
11. The contractor is required to submit the design and details of the temporary protective shield sealed by Professional Engineer registered in the State of Delaware prior to commencing work.
12. After protective shield has served its purpose, and approval has been given by the Engineer, the Contractor shall remove and dispose of the temporary protective shield away from the site to the satisfaction of the Engineer.

**Method of Measurement:**

The quantity of temporary protective shields will not be measured.

**Basis of Payment:**

The quantity of temporary protective shield will be paid for at the Contract lump sum price. Price and payment will constitute full compensation for furnishing all materials and performing the work noted on the Plans, for removal and disposal of the protective shield materials, and for all labor, tools, equipment, design and incidentals necessary to complete the work.

9/16/10

**602579 - DRILLING HOLES AND INSTALLING DOWELS**

**Description:**

This work consists of furnishing all materials and drilling holes for dowels or anchor bolts as required and grouting the anchor bolts or dowels in place where required in the locations indicated on the Plans or as directed by the Engineer.

**Materials:**

The material for epoxy grout shall be MARK-194 CARBOPOXY GROUT as manufactured by POLY-CARB, 33095 Bainbridge Road, Cleveland, Ohio 44139 (Telephone 1-800-225-5649 or 216-248-1223) or SIKADUR 31 HI-MOD GEL as manufactured by Sika Corporation, 3000 Valley Ford Circle, King of Prussia, PA 19406, (Telephone 1-800-933-7452) or MASTERFLOW MP as manufactured by Master Builders, Inc., 23700 Chagrin Boulevard, Cleveland, Ohio 44122, (Telephone 1-216-831-5500 or 1-800-628-9990) or approved equal.

**Construction Methods:**

Drill holes at the locations and to the minimum depth shown on the Plans. Hole diameters shall be drilled in accordance with the epoxy grout manufacturer's recommendations considering the size(s) of the dowels or as shown on the Plans. Grout the anchor bolts or dowels in place using the epoxy grout in a manner to complete bonding of the anchor bolts or dowels in the holes and in accordance with manufacturer's recommendations. Repair any damage caused by the drilling operations to the satisfaction of the Engineer at no additional cost to the Department.

**Method of Measurement:**

The quantity of holes will be measured as the actual number of each hole drilled, grouted and accepted.

**Basis of Payment:**

The quantity of holes will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing and placing all materials, for all labor, equipment, tools, and all necessary incidentals to complete the work. Dowels and/or anchor bolts will be measured and paid for under a separate item(s) unless indicated otherwise on the Plans.

12/10/01

**602580 - PARTIAL REMOVAL OF PCC MASONRY**

**Description:**

Removal of portion of existing portland cement concrete structure shall consist of removing portions or all of the portland cement concrete curbs, parapets, deck at the joints, concrete beams, diaphragms, abutment backwalls, etc., as specifically indicated on the Plans and as directed by the Engineer.

**Construction Methods:**

The method of removal employed must meet the approval of the Engineer. The technique chosen must not be detrimental to the remaining structure. Pneumatic hammers, if used, shall not exceed 16 lb (7 kg) unless specified otherwise on the Plans.

During removal operations, the Contractor shall make full provisions for maintenance and protection of vehicular traffic. All removed material shall become the property of the Contractor and shall be removed from the site and disposed of on spoil areas approved by the Engineer.

All bar reinforcement, exposed during the removal of the concrete and intended for re-use in the new construction, shall be thoroughly cleaned of rust and other foreign material by shot or grit blasting to the satisfaction of the Engineer. There shall be no separate payment for such work, and the cost shall be included in the item. After removal of all concrete as required, the remaining concrete surface shall be thoroughly cleaned with oil-free compressed air.

The use of explosives is not permitted.

**Method of Measurement:**

The quantity of removed existing portland cement concrete will be measured as the number of cubic yards (meters) of concrete removed as directed on the Plans or by the Engineer.

**Basis of Payment:**

The quantity of removed existing portland cement concrete will be paid for at the Contract unit price per cubic yard (meter). Price and payment shall constitute full compensation for removal and disposal of portions of existing concrete structures as applicable and required above, surface preparation including airblast cleaning, shot or grit blast cleaning of reinforcement bars for protection of traffic if applicable during removal operation, for all labor, equipment, tools, and incidentals necessary to complete the work.

3/14/02

**602616 WATERPROOFING PCC MASONRY SURFACES**

**DESCRIPTION:**

Seal concrete surfaces at ends of pier caps as specified in plans using materials, surface preparation, and application of penetrant sealers as specified in this Section and in accordance with the manufacturer recommendations. Perform surface preparation and application to all areas as shown in the plans or as directed by the Engineer.

**PENETRANT SEALERS**

**Materials:**

Use alkylalkoxysilane penetrant sealers, with 40 percent solids and active materials dispersed in water that meet the following:

Table 1: Physical Properties of Penetrant Sealers	
Appearance	White, Milky Liquid
VOC content (EPA method 24)	Less than 350 g/l
Flash Point (ASTM 3278)	Greater than 200°F SETA
Resistance to Chloride ion penetration AASHTO T259 and T260	Less than 0.52 pounds/yd <sup>3</sup> (criteria of 1.5) at 1/2 inch level; 0.00 pounds/yd <sup>3</sup> (criteria of 0.75) at 1 inch level
Water absorption test (ASTM C 642)	0.50 percent maximum / 48 hours; 1.5 percent maximum / 50 days
NCHRP 244	
Series II - cube test	
Water weight gain	85 percent reduction minimum
Absorbed chloride	87 percent reduction minimum
Series IV - Southern climate	
Absorbed chloride	95 percent reduction minimum
Scaling resistance test (ASTM C 672)	(non - air - entrained concrete) 0 rating "No Scaling" (100 cycles)

**SURFACE PREPARATION FOR PENETRANT SEALER:**

**General:**

Prepare concrete surfaces to receive a penetrant sealer in accordance with these Specifications for surfaces of recently cast concrete (new construction).

**Surface Preparation for New Construction:**

Remove substances such as dust, grime, dirt, curing compounds, form oil, debris, etc. by water blasting, light sandblasting, wire brushing, or other methods acceptable to the Engineer, all in accordance with the penetrant sealer manufacturer's recommendations. When using cleaning methods other than water blasting, wash the cleaned surfaces with water meeting the requirements of Section 803, as a final cleaning operation.

**Water for Blasting:**

Use water meeting the requirements of Section 803.

**Concrete Surface Cleaning Operation:**

During the cleaning operation, exercise sufficient care to minimize the removal of the concrete matrix. Furnish hand tools, power grinders, and other similar equipment to remove materials which cannot be removed by water blasting without abrading the concrete matrix beyond acceptable limits. Wash concrete surfaces cleaned by methods other than water blasting with water blasting equipment as the final cleaning operation.

Limit the duration of water blasting to provide a light abraded surface. Do not allow surface abrasion to exceed 0.016 inch. The Engineer will not require further cleaning of stains still apparent after abrading to a depth of 0.016 inch. Avoid exposure of coarse aggregate by water blasting. Reclean concrete surfaces which become contaminated before applying the penetrant sealer at no expense to the Department prior to applying the penetrant sealer.

**Application of Penetrant Sealer Materials:**

Apply the penetrant sealer only to surfaces which have been prepared in accordance with these Specifications and approved by the Engineer. For application of the penetrant sealer, meet these Specifications and the penetrant sealer manufacturer's recommendations.

Prior to application of any penetrant sealer, cure concrete for a minimum of 21 days.

Apply penetrant sealer no later than ten days after completion of the surface preparation and prior to any contamination of the prepared surfaces as determined by the Engineer.

**Application Equipment:**

Apply the penetrant sealer using any suitable air or airless sprayer with an operating pressure of approximately 20 psi.

**Application Limitations:**

Apply the penetrant sealer material only when the ambient air temperature is between 50 and 90°F. Apply the penetrant sealer only to concrete surfaces which have dried a minimum of 48 hours after water last contacted the concrete surfaces. Do not apply the penetrant sealer when winds are blowing 25 mph or more, during rainfall, or when water spray or mist is present.

**Application:**

Apply the penetrant sealer only to concrete surfaces that have been prepared in accordance with the requirements and limitations set forth in these Specifications. Determine the actual coverage rate in square feet per gallon on the basis of field trials. Conduct a field trial to determine coverage rate at the beginning of any penetrant sealer application operation. For each field trial, determine the optimum coverage rate for 50 ft<sup>2</sup> of surface area. Maintain the penetrant sealer application rate between 155 and 225 ft<sup>2</sup> covered per gallon of penetrant sealer used. Apply the penetrant sealer in a uniform manner without puddling and skips. Redistribute any penetrant sealer which is applied and subsequently puddles in low areas over the concrete surfaces by use of a squeegee. Generally, begin the application of the penetrant at the lowest elevation and proceed upward toward higher elevations.

Maintain operating pressures in the sprayers used for application of the penetrant sealer material sufficiently low so that atomization or misting of the material does not occur.

### **CONTROL OF MATERIALS:**

#### **Packaging and Identification:**

Deliver the penetrant sealer to the project in unopened, sealed containers with the manufacturer's label identifying the product and with numbered seals intact. Ensure that each container is clearly marked by the manufacturer with the following information:

- a. Manufacturer's name and address.
- b. Product name.
- c. Date of manufacture.
- d. Expiration date.
- e. LOT identification number.
- f. Container serial number.

#### **Manufacturer's Certification:**

Provide the Engineer a certification from the manufacturer, confirming that the penetrant sealer meets the requirements of this Section. Do not incorporate these materials into the project until the Engineer has accepted and approved the certification for the material. Submit such certification for each LOT of material delivered to the project. In each certification, identify the serial or LOT numbers of the containers certified.

#### **Materials Sampling for Tests:**

The Engineer may require samples from each LOT or container of materials delivered to the project or from containers at the point of use. When samples are required, furnish samples in accordance with the Engineer's instructions.

#### **Storage of Materials:**

Store materials delivered to the job site in original unopened containers within an appropriate storage facility. Use a storage facility that provides protection from the elements, and safe and secure storage of the materials.

#### **Unused Material in Opened Containers:**

Do not return unused material in opened containers to storage for later use. Either apply such material to appropriate areas on concrete surfaces or remove and dispose of it at offsite locations provided by the Contractor.

#### **Acceptance:**

The Engineer will accept penetrant sealer application when it is determined that the Contractor has properly cleaned all surface areas to be sealed and has applied the penetrant sealer within the required rates of application.

**MEASUREMENT AND PAYMENT**

The preparation, cleaning, testing, certifications, field trials, furnishing, and applying of the concrete sealer on the various ends of pier caps will not be measured but the cost will be incidental to the pertinent "Portland Cement Concrete Masonry" item. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

3/11/11

**602717 - REHABILITATION OF CONCRETE STRUCTURE, PIERS AND ABUTMENTS**  
**602718 - REHABILITATION OF CONCRETE STRUCTURE, PYLONS BELOW DECK LEVEL**  
**602719 - REHABILITATION OF CONCRETE STRUCTURE, PYLONS ABOVE DECK LEVEL**  
**602720 - REHABILITATION OF CONCRETE STRUCTURE, INTERIOR PYLONS ABOVE DECK LEVEL**  
**602721 - REHABILITATION OF CONCRETE STRUCTURE, EXTERIOR BOX GIRDER AND DELTA FRAMES**  
**602722 - REHABILITATION OF CONCRETE STRUCTURE, INTERIOR BOX GIRDER**  
**602723 - REHABILITATION OF CONCRETE STRUCTURE, DECK LEVEL ELEMENTS**

**Description:**

This work consists of preparation and furnishing all materials, and repairing portions of the existing concrete substructure and/or superstructure in accordance with the notes and details on the Plans and as directed by the Engineer.

All applicable requirements of Section 602 of the Standard Specification for performing the work under this item shall be applicable except as modified herein.

**Materials:**

Concrete for repair work shall consist of a mixture of Portland Cement, aggregate, water, and other admixtures to provide a workable concrete. The Contractor has the option of using either Class A Concrete, Micro-Silica Modified Concrete, or Latex Modified Concrete for this item. The minimum concrete temperature at the time of placement shall be 75°F (24°C). The mix shall have a minimum compressive strength of 2000 psi (15 MPa) in 6 hours, if required in the Plans, and 4500 psi (30 MPa) in 28-days. The following shall be included in the Portland Cement Concrete mixture composition supplied by the Contractor:

Coarse Aggregate - Del. No. 8 Stone meeting the grading requirements of Section 813

Coarse Aggregate/Sand Ratio - 50 to 60%

Portland Cement Type I - 705 lb/yd<sup>3</sup> (418 kg/m<sup>3</sup>) [Min.]

Water/Cement ratio - 0.45 (Max.)

Slump - 3" - 6" (75 to 150 mm)

Air - 5 % to 8%

Admixture - The quantity and AASHTO type or combination of AASHTO types of admixtures shall be determined by the Contractor.

If the Contractor chooses to use Class A concrete, the concrete shall have materials present in the mixture to mitigate alkali-silica reactivity (ASR) as per Section 812. Also, accelerators, if used, shall be non-chloride based.

If the Contractor chooses to use Micro-Silica Modified Concrete, the Micro-Silica shall conform to the requirements of AASHTO M307. If the Contractor chooses Latex Modified Concrete, the Latex Modifier shall be non-toxic, film forming, polymeric emulsion to which all stabilizers have been added at the point of manufacture, and shall be homogeneous and uniform in composition.

The Contractor shall be responsible for the quality of the concrete placed in any weather or atmospheric conditions. A smooth, durable riding surface of uniform texture, true to the required grade and cross-section, shall be obtained.

If Class A Concrete is utilized, prior to concrete placement, an approved bonding agent shall be applied to the existing concrete to ensure proper bond.

If either the Micro-Silica Modified Concrete or the Latex Modified Concrete are utilized, the bonding agent shall be the rehabilitation concrete grout, placed and brushed into the rehabilitation areas. The grout shall be scrubbed onto the rehabilitation areas with enough care to ensure that all surfaces are evenly covered and that excess grout will not collect in low area.

The epoxy bonding compound shall conform to the requirements provided in the Section 602.14b of the

Standard Specifications.

Reinforcement, if required, shall be as indicated on the Plans.

**Construction Methods:**

All deteriorated, loose, and honeycombed concrete, as determined by the Engineer, shall be removed from the surface areas to be repaired with a pneumatic hammer. Unless specified otherwise on the Plans, the size of the hammer shall be 15 lb (7 kg). maximum for superstructure repair and 30 lb (14 kg). maximum for substructure repair.

All bar reinforcement exposed during the removal of the concrete shall be thoroughly cleaned of rust and other foreign material by abrasive grit (use non silica, low dusting abrasive) blasting and then cleaned with a stream of compressed air before starting any repair work. In the case of damaged bar, it shall be cut and mechanically spliced or replaced with a new bar of the same size and lapped or field-welded to the ends of the existing bar to the satisfaction of the Engineer. There shall be no separate payment for such work, and the cost shall be included in the item except that the new reinforcing bar will be paid for separately under a separate item in this Contract.

All prepared surfaces shall be cleaned by shot or grit blasting to remove dust, oil, grease, and other contaminants as determined by the Engineer. The surface areas shall be cleaned with water under high pressure and the excess water shall be removed by high air pressure or high-powered vacuum to render a dry surface area prior to the application of the mortar. Prior to application of the concrete, an approved epoxy bonding compound will be applied to the existing concrete surface.

The Contractor shall submit to the Engineer a drawing showing details of forms and support system with appropriate dimensions for approval prior to the placing of concrete to repair the structure.

Concrete shall not be allowed to drop from the top of the forms which could otherwise result in the separation of the mix. Only approved mixing and placing equipment shall be used in preparation and handling of the concrete. Oil and other rust inhibitors shall be removed from all equipment in contact with the concrete before the mixes are used.

**Method of Measurement:**

The quantity of rehabilitation of concrete structure will be measured as the number of cubic feet (cubic meters) of concrete placed for the purpose of structure rehabilitation and accepted.

**Basis of Payment:**

The quantity of rehabilitation of concrete structure will be paid for at the Contract unit price per cubic feet (cubic meter). Price and payment will constitute full compensation for furnishing and placing all materials including concrete, abrasive grit blast cleaning of reinforcement bars, splicing and/or replacement of existing reinforcement bars, removal and disposal of deteriorated concrete, placement and removal of formings, surface preparation, for submission of working drawings, and all other work as described herein and on the Plans, for all labor, tools, equipment, and necessary incidentals to complete the work but shall not constitute payment for new bar reinforcement which shall be paid for under a separate item of this Contract.

3/3/08

**602772 - MECHANICALLY STABILIZED EARTH WALLS****Description:**

This work shall consist of the design and construction of mechanically stabilized earth (M.S.E.) retaining walls in accordance with the AASHTO definitions of mechanically stabilized earth walls employing tensile reinforcements in the soil mass. The M.S.E. retaining wall shall be constructed in conformance with these specifications and to the lines, grades, and dimensions shown on the Plans or as established by the Engineer. Design details for these structures shall be as submitted for approval.

The M.S.E. retaining wall shall be designed in conformance with the 2007 AASHTO LRFD Bridge Design Specifications, 4<sup>th</sup> Edition including all current Interims and the requirements specified on the Plans.

The following additional specific design requirements shall be met by the developed plans:

- a. All retaining wall components shall be designed for a minimum service life of 100 years.
- b. Completed walls shall have a concrete facing with a finish or aesthetic treatment as approved by the Engineer.

**Design Requirements:**

The design of the internal stability of the MSE wall shall be the responsibility of the wall manufacturer. Design constraints imposed by external (overall) stability, such as allowable bearing pressure due to the combined effects of vertical and lateral loads, minimum length of reinforcing elements, as set forth herein, shall be the responsibility of the Contractor.

Working drawings bearing the fabricator's or supplier's title block and design calculations sealed by a professional engineer registered in the State of Delaware shall be submitted for review and approval by the Engineer at least 4 weeks before work is to begin. Working drawings and design calculations shall include the following:

- (a) Existing ground elevations that have been verified by the Contractor for each location involving construction wholly or partially in original ground.
- (b) Layout of wall that will effectively retain the earth but not less in height or length than that shown for the wall system in the Plans.
- (c) Complete design calculations substantiating that the proposed design satisfies the design parameters in the Plans and in the special provisions.
- (d) Complete details of all elements required for the proper construction of the system, including complete material specifications.

No work or ordering of materials shall commence until approval of the working drawings has been given by the Engineer. Acceptance of the Contractor's working drawings shall not relieve the Contractor of his responsibility under the contract for the successful completion of the work. All work pertaining to Working Drawings for MSE retaining walls shall be done at no additional cost to the Department.

*Internal Stability:* The internal stability of a mechanically stabilized earth structure shall be the responsibility of the wall supplier. Internal stability issues include, but are not limited to, pullout (or

geotechnical) failure of the soil reinforcing elements, tensile failure of the soil reinforcing elements, failure of panel/reinforcement connections, failure through the backfill material within the reinforced mass, and failure along a reinforcing element surface within the reinforced soil mass.

Sliding, overturning, and bearing capacity shall be evaluated by the wall supplier. The allowable bearing capacity at the MSE walls shall be determined by the Contractor and submitted for approval by the Engineer.

*Failure Plane:* The so-called failure plane shall be taken as coincident with the locus of the points of maximum tensile force which separates the reinforced mass into an active zone between the face of the wall and the line of maximum tensile forces, and a resistant zone behind the maximum tensile forces line. The location of the so-called failure plane shall be adjusted, where necessary, to account for the effects of significant externally applied loads, such as those due to a bridge abutment footing supported directly on the mechanically stabilized backfill.

*Resistance Factors for Permanent MSE Walls:*

0.9 for pullout of tensile reinforcing elements.

1.0 for sliding of the reinforced soil mass along the interface between the reinforced mass and the underlying native soil. The passive resistance of the soil in front of the embedded portion of the wall shall not be included in evaluating lateral stability of the reinforced mass.

0.75 for failure at the facing panel/reinforcing element connection based on the maximum allowable reinforcement tension at the end of the design service life.

*Panel/Reinforcement Connections:* All connections shall be positive structural connections subject to the galvanizing and metal loss rates, for metal reinforcing elements, and allowable tensile stresses given in Stresses in Reinforcing Elements. The structural adequacy and pullout capacity of the connections shall be demonstrated by test data from pullout and flexural tests on full size panels in which all connections are loaded simultaneously. The test data shall be provided by the manufacturer.

*Drainage:* Drainage shall be as designed by the Contractor or as directed by the Engineer. Internal and external drainage shall be evaluated for all structures to prevent saturation of the backfill or to intercept any surface flows containing aggressive elements such as de-icing salts. Internal drainage of the mechanically stabilized backfill shall be considered where the anticipated rate of surface infiltration due to precipitation exceeds the vertical permeability of the backfill material.

*Length of Reinforcing Elements:* The length of the reinforcing elements shall be constant over the entire height of any wall section. The minimum reinforcement length shall be as shown on the Plans and not less than eight (8) feet in accordance with AASHTO. In addition, the length of the reinforcing elements shall be sufficient to satisfy all the design criteria with respect to both internal and external stability.

*Stresses in Reinforcing Elements:* The reinforcing elements shall be designed to have a minimum design life of 100 years with all material and other resistance factors intact at the end of the design life of the mechanically stabilized earth structure.

Unless otherwise indicated by the Engineer, the following metal loss rates shall be used in determining the useful area of metal soil reinforcement remaining at the end of the nominal service life:

Loss of Galvanizing (first 2 years):	0.58 mil./year
Loss of Galvanizing (2 years - depletion):	0.16 mil./year

Carbon steel (after zinc depletion): 0.47 mil./year

The allowable tensile stress in the longitudinal wires of the mesh reinforcing elements shall not exceed fifty-five (55) percent of the nominal yield stress of the steel, provided that the yield stress does not exceed 65 kips/sq.in. The maximum tension in any reinforcing element shall not exceed the product of the maximum allowable tensile stress and the area of steel remaining at the end of the nominal service life.

*Stresses at Panel/Reinforcement Connections.* The horizontal earth pressure used to design the connections and facing panels shall be equal to the maximum horizontal stress computed at each reinforcement level, but in no case shall it be less than eighty-five (85) percent of the maximum horizontal pressure. In the case of rigid panel/reinforcement connections the allowable stress in the reinforcement at the connection shall be reduced to allow for bending stresses induced in the connection due to relative vertical movement between the facing panels and the reinforced backfill.

*Internal Horizontal Stresses:* For MSE wall systems with quasi-inextensible reinforcing elements, the horizontal stress at each reinforcement level shall be computed by multiplying the corresponding vertical stress by an earth pressure coefficient, K. The vertical stress shall be computed using a layer-by-layer approach following Meyerhof's analysis for eccentrically loaded footings; i.e., the resulting vertical stress at any reinforcement level is a function of the vertical stress due to the self weight of the overlying backfill material and the increase in vertical stress due to the overturning effects of the lateral load from the random fill retained by the mass of reinforced backfill.

The value of the earth pressure coefficient, K, shall be assumed equal to the at-rest ( $K_o$ ) value at the top of the wall decreasing linearly to the Rankine active value ( $K_a$ ) at a depth of 20 feet. At depths in excess of 20 feet, the value of K shall be taken as  $K_a$ . For normally consolidated soils,  $K_o = 1 - \sin\phi$ , where  $\phi$  is the angle of shearing resistance of the backfill material. For typical values of  $\phi$ ,  $K_o$  may be assumed equal to  $1.5K_a$ .

*Pullout Resistance (Anchorage) Factors:* Non-dimensional anchorage factors (denoted as  $A_c$ ) as determined by laboratory or field pullout tests on reinforcing elements shall be based on the interpreted failure load at a maximum displacement of three-quarters (3/4) of an inch. The anchorage factor,  $A_c$ , shall be computed from the expression

$$A_c = \frac{\text{Load at 3/4-inch displacement}}{p_v d b N}$$

where  $p_v$  = vertical stress (due to self weight of backfill only) at the reinforcement level,  $d$  = diameter of transverse wires,  $b$  = width of transverse wires for a 6-inch spacing of longitudinal wires,  $N$  = number of transverse wires.

The spacing between transverse wires shall not be less than six (6) inches. The non-dimensional anchorage factor shall be assumed to decrease linearly from 40 at the top of the wall to 15 at a depth of 20 feet. At depths greater than 20 feet the anchorage factor shall be taken equal to 15.

### **Architectural Treatment**

All walls shall have the same shape and sized panels except as necessary to maintain grade and length. All panels shall have a cruciform shape with each panel nominal size (out-to-out of cruciform) of approximately 5' by 5'. The color of the concrete panels shall match the adjacent concrete structures.

A pilaster made of individual panels, approximately 5' high x 4' wide, shall be placed at each abutment corner and then at equal intervals along the wall (approximately 90' intervals). The abutment corner shall split the

panel evenly. The pilaster panel shall be flush with the remaining wall.

All panels shall have a smooth float finish in accordance with Section 602.17.d. The contractor shall submit sample drawings of a typical wall elevation along with details of the typical and pilaster panel and may be required to produce a sample panels before panel fabrication can begin.

**Materials:**

The Contractor shall make arrangements to purchase or manufacture the concrete facing panels, reinforcing mesh or strips, attachment devices, and all other necessary components. Materials not conforming to this section of the specifications shall not be used without written consent from the Engineer.

*Steel Reinforcing Mesh.* Reinforcing mesh shall be shop fabricated of cold drawn steel wire conforming to the minimum requirements of A 82 and shall be welded into the finished mesh fabric in accordance with A 185. Galvanization shall be applied after the mesh is fabricated and conform to the minimum requirements of A 123.

*Steel Reinforcing Strips.* Reinforcing strips shall conform to the physical and mechanical properties of ASTM A 572, Grade 65 steel. Galvanizing shall conform to the minimum requirements of AASHTO M111 (ASTM A 123).

*Steel Connectors.* Connectors shall be fabricated from cold drawn steel wire conforming to the minimum requirements of A 82. Pins shall be fabricated from A 36 steel. Connectors and pins shall be galvanized to conform to the minimum requirements of A 123.

*Filter Fabric.* Where required by design, filter fabric shall be placed behind the facing units. Filter fabric shall be woven polypropylene fabric, meeting the requirements of M 288 for a Class I geotextile having an Ultraviolet Stability of 70% strength retention after 500 hours as tested by D 4355. Slit film geotextile shall not be allowed.

*Backfill.* Multiple types of backfill are required for the construction of the MSE walls. All backfill material used in the structure volume shall be reasonably free from organic or otherwise deleterious materials and shall be as specified on the plans. Placement limits are shown on the plans. The material requirements for each backfill type are as follows:

Select Backfill. Select backfill shall conform to the following gradation limits as determined by AASHTO T-27 (ASTM D-422):

Reinforced Backfill	
Sieve Size	Percent Passing
4 inches	100
No. 40	0-60
No. 200	0-15

In addition, the select backfill material shall conform to the following requirements:

- a) Plasticity Index: The Plasticity Index (P.I.), as determined by AASHTO T- 90 (ASTM D-4318), shall not exceed 6.

b) The material shall be substantially free of shale or other soft, poor durability particles. Testing in accordance with AASHTO T-104 shall be performed to verify a magnesium sulfate soundness loss of less than 30% after four cycles.

c) Electrochemical Requirements - The backfill materials shall meet the following criteria:

<u>Requirements</u>	<u>Test Methods</u>
Resistivity >3,000 ohm-cm	AASHTO T-288-91
pH 5-10	AASHTO T-289-91
Chlorides <100 parts per million	AASHTO T-291-91
Sulfates <200 parts per million	AASHTO T-290-91
Organic Content <1%	AASHTO T-267-86

If the resistivity is greater or equal to 5000 ohm-cm, the chloride and sulfates requirements may be waived.

DelDOT No. 57 Stone. Free draining stone conforming to DelDOT No. 57 stone or approved equal shall be placed to an elevation as specified in the plans of the MSE embankment.

The Contractor shall furnish to the Engineer a Certificate of Compliance certifying that the backfill materials comply with this section of the specifications prior to backfill placement. A copy of all test results performed by the Contractor, which are necessary to assure compliance with the specifications, shall also be furnished to the Engineer. Backfill not conforming to this specification shall not be used without the written consent of both the Engineer and the wall supplier.

*Concrete:* Concrete for the facing, leveling pad, moment slab and barrier shall conform to the requirements of Section 602 of the Specifications.

**Construction Methods:**

The selected MSE wall manufacturer shall provide a representative on site at the outset of the wall construction and periodically throughout construction of the wall and at the direction of the Engineer. The wall manufacturer’s representative shall be present at a pre-construction conference to provide an overview of the wall system and a detailed construction procedure to the contractor and the Engineer.

*Wall Excavation.* Excavation shall be in accordance with the requirements of the general specifications and in reasonably close conformity with the limits shown on the Plans. Temporary excavation support as required shall be the responsibility of the Contractor. The base of the excavation shall be completed to within +/- 3 inches of the staked elevations unless otherwise directed by the Engineer.

*Foundation Preparation.* The foundation for the structure shall be graded level for a width 1 foot beyond the length of the reinforcement elements or as shown on the Plans. Prior to wall construction, the foundation shall be proofrolled under the observation of the Engineer. Any unsuitable foundation material as determined by the Engineer shall be excavated to the determined depth and replaced with Borrow Type B and shall be compacted in accordance with Backfill Placement as described below.

At each panel foundation level, a precast reinforced or a cast-in-place unreinforced concrete leveling pad of the type shown on the plans shall be provided. The leveling pad shall be cured a minimum of 12 hours before placement of wall panels.

*Wall Erection.* The wall system components shall be constructed in accordance with the wall system

supplier's recommendations and construction manual. The wall shall be constructed vertical and within the specified tolerances. The overall vertical tolerance of the wall and the horizontal alignment tolerance shall not exceed 3/4-inch per 10 feet. Bulging in the vertical or horizontal direction shall be limited to 2 inches as measured from the theoretical wall line. The Engineer shall be notified of any bulging areas that exceed this limit.

*Backfill Placement.* Backfill placement shall closely follow erection of each course of concrete facing units. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the facing. Any wall materials that become damaged or disturbed during backfill placement shall be removed and replaced at the Contractor's expense or corrected as directed by the Engineer. The Engineer will be the sole authority as to the acceptability of any repairs to damaged wall materials. Any misalignment or distortion of the wall elements due to placement of backfill outside the limits of this specification shall be corrected as directed by the Engineer.

Backfill within the zone of soil reinforcements shall be compacted to 95% maximum dry density and optimum moisture content, as determined by AASHTO T 99, by at least four (4) passes of a heavy roller having a minimum dynamic force of 20 tons impact per vibration and a minimum frequency of 16 hertz.

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. The water content of the wall backfill shall not deviate from the optimum water content by more than 2%. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift.

The maximum lift thickness after compaction shall not exceed 10 inches regardless of the vertical spacing between layers of soil reinforcements. The Contractor shall decrease this lift thickness as required to obtain the specified density.

Prior to placement of the soil reinforcements, the backfill elevation after compaction within the zone of soil reinforcements shall be 2 inches above the connection elevation from a point approximately 24 inches behind the facing to the free end of the soil reinforcements unless otherwise shown on the Plans.

Compaction within 3 feet of the facing shall be achieved by at least three (3) passes of a lightweight mechanical tamper, roller or vibratory system. Care shall be exercised in the compaction process to avoid misalignment of the facing. Heavy compaction equipment shall not be used to compact backfill within 3 feet of the wall face. At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to direct runoff of rainwater away from the wall face. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

*Leveling Pad.* The concrete leveling pad at the concrete facing shall be unreinforced and constructed to the elevation and width shown on the Plans. The leveling pad shall be constructed on compacted, drained subgrade.

*Utilities.* The contractor shall accommodate the passage of utilities through the reinforced embankment material. The soil reinforcements shall be placed to permit the installation and operation of, and access to, the utilities constructed within the embankment while satisfying the design requirements of the MSE wall. The MSE wall manufacturer shall provide a construction sequence for installation of utilities within the reinforced embankment which does not jeopardize the integrity and stability of the reinforced soil mass.

*Moment Slab and Barrier.* The moment slab and barrier shall be constructed according to the details shown on the plans.

*Toe protection.* The toe of the wall shall be embedded in accordance with the Plans and shall be protected as required for the life of the structure to avoid undermining the wall face.

**Method of Measurement:**

MSE Wall design and construction including all material, labor, equipment, expendables, etc., incidental to their installation and testing, will not be measured but will be paid for at the Contract lump sum price for pertinent Retaining Wall or Abutment items. All excavations required for the construction of the MSE Wall will not be measured and will be incidental to the construction of the pertinent Retaining Wall or Abutment items. Temporary excavation support as required will not be measured and will be incidental to the construction of the pertinent Retaining Wall or Abutment items. All backfill material behind the MSE Wall which is not Type F borrow and as shown on the MSE Wall plans, will not be measured and will be incidental to the construction of the pertinent Retaining Wall or Abutment items. Excavation of unsuitable material will be paid for under Item 212000 undercut excavation and backfilling with Borrow Type B will be paid for under Item 209002.

The concrete and reinforcement for the moment slab and barrier and coping will be measured separately and will be paid for as a separate item. The concrete leveling pad is included in this pay item.

**Basis of Payment:**

The payment will be full compensation for all components of the MSE Wall and shall include full compensation for designing, fabricating, furnishing, installing and for all materials, labor, tools, equipment, and incidentals necessary to complete the installation in conformance with the plans and Specifications. In the event that an increase or decrease in the area of the wall elevation is required, the increase or decrease in the lump sum bid shall equal the increased or decreased area multiplied by the lump sum price divided by the original elevation area. The "original elevation area" shall include the below-grade area of the concrete fascia.

Retaining Walls will not be measured but will be paid for at the Contract Lump Sum price for the pertinent Retaining Wall or Abutment items.

**NOTE:**

A breakout sheet attached to the Proposal list the walls under this item. The Contractor shall fill in a unit price for each item and the cost (unit price times the proposed quantity). The lump sum bid for Item 602772 - Mechanically Stabilized Earth Walls shall be the sum of the cost for all items listed. The breakout sheet shall be attached to the Bid Proposal. Failure to submit the breakout sheet with the Bid Proposal will result in the Bid Proposal being declared non-responsive and rejected.

The Department reserves the right to delete from the Contract one or more of the items listed and right to add or subtract from the quantity of each item. The lump sum to be paid will be adjusted in accordance with the Contractor's unit prices as required above. There will be no extra compensation if such additions and/or deletions are made.

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**602773 - PCC MASONRY FOR MECHANICALLY STABILIZED EARTH WALLS****Description:**

This work shall consist of the construction of the cast-in-place concrete coping of mechanically stabilized earth walls. All concrete shall be constructed in conformance with these specifications and to the lines, grades, and dimensions shown on the Plans or as established by the Engineer. Design details for these structures shall be as shown on the Plans.

**Materials:**

Excavation:	Section 207
Concrete:	Section 602
Reinforcing steel:	Section 604

**Construction Methods:**

All concrete construction shall be performed in accordance with Section 602 of the Standard Specifications and as modified herein.

**Method of Measurement:**

PCC Masonry for Mechanically Stabilized Earth Walls shall be measured per lump sum. Additions or subtractions to the volume of concrete due to variations in the face of the wall or infiltration of the concrete into the stabilized soil mass shall not be computed.

**Basis of Payment:**

The quantity of PCC Masonry for Mechanically Stabilized Earth Walls shall be paid for in accordance with Section 602.27 except as modified herein.

**NOTE:**

A breakout sheet attached to the Proposal list the walls under this item. The Contractor shall fill in a unit price for each item and the cost (unit price times the proposed quantity). The lump sum bid for Item 602773 - P.C.C. Masonry for Mechanically Stabilized Earth Walls shall be the sum of the cost for all items listed. The breakout sheet shall be attached to the Bid Proposal. Failure to submit the breakout sheet with the Bid Proposal will result in the Bid Proposal being declared non-responsive and rejected.

The Department reserves the right to delete from the Contract one or more of the items listed and right to add or subtract from the quantity of each item. The lump sum to be paid will be adjusted in accordance with the Contractor's unit prices as required above. There will be no extra compensation if such additions and/or deletions are made.

3/3/11

**602774 - MASONRY FOR LIGHT POLE FOUNDATION (CY)****Description:**

This work shall consist of all labor, materials, equipment, and services necessary to perform all operations to complete the installation of drilled shafts for light poles. The work shall be completed in accordance with the plans, Delaware Department of Transportation's Specifications for Road and Bridge Construction dated August 2001 (Standard Specifications), and this Special Provision. The work involves installing constant-diameter drilled shafts through Coastal Plain sediments and Piedmont Residuum. High water tables may be present.

**Materials:**

Materials shall meet the following requirements:

## a. Portland Cement Concrete

Portland cement concrete shall be 4500-psi minimum (Class A) and shall meet the requirements specified in Section 602 and 812, in the Delaware Department of Transportation's Specifications for Road and Bridge Construction (August 2001). Where not otherwise specified, ACI 336.1-94 shall be followed. Water used in mixing concrete shall conform to Section 803 of the Standard Specifications.

Concrete shall remain workable and maintain a 4-inch slump for up to four hours after placing. If free fall methods are utilized for placement, the maximum coarse aggregate size shall be reduced to 3/8-inch. A slump value range of 5 ±1-inch shall be provided for all uncased holes and a slump range of 6 ±1.5-inch shall be provided for cased holes. A minimum slump of 6-inch with the addition of a retarder is required when a casing is being withdrawn. An acceptable water reducing and retarding admixture shall be added to the concrete to produce the specified slump. Under no circumstances shall the admixture cause segregation of the concrete. If any admixtures are added to the concrete at the site, the admixture must be added to the concrete by a qualified Contractor-furnished technician. Immediately after the addition of the admixture, the drum shall be turned a minimum of thirty revolutions, at mixing speed, until the concrete is thoroughly mixed. The technician shall then test the slump and consistency of the concrete mixture. Under no circumstances shall the Contractor add additional water to the concrete mixture to reach the desired slump.

## b. Reinforcing Steel

Deformed reinforcing bars shall be in accordance with the sizes, spacing, dimensions, and details shown on the plans and shall conform to AASHTO M31, Grade 60, and the requirements of Section 603 and 604 of the Specifications.

## c. Casing

Casing shall be metal, smooth, clean, watertight, and of ample strength to withstand both handling and driving stresses and the pressure of both concrete and the surrounding earth materials. Thickness of the casings shall not be less than 0.25-inch. The inside diameter of casing shall not be less than the specified size of the shaft. No extra compensation will be allowed for concrete required to fill an oversized casing or oversized excavation. All casings shall be removed from shaft excavations. Permanent steel casings shall not be used.

## d. Slurry

Use of slurry shall not be permitted.

## e. Ground Rod and Clamp

Ground rods shall be copper clad, approved by the Underwriter's Laboratory, and be supplied with approved clamps for connecting the grounding conductor to the rod. Ground rods shall be 3/4 inch diameter by 10 foot, sectional, unless otherwise specified on the Plans.

## f. Conduit sweeps

Conduit sweeps shall meet the requirements for galvanized steel rigid conduit in Section 745 of the Delaware Department of Transportation's Specifications for Road and Bridge Construction (August 2001).

## g. Anchor Bolts

Anchor bolts will be supplied by the same entity that supplies the poles. Anchor bolts shall have a minimum yield strength of 55,000 psi.

**Contractor Qualification:**

This work shall be performed under the supervision of the Contractor's superintendent, who will be fully knowledgeable and experienced, as defined herein, in the construction of drilled shaft foundations of similar sized shafts and geotechnical conditions using both cased and slurry methods. Further, the Contractor and the Contractor's superintendent performing the work shall document at least five years previous experience within the last eight years constructing drilled shafts, with at least two years at the current firm. The Contractor's equipment shall have the capacity to undertake the work and shall be sufficient to complete the work within the specified contract time.

The Contractor shall provide documentation of his qualifications, experience record, prior project references, and the availability of the equipment needed to perform the required work. All prior project references shall be currently available personnel who can verify the quality of the contractor's previous work and shall include current name, address, and telephone number. This documentation shall reference the experience of the drilled shaft Contractor and the drilled shaft Contractor's superintendent in responsible charge of the drilled shaft operations. This documentation shall reference successful construction of similar sized shafts in the following conditions:

- a. Experience in successfully installing drilled shafts of the size shown in the plans. The minimum experience shall consist of ten similar-sized projects in the past five years. Descriptions of projects must include a point of contact with the owner that is familiar with the project.
- b. Experience in cleaning shaft bottoms when working under wet conditions.

**Equipment:**

The Contractor shall furnish all equipment and instrumentation necessary for installation of the shafts.

The excavation and drilling equipment shall have adequate capacity including power, torque, and down thrust to excavate a hole of the maximum diameter shown on the plans and to a depth of 15-feet or 20 percent beyond the depths shown in the contract documents, whichever is greater.

The excavation and tools shall be of adequate design, size, and strength to perform the work shown in the contract documents or described herein. When the material encountered cannot be drilled using conventional earth augers with soil or rock teeth, drilling buckets, and/or over-reaming tools, the Contractor shall provide special drilling equipment including but not limited to: rock core barrels, rock tools, air tools, blasting materials, and other equipment as necessary to construct the shaft excavation to the size and depth required.

Provide a descriptive listing of available equipment that is fully capable of cleaning shaft bottoms when shafts are excavated under wet conditions.

**Site Information:**

Test Boring Log sheets are included in the contract documents for use by the Contractor. Data on subsurface conditions is not intended as representations or warranties of continuity of such conditions. It is expressly understood that the Department will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. The data is made available for the convenience of the Contractor. The Contractor may make additional test borings and other exploratory operations at no additional cost to the Department.

Two geotechnical engineering reports titled Final Foundations Report – Bridge and Associated Wingwalls, dated April, 2009 and the Final Foundations Report – Retaining Walls, dated April 2009, for the SR1/I-95 Interchange Improvements have been prepared for this project by Rummel, Klepper, and Kahl, LLP (RK&K) and URS Corporation (URS). These reports were prepared to establish design guidelines only and should not be considered part of the contract documents nor as a warranty of subsurface conditions. These reports may not be sufficient for use by specialty contractors. Contractors or prospective bidders may contact the Delaware Department of Transportation to review a copy of these reports.

**Submittals:**

The Contractor shall submit to the Engineer for review and approval, an installation plan for the construction of drilled shafts not less than thirty days before the start of work as detailed in this Special Provision. The submittal shall include at least the following:

- a. List of proposed equipment to be used including cranes, drills, augers, bailing buckets, final cleaning equipment, tremie or concrete pumps, casing, and other appurtenances.
- b. Details of overall construction operation sequence and the sequence of shaft construction in bents or groups, including scaled plan and profile showing the location, size and movements of equipment setup and operations. The completion of any required integrity and loading tests shall be noted in this construction operation sequence.
- c. Submit project experience and resumes in accordance with Contractor Qualification.
- d. Details of shaft excavation and stabilization methods.
- e. Method of monitoring verticality of the shaft excavation during excavation and details of proposed corrective measures to be implemented as necessary.
- f. Very specific details of methods to clean the shaft excavation. Details shall include at least three alternative bottom cleaning methods with descriptions of equipment to be used when installing drilled shafts with wet methods. Include details of method for identifying type of bearing material for consistency with design assumptions prior to placement of concrete.
- g. Details of reinforcement placement including support and centralization methods.
- h. The concrete mix design, including admixtures to be used. Details of concrete placement, curing, and protection.
- i. A copy of the proposed report format for planned shaft inspections. Record information for each shaft and details of any required load or integrity tests.
- j. Other information shown on the plans or requested by the Engineer.

The Contractor will not be permitted to start construction of any drilled shaft, until the complete installation plan submittal as described above has been received, reviewed and written approval to begin construction has been issued by the Engineer.

The Contractor will not be permitted to start the construction of drilled shafts for which working drawings are required until the Engineer has approved such drawings. Such approval will not relieve the Contractor of responsibility for results obtained by the use of these drawings or any of his other responsibilities under the contract.

Submittals during construction shall include record information for each shaft and details of any required loading or integrity tests as required.

**Construction Methods:**

## a. Protection of Existing Structures

All reasonable precautions shall be taken to prevent damage to all existing structures, utilities, and the public. These measures shall include but are not limited to, selecting construction methods and procedures that will prevent excessive caving of the shaft excavation, monitoring, and controlling the vibrations from the driving of casing or sheeting, drilling of the shaft, or from blasting, if permitted. The Contractor shall verify that there are no subsurface utilities in close proximity of each shaft before beginning excavation activities.

## b. Construction Sequence

Where drilled shafts are to be installed in conjunction with embankment placement, they shall be constructed after the placement of the fill.

Excavation of adjacent drilled shafts or other structures or utilities within a radius of three shaft diameters will not be permitted until concrete has been in place for at least 48 hours.

## c. Methods of Construction

Excavations required for shafts shall be performed through whatever materials are encountered, to the dimensions and elevations shown on the plans or otherwise required by the Standard Specifications and Special Provisions. The method used shall be suitable for the intended purpose and materials encountered. The dry method or temporary casing method will be used as necessary to produce sound, durable concrete foundation shafts that are free of any defects. Wet method may only be used after the Engineers approval. When a particular method of construction is required in the contract documents, that method shall be used. If no particular method is specified for use, the Contractor shall select and use the method, as determined by site conditions, subject to approval of the Engineer, which is needed to properly accomplish the work.

The estimated lengths shown on the plans and in the geotechnical reports should be considered approximate. Additional shaft lengths might be required depending on actual subsurface conditions. Shorter shaft lengths than indicated on the plans may only be constructed with the written approval of the Engineer.

## 1. Dry Construction Method

The dry construction method shall be used only at sites where the ground-water table and site conditions are suitable to permit construction of the shaft in a relatively dry excavation (i.e., less than 3-inch of water accumulates above the final base elevation over a one-hour period when no pumping is permitted), and where the sides and bottom of the shaft are stable and may be visually inspected prior to placing the concrete.

The dry method consists of drilling the shaft excavation, removing accumulated water and loose material from the excavation, placing temporary casing, inspecting the bearing stratum, removing temporary casing, placing the reinforcing steel if required, and placing the shaft concrete in a relatively dry excavation. If caving occurs or if there is excess seepage into the drilled shaft, the drilling should be continued using a casing to maintain the integrity of the hole. Concrete shall be placed in accordance with Section VII.I.

## 2. Wet Construction Method

The wet construction method shall not be used.

## 3. Temporary Casing Construction Method

The temporary casing construction method shall be used at all sites where excessive caving or seepage could occur. When a nearly impervious formation is reached, a temporary casing shall be placed in the hole and sealed in the nearly impervious formation. As an alternative to use of the wet excavation method, temporary casing may be installed by drilling, driving, or vibratory procedures in advance of excavation to the lower limits of the caving material. Slurry may not be used. Significant caving

shall be considered to be more than 50% increased volume over theoretical shaft volume, for a section exceeding 10-feet of shaft. Casing shall be installed to the final base elevation to allow inspection of the bearing stratum.

After the reinforcing steel cage has been placed, fill the excavation with concrete. Before the casing is withdrawn and while the casing is being withdrawn, the level of fresh concrete in the casing shall be at such a level that all the fluid trapped behind the casing is displaced upward without contaminating the shaft concrete. Placement of the concrete and pulling of the temporary casing shall be conducted in accordance with Sections VII.I and VII.J of this Special Provision.

#### 4. Alternative Construction Methods

The Contractor may propose alternative methods to prevent caving and control ground water. Such proposals, accompanied by supporting technical data, shall be submitted in accordance with Section VI, Submittals. Written approval from the Engineer is required before the use of alternative construction methods.

##### d. Excavations

The bottom elevation of drilled shafts shown on the plans may be adjusted during construction if the Engineer determines that the foundation material encountered during excavation is unsuitable or differs from that anticipated in the design of the drilled shaft. The Contractor shall take soil samples when shown on the plans or as directed by the Engineer to determine the character of the material directly below the shaft excavation. The Engineer will inspect the samples or cores and determine the final depth of required shaft excavation.

The Contractor shall maintain a construction method log during shaft excavation. The log shall contain information such as the description and approximate top and bottom elevation of each soil or rock material, seepage or groundwater, and remarks.

Excavated materials, which are removed from the shaft excavation and any drilling fluids used, shall be disposed of off site in accordance with local environmental regulations and the contract documents or as directed by the Engineer.

##### 1. Unclassified Excavation

Drilled shaft excavation is designated as unclassified; the Contractor shall provide the necessary equipment to remove and dispose of any materials encountered in forming the drilled shaft excavation to the dimensions shown on the plans or as directed by the Engineer. No separate payment will be made for excavation of materials of different densities and character.

The Contractor shall provide tools such as augers fitted with either soil or rock teeth, and drilling buckets attached to drilling equipment of the size, power, torque, and down thrust approved for use by the Engineer. Material normally classified as decomposed rock, weathered, rock, disintegrated rock, or rock shall be considered as unclassified excavation. The Contractor shall provide appropriate tools such as, but not limited to, equipment listed in Section IV of these provisions in order to install the drilled shafts to their design depths.

##### e. Obstructions

The Contractor shall remove surface and subsurface obstructions at drilled shaft locations. Such obstructions may include man-made materials, such as old concrete foundations, and natural materials, such as boulders. Boulders are defined as stones with a least dimension greater than 1-foot. Special tools and/or procedures shall be employed by the Contractor after the hole cannot be advanced more than 1-foot in thirty minutes using approved equipment operating at maximum power, torque, and down thrust, using conventional augers fitted with soil or rock teeth, drilling buckets, and/or under-reaming tools. Such special procedures/tools may include but are not limited to: chisels, boulder breakers, core barrels, air tools, hand excavation, temporary casing, and increasing hole diameter. Blasting shall not be permitted unless specifically approved in writing by the

Engineer.

f. Lost Tools

Drilling tools that are lost in the excavation shall not be considered obstructions and shall be promptly removed by the Contractor without compensation. All costs due to lost tool removal shall be borne by the Contractor including but not limited to costs associated with hole degradation due to removal operations or the time the hole remains open.

g. Excavation Inspection

The Contractor shall provide details of shaft construction to the Engineer for review. The Contractor shall provide equipment for checking the dimensions and alignment of each shaft excavation. The Contractor shall determine the shaft dimensions and alignment under the observation and/or direction of the Engineer. Final shaft depth shall be measured after final cleaning.

Shaft cleanliness and the bearing surface condition will be evaluated and approved by the Engineer. The Contractor shall provide safe access and egress to the Engineer for inspection of the bottom of the excavation prior to placement of reinforcing steel and concrete. After the Contractor has prepared the bottom of the shaft excavation, the Contractor shall notify the Engineer. The Contractor shall coordinate schedules for excavation inspection by the Engineer.

The Contractor shall not permit any worker to enter the shaft excavation for any reason unless: both a suitable casing has been installed and the water level has been lowered and stabilized below the level to be occupied, and adequate safety equipment and procedures have been provided to workers entering the excavation. The Contractor shall follow OSHA guidelines for confined space entry.

Prior to placement of reinforcing steel and concrete, the Contractor shall ensure that loose material from the bottom and sides of excavation have been removed and that shaft is within the specified tolerances. Specified tolerances are listed in Section VII.K of this Special Provision. The shaft excavation shall be cleaned to remove all accumulated sediment and water.

The Contractor shall be responsible for correcting drilled shafts that are not constructed within the specified tolerances. Remedial measures, including engineering analysis and redesign, to correct for out-of-tolerance drilled shaft foundations, shall be performed at no additional cost to the Department.

h. Reinforcing Steel Cage Construction and Placement

The reinforcing steel cage consisting of the steel shown on the plans plus cage stiffener bars, spacers, centralizers, and other necessary appurtenances shall be completely assembled and placed as a unit immediately after the shaft excavation is inspected and accepted and prior to shaft concrete placement. Prior to installation of the steel cage in the shaft excavation, inspect and clean the reinforcing steel of materials that prevent effective bonding. Clear spacing between bars of the rebar cage shall be at least five times the size of the maximum coarse aggregate. Hooks at the top of the rebar cage shall not be bent outward if temporary casing will be used. Similarly, interior hooks must be designed to permit adequate clearance for a concrete tremie pipe (i.e., 12-inch minimum), if concrete is to be tremied into place. Where clearance is a problem, hooks may be placed on dowels that may be rotated after concrete placement or casing removal and repositioned after the tremie is removed. The concrete must remain fluid during dowel repositioning. Shafts that require a large amount of reinforcing steel shall use bundled longitudinal bars to maintain the minimum clear spacing requirement. The assembled rebar cage outside diameter shall be at least 6-inches smaller than the drilled hole diameter, which corresponds to at least 3-inches of concrete cover over the rebar on all sides.

The reinforcing steel in the shaft shall be tied and supported so that the reinforcing steel will remain within allowable tolerances until the concrete will support the reinforcing steel. When concrete is placed by tremie methods, temporary hold-down devices shall be used to prevent uplifting of the steel cage during concrete placement. Concrete spacers or other approved noncorrosive spacing devices shall be used at sufficient intervals not exceeding 5-feet along the shaft excavation. At least three spacers shall be evenly distributed

around the circumference of the reinforcing steel at each elevation where used.

i. Concrete Placement, Curing, and Protection

All concrete placement, consolidation and curing activities shall conform to the recommendations of Section 602 and 812 of the Standard Specifications, except as otherwise specified herein.

Concrete shall be placed as soon as possible after reinforcing steel cage placement. Concrete placement shall be continuous in the shaft to the top elevation of the shaft. Placement shall continue after the shaft is full until good quality concrete is evident at the top of the shaft.

Concrete to be placed in dry shafts less than 50-feet in length may be placed by allowing the concrete to free fall into the excavation, provided that the concrete does not hit the reinforcing steel or the sides of the excavation. This is subject to performance satisfactory to the Engineer during construction. Limit the segregation of the concrete by placing the concrete through the use of a centering tube, sectionalized pipe or other means to direct the free fall of the concrete so that it does not strike the sides or reinforcement of the shaft. If water has infiltrated the base of the excavation, it shall be removed prior to placement of the concrete. No more than 1-inch of standing water shall be allowed in the base of an excavation at the time of concrete placement to prevent segregation of the concrete. The Engineer shall have the final decision as to the allowable amount of water in the base of the excavation. The Engineer may require the Contractor to have a small sump pit in the base of the excavation to allow removal of any accumulated water.

Concrete to be placed in water shall be placed through a tremie or concrete pump. The tremie shall be supported so as to permit free movement or permit rapid lowering when necessary to retard or stop the flow of concrete. The discharge end shall be sealed closed at the start of work so as to prevent water or slurry from entering the tube before the tube is filled with concrete. After placement has started the tremie tube shall be kept full of concrete to the bottom of the hopper. If water enters the tube after placement is started, the tremie shall be withdrawn, the discharge end resealed, and the placement restarted. The flow of concrete shall be continuous until the work is completed. The discharge end of the tremie shall always be located a minimum of 5-feet below the level of the already placed concrete.

Tremie pipes shall be a minimum of 10-inch diameter. Tremie pipes shall not have aluminum parts that will react with concrete. Pump hoses shall be a minimum of 4-inch diameter. All tremie pipe or pump hoses and connections shall be watertight.

The concrete placing rate shall be not less than 30 cubic yards of concrete per each one-hour period. The concrete mix shall be of such design that the concrete remains in workable plastic state throughout the placement of the concrete for the entire drilled shaft.

All concrete, except for that placed under water, shall be vibrated to a depth of 5-feet below the ground surface except where soft uncased soil remaining in the excavation will possibly mix with the concrete. After placement, any exposed surfaces of the shaft concrete shall be protected to allow proper curing.

For at least 48-hours after shaft concrete has been placed, no construction operations that will cause soil movement adjacent to the shaft, other than mild vibration, shall be conducted.

j. Casings and Forms

When the shaft extends above ground or through a body of water, the portion of the shaft exposed above ground or through a body of water may be formed with removable concrete forms except when a permanent form is specified. Removable forms shall be stripped from the shaft in a manner that will not damage the concrete. Forms can be removed when the concrete has attained sufficient strength provided: curing of the concrete is continued for the full 72-hour period in accordance with the specifications and the concrete has reached 75-percent of its design compressive strength as determined from concrete cylinder breaks.

Temporary casings shall be removed while the concrete remains workable. The removal of temporary casing shall not be allowed until the level of the concrete placed in the shaft is great enough to withstand the pressure

exerted by the surrounding soil, water or drilling fluid. After concreting begins, removal of the casing should begin within 1-hour, before the concrete begins to set. Telescoping casing may be used, but the bottom end of the temporary casing shall be located a minimum of 5-ft below the level of already placed concrete. If the concrete begins to set prior to removal of the casing, the removal of the casing should cease, and the casing should be cut off at its current elevation and remain in the ground permanently. No payment shall be given for any casing not retrieved.

Movement of the casing by rotating, exerting downward pressure and tapping to facilitate extraction or extraction with a vibratory hammer will not be permitted. Casing extraction shall be at a slow, uniform rate with the pull in line with the shaft axis. Do not damage or displace reinforcing cage when withdrawing casing.

k. Construction Tolerances

The following construction tolerances shall be maintained in constructing drilled shafts.

1. The center of the drilled shaft shall be within 3-inches of the plan position in the horizontal plane at the plan elevation for the top of the shaft.
2. The vertical alignment of the shaft excavation shall not vary from the plan alignment by more than 0.25-inch per foot.
3. After all the shaft concrete is placed; the top of the reinforcing steel cage shall be no more than 6-inches above and no more than 3-inches below plan position.
4. When casing is used, the inside diameter of the casing shall not be less than the shaft diameter shown on the plans. When casing is not used, the minimum diameter of the drilled shaft shall not be more than 1-inch less than the diameter shown on the plans.
5. The top elevation of the shaft shall be within 1-inch of the plan top of shaft elevation.
6. The bottom of the shaft excavation shall be normal to the axis of the shaft within 1-inch per foot of shaft diameter.
7. The reinforcing steel shall be placed so that the outer edges of the reinforcing cage are located uniformly a minimum of 3-inches inside the perimeter of the design shaft size.

Drilled shaft excavations constructed in such a manner that the concrete shaft cannot be completed within the required tolerances are unacceptable. Correction methods shall be submitted by the Contractor for the Engineer's approval. Approval will be obtained before continuing with the drilled shaft construction. Materials, engineering and work necessary to effect correction for out-of-tolerance drilled shaft excavations shall be furnished at no cost to the Department.

l. Conduit Sweeps

The end of the conduit sweeps in the ground shall be extended outside the concrete and any forms or sheeting by 12 inches and capped or connected to the existing or proposed conduit. If the conduit is to be capped underground for future use, it shall be sealed with a galvanized threaded conduit plug. Tape is NOT an approved conduit plug. The location of the conduits shall be marked on the base with arrows drawn in the wet concrete within 6 inches of the outer edge.

m. Record Information

The Contractor shall provide the following minimum record information. For each drilled shaft foundation installed, record on drilled shaft installation logs the location, alignment, dimensions, elevation of the top and bottom, depth of the bearing stratum penetration, description of the materials encountered at all elevations, elevation of the water table during excavation, condition of the bottom of the excavation, concrete data,

verticality and deviation of shaft or reinforcing steel from the plan location, and other data called for on the report form or pertinent to the drilled shaft. Record the theoretical volume of excavation, volume of concrete placed versus depth, and total volume of concrete placed. Report observed irregularities to the Engineer within eight hours of discovery. Record the time drilling started and stopped and any significant stoppages or delays. Record the time concreting started and stopped.

Minimum Record Information shall be in accordance with FHWA Publication No. IF-99-025 "Drilled Shafts" or Association of Drilled Shaft Contractors' "Drilled Shaft Inspector's Manual" (1989). A copy of the inspection report planned for use shall be submitted to the Engineer for approval. Submit draft record information for each completed shaft to the Engineer within twenty-four hours of completion. Submit final record drawings of each drilled shaft installed no more than three weeks after completion of the work. Submit records on a weekly basis, or more frequently if variation occurs.

n. Site Operations

The Contractor shall conduct his operations in a neat and orderly manner. Equipment and materials shall not be placed or stored beyond limits approved by the Engineer and shall promptly be removed when no longer needed. All materials, water, slurry, and auger cuttings shall be confined to the specified work area so as not to migrate from the specified work area.

o. Construction Adjacent to Freshly Drilled Shafts

No construction activity, including drilling, within a radius of three shaft diameters of a freshly drilled shaft shall take place until the concrete shaft has cured for at least 48- hours and the Engineer has provided written approval.

**Method of Measurement:**

The quantity of "Masonry for Light Pole Foundation" will be measured per cubic yard installed and accepted.

**Basis of Payment:**

The payment for the item "Masonry for Light Pole Foundation" as called for by the contract shall be made at the contract unit price(s) per cubic yard complete in place and accepted, which price and payment will constitute full compensation for furnishing and fabricating and placing all materials, clearing and grubbing the areas, normal excavation in accordance with Section 207, concrete and reinforcing bars, construction of foundations, backfilling and compaction, grading, sodding if required to restore the site to its original condition or as required by the Plan, and for all labor, equipment, tools and incidentals necessary to complete the work.

4/29/11

**602779 - POST-TENSIONING GROUT**

**GENERAL.** Grout to fill the voids between post-tensioning steel and their conduits shall conform to this Specification. The ingredients intended for use in bonded, post-tensioning work can include Portland cement, mineral additives, admixtures, aggregates, and water. Grout shall be prebagged in plastic lined or coated bags. Grout bags shall be stamped with the date of manufacture, lot number, and mixing instructions. Any change of materials or material sources requires the retesting and certification of the conformance of the grout with the physical properties requirements. A copy of the Quality Control Data Sheet for each lot and shipment shall be submitted to the Engineer. Materials with an age from date manufacturer in excess of 180 days shall be retested and certified before use or removed and replaced.

**PORTLAND CEMENT AND BLENDED HYDRAULIC CEMENT.** Refer to Section 801. Blended cements, if used, shall be compatible with other ingredients of the grout.

**CONCRETE ADMIXTURES.** Refer to Section 812. Compatibility with the cement, mineral additives, and other admixtures being considered shall be established during the grout trial mixes.

**Pozzolans.** Pozzolans shall be limited to percentages by weight given in Section 822.

**High Range Water Reducing Admixtures.** High Range Water Reducing Admixtures shall not be used in excess of 45 oz. per 100 lb. of Portland cement.

**Anti-Bleeding Admixtures.** Anti-bleed admixtures may be used in grout if the requirements of testing outlined in this section are satisfied. The anti-bleed admixture's performance in post-tensioning grouts shall conform to the acceptable criteria for the bleed tests using both the modified C940 test and the Pressure Bleed Test using a Gelman filter funnel with a test pressure of 50 psi (refer to Appendix C of Post-Tensioning Institute's Specification for Grouting of Post-Tensioned Structures, 2000).

**Expansion Causing Admixtures.** Pre-hardening expansive admixtures based on gas information that are potentially harmful to the grout or the prestressing steel shall not be used. For inert gas forming materials, the level of vertical height change shall be no greater than 2.0 percent for up to 3 hours when measured in conformance with C940.

**AGGREGATES.** Aggregates, if used, shall have a maximum size passing a No. 50 sieve (300 micron) and shall conform to C33 except for gradation.

**WATER.** Refer to Section 803.

**TESTING REQUIREMENTS.** Grout manufacturer shall submit certified test reports from an audited and independent Cement Concrete Research Laboratory (CCRL) that shows the material conforms to the requirements specified herein. The tests shall be performed on each lot and shipment provided to the project. The test reports, detailing the types and number of tests performed, test procedures, results, and comparison of results with specified values, shall be submitted to the Engineer for approval at least eight weeks prior to the scheduled start of production grouting. Any change in the type, brand or manufacturing source throughout the duration of the grouting will require submittal of certified test results at least eight weeks prior to use of the new materials.

**PHYSICAL PROPERTY REQUIREMENTS.** The grout shall not contain aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas. Grout shall achieve a non-bleed characteristic and shall conform to the following physical properties. Grout shall be tested at the temperature and humidity conditions expected on-site, but at temperatures not to exceed 90 degrees F or less than 40 degrees F. Grout

shall be used only within the range of conditions tested successfully.

Property	Test Value	Test Method
Total Chloride Ions by Weight of Cementitious Material, Maximum	0.08%	ASTM C1152
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C136 <sup>(1)</sup>
Wet Density – Laboratory	Report maximum and minimum obtained test value lb/ft <sup>3</sup>	ASTM C185
Wet Density – Field	Report maximum and minimum obtained test value lb/ft <sup>3</sup>	ASTM C138
Water/Cementitious Materials Ratio, Maximum	0.45	---
Volume Change @ 24 Hours and 28 Days	0.0% to +0.2%	ASTM C1090 <sup>(2)</sup>
Expansion, Up to 3 Hours	2.0%	ASTM C940
Compressive Strength, Average of 3 Cubes, at 28 Days, Minimum	7,000 psi	ASTM C942
Initial Set of Grout	Minimum - 3 hours Maximum – 12 hours	ASTM C953
Fluidity Test <sup>(3)</sup> Efflux Time from Flow Cone (a) Immediately After Mixing	Minimum - 20 seconds Maximum - 30 seconds or Minimum - 9 seconds Maximum - 20 seconds	ASTM C939  ASTM C939 <sup>(3)</sup>
(b) 30 Minutes After Mixing with remixing for 30 Seconds	Maximum - 30 seconds or Maximum - 30 seconds	ASTM C939  ASTM C939 <sup>(4)</sup>
Bleeding @ 3 Hours	Maximum-0.0 percent	ASTM C940 <sup>(5)</sup>
Permeability @ 28 Days	Maximum 2500 coulombs at 30 V for 6 hours	ASTM C1202

(1) Use ASTM C117 procedure modified to use a #50 sieve. Determine the percent passing the #50 sieve after washing the sieve.

(2) Modify C1090 to include verification at both 24 hours and 28 days.

(3) Adjustments to flow rates shall be achieved by strict compliance with the manufacturer's recommendations.

(4) Grout fluidity shall conform to the standard C939 flow cone test for non-thixotropic grouts or the modified test described herein for thixotropic grouts. Modify the C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a 1 liter container placed directly under the flow cone.

(5) Modify C940 to conform with the wick induced bleed test specified in the C940 Modifications herein.

#### C 940 Modifications:

(a) Condition dry ingredients, mixing water, prestressing strand and test apparatus overnight at 70 to 76 degrees F (21 to 25 degrees C).

(b) Insert 800 ml of mixed conditioned grout with conditioned water into the 1000 ml graduated cylinder. Mark the level of the top of the grout.

- (c) Wrap the strand with 2-inch wide duct or electrical tape at each end prior to cutting to avoid splaying of the wires when it is cut.
- (d) Degrease with acetone or hexane solvent and wire brush to remove any surface rust on the strand before temperature conditioning. Completely insert a 20-inch length of conditioned, cleaned, A416 7-wire strand 0.5-inch diameter into the 1000 ml graduated cylinder. Using a centralizer or other means, center and fasten the strand so it remains essentially parallel to the vertical axis of the cylinder. Mark the level of the top of the grout.
- (e) Store the mixed grout at the temperature range listed above in (a).
- (f) Measure the level of the bleed water every 15 minutes for the first hour and hourly afterward for 2 hours.
- (g) Calculate the bleed water, if any, at the end of the 3 hour test period and the resulting expansion per the procedures outlined in C940, with the quantity of bleed water expressed as a percent of the initial grout volume. Note if the bleed water remains above or below the top of the grout.

**ACCELERATED CORROSION TEST METHOD (ACTM).** Perform the ACTM as outlined in Appendix B of the “Specification for Grouting of Post-Tensioning Structures” published by the Post-Tensioning Institute. Report the time to corrosion for both the grout being tested and the control sample using a 0.45 water-cement ratio neat grout. A grout that shows a longer average time to corrosion in the ACTM than the control sample and the time to corrosion exceed 1,000 hours is considered satisfactory.

**MEASUREMENT AND PAYMENT.** The preparation, testing, furnishing and installation of the post-tensioning grout will not be measured, but the cost will be incidental to the lump sum price of the pertinent “Post-Tensioning Pier Cap - Bonded System” item.

3/1/11

**602785 – PORTLAND CEMENT CONCRETE MASONRY, SUBSTRUCTURE 6,000 PSI****Description:**

This work shall consist of furnishing and placing Portland cement concrete for structures and incidental construction.

**Materials:**

Materials for concrete structures shall conform to the Standard Specifications, Section 602 & 812, except as modified herein.

Class A concrete shall have a Design Compressive Strength,  $f'_c$  at 28 days of 6,000 psi

**Construction Methods:**

All construction shall be performed in accordance with Section 602 & 812 of the Standard Specifications and as modified herein.

When “Mass Concrete” is designated in the Contract Documents, the contractor shall provide an analysis of the anticipated thermal developments in the mass concrete elements for all expected project temperature ranges using the proposed mix design, casting procedures, and materials.

The contractor shall use a Specialty Engineer following the procedure outlined in Section 207 of the ACI Manual of Concrete Practice to formulate, implement, administer and monitor a temperature control plan, making adjustments as necessary to ensure compliance with the Contract Documents. The measures and procedures intended for use to maintain a temperature differential of 35° F [20° C] or less between the interior core center and exterior surface(s) of the designated mass concrete elements during curing shall be described.

The contractor shall submit both the mass concrete mix design and the proposed mass concrete plan to monitor and control the temperature differential to the Engineer for acceptance 90 days prior to the first pour of mass concrete. The Engineer will review the submittal for acceptance. Ground granulated blast furnace slag or fly-ash may also be used in the mix to reduce the heat of hydration. Slag or fly-ash may be used as a cementitious replacement material for cement up to a maximum limit of 75% by weight of total cementitious material in the mix. Slag and/or fly-ash shall be from a source approved by the Engineer, shall be compatible with the type of cement used and thoroughly blended in the mix. Other precautions for reducing the heat of hydration may be taken, such as the addition of controlled quantities of ice in lieu of equal quantities of mixing water or cooling tubes. However, the mix shall contain no frozen pieces of ice after blending and mixing components.

All constituent materials shall be compatible with the proposed cements, workability enhancing additives and water reducing agents as necessary to provide concrete satisfying all requirements of the Contract Documents.

The contractor shall provide temperature monitoring devices to record temperature development between the interior core center and exterior surface(s) of the elements in accordance with the accepted mass concrete plan. He shall read the monitoring devices and record the readings at intervals no greater than 6-hours. The readings shall begin when the mass concrete placement is complete and continue until the maximum temperature differential (not maximum temperature) is reached and a decreasing temperature differential is confirmed as defined in the temperature control plan. The contractor shall furnish a copy of

all temperature readings to the Engineer. If the 35° F [20° C] differential has been exceeded, he shall take immediate action, as directed by the Specialty Engineer, to retard further growth of the temperature differential.

A Specialty Engineer shall be used to revise the previously accepted plan to ensure compliance on future placements. No mass concrete shall be placed until the Engineer has accepted the mass concrete plan(s). When mass concrete temperature differentials are exceeded the contractor shall provide all analyses and test results deemed necessary by the Engineer for determining the structural integrity and durability of the mass concrete element, to the satisfaction of the Engineer.

**Defective Work**

Provisions for defective work shall conform to section 602.25 of the Standard Specifications except as modified herein.

**Method of Measurement:**

The quantity of Portland cement concrete masonry, substructure 6,000 psi shall be measured in accordance with Section 602.26 of the Standard Specifications except as modified herein.

**Basis of Payment:**

The quantity of Portland cement concrete masonry, substructure 6,000 psi shall be paid in accordance with Section 602.27 of the Standard Specifications except as modified herein.

No separate payment shall be made for materials, labor, equipment and incidental items associated with controlling the heat of hydration for Mass Concrete. These items shall be deemed to be included in the payment under this item of work.

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**602786 – PORTLAND CEMENT CONCRETE MASONRY, SUBSTRUCTURE 8,000 PSI****Description:**

This work shall consist of furnishing and placing Portland cement concrete for structures and incidental construction.

**Materials:**

Materials for concrete structures shall conform to the Standard Specifications, Section 602 & 812, except as modified herein.

Class A concrete shall have a Design Compressive Strength,  $f'_c$  at 28 days of 8,000 psi

**Construction Methods:**

All construction shall be performed in accordance with Section 602 & 812 of the Standard Specifications and as modified herein.

When “Mass Concrete” is designated in the Contract Documents, the contractor shall provide an analysis of the anticipated thermal developments in the mass concrete elements for all expected project temperature ranges using the proposed mix design, casting procedures, and materials.

The contractor shall use a Specialty Engineer following the procedure outlined in Section 207 of the ACI Manual of Concrete Practice to formulate, implement, administer and monitor a temperature control plan, making adjustments as necessary to ensure compliance with the Contract Documents. The measures and procedures intended for use to maintain a temperature differential of 35° F [20° C] or less between the interior core center and exterior surface(s) of the designated mass concrete elements during curing shall be described.

The contractor shall submit both the mass concrete mix design and the proposed mass concrete plan to monitor and control the temperature differential to the Engineer for acceptance 90 days prior to the first pour of mass concrete. The Engineer will review the submittal for acceptance. Ground granulated blast furnace slag or fly-ash may also be used in the mix to reduce the heat of hydration. Slag or fly-ash may be used as a cementitious replacement material for cement up to a maximum limit of 75% by weight of total cementitious material in the mix. Slag and/or fly-ash shall be from a source approved by the Engineer, shall be compatible with the type of cement used and thoroughly blended in the mix. Other precautions for reducing the heat of hydration may be taken, such as the addition of controlled quantities of ice in lieu of equal quantities of mixing water or cooling tubes. However, the mix shall contain no frozen pieces of ice after blending and mixing components.

All constituent materials shall be compatible with the proposed cements, workability enhancing additives and water reducing agents as necessary to provide concrete satisfying all requirements of the Contract Documents.

The contractor shall provide temperature monitoring devices to record temperature development between the interior core center and exterior surface(s) of the elements in accordance with the accepted mass concrete plan. He shall read the monitoring devices and record the readings at intervals no greater than 6-hours. The readings shall begin when the mass concrete placement is complete and continue until the maximum temperature differential (not maximum temperature) is reached and a decreasing temperature differential is confirmed as defined in the temperature control plan. The contractor shall furnish a copy of

all temperature readings to the Engineer. If the 35° F [20° C] differential has been exceeded, he shall take immediate action, as directed by the Specialty Engineer, to retard further growth of the temperature differential.

A Specialty Engineer shall be used to revise the previously accepted plan to ensure compliance on future placements. No mass concrete shall be placed until the Engineer has accepted the mass concrete plan(s). When mass concrete temperature differentials are exceeded the contractor shall provide all analyses and test results deemed necessary by the Engineer for determining the structural integrity and durability of the mass concrete element, to the satisfaction of the Engineer.

**Defective Work**

Provisions for defective work shall conform to section 602.25 of the Standard Specifications except as modified herein.

**Method of Measurement:**

The quantity of Portland cement concrete masonry, substructure 8,000 psi shall be measured in accordance with Section 602.26 of the Standard Specifications except as modified herein.

**Basis of Payment:**

The quantity of Portland cement concrete masonry, substructure 8,000 psi shall be paid in accordance with Section 602.27 of the Standard Specifications except as modified herein.

No separate payment shall be made for materials, labor, equipment and incidental items associated with controlling the heat of hydration for Mass Concrete. These items shall be deemed to be included in the payment under this item of work.

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**602787 - POST-TENSIONED PIER CAP BONDED SYSTEM****Description:**

This work shall consist of furnishing, installing, stressing, and grouting post-tensioning steel in accordance with the Contract Documents, these Special Provisions, and the 2004 AASHTO LRFD Bridge Construction Specifications with 2007 interim revisions. This includes, but is not limited to preparation of working drawings, testing of post-tensioning material and appurtenances, furnishing and installing ducts, post-tensioning steel and appurtenances, clearing of all ducts prior to grouting, air pressure testing of all ducts prior to grouting, stressing and grouting strand and bar tendons, site visits by grout manufacturer representative, inspection of grouting, and reporting on tendon stressing and grouting operations.

**Materials:**

Low Relaxation Post-Tensioning Strands	ASTM A 416, Grade 270
High Strength Epoxy Coated Post-Tensioning Bar	ASTM A 722, Type II
Corrugated Polyethylene Duct	ASTM D 3350
Corrugated Polypropylene Duct	ASTM D 4101
Semi-Rigid Galvanized Metal Duct	ASTM A 653
Fusion Bonded Epoxy Powder Coating for Steel and Touch Up System	Section 604

**Post-Tensioning Steel.** Epoxy coated high-strength post-tensioning bars shall be Grade 150, high strength deformed bars conforming to the requirements of AASHTO M 275 (ASTM A 722), Type II. Epoxy coating shall meet the requirements of ASTM A 775. Post-tensioning strand shall be low relaxation, Grade 270, uncoated seven-wire strand conforming to the requirements of AASHTO M 203 (ASTM A 416). The proper use of bars and strand is predicated upon the use of suitable accessory material. Details for the use of these materials shall be furnished by the manufacturer and submitted to the Engineer for approval.

**Ducts (Strand Tendons).** All ducts used for internal post-tensioning strand tendons shall meet the requirements in the current AASTO LRFD Bridge Construction Specifications. They shall be either high-density corrugated polyethylene (HDPE) conforming to the requirements of ASTM D 3350 with cell classification of 345464A, or corrugated polypropylene conforming to the requirements of ASTM D 4101 with a cell classification range of PP0340B44544 to PP0340B65884.

The duct material shall not react with concrete or enhance corrosion of prestressing steel and shall be free of water soluble chloride. Corrugated duct shall be either corrugated with a spiral having a pitch not less than 1/10 of the radius of the duct or concentrically corrugated. Material thickness shall not be less than 0.050 inches  $\pm$  0.010 inches and shall be such that wearing through the wall by the bar or strand during stressing is avoided. Corrugated duct shall be designed so that a force equal to 40 percent of the ultimate tensile strength of the tendon will be transferred through the duct into the surrounding concrete in a length not exceeding 45 duct diameters. Twelve static pull out tests shall be conducted to determine compliance of a duct with a force transfer requirement. If ten of these tests exceed the specified force transfer, the duct is acceptable. The Contractor shall provide to the Engineer certified test reports verifying that the duct meets specification requirements in regard to force transfer to be reviewed and approved by the Engineer.

The minimum radius for corrugated duct shall be 30 feet. Duct curvature with radii less than 30 feet may be approved by the Engineer based on review of test data. The confinement reinforcement for curved ducts shall be proportioned in accordance with Section 5.10.4.3 of the AASHTO LRFD Bridge Design Specifications.

All duct material shall be sufficiently rigid to withstand loads imposed during placing of concrete and internal pressure during grouting while maintaining its shape, remaining in proper alignment and remaining

watertight. Mandrels shall be used in the ducts for the pier caps at Ramp A over I-95, Ramp A over SR7 and Ramp B over SR7.

Duct installed and cast into concrete prior to prestressing steel installation, must be capable to withstand at least 10 feet of concrete fluid pressure. Also, such duct shall not dent more than 1/8-inch under 100 lbs. concentrated forces applied between corrugations. The concentrated force shall be applied by a No. 4 reinforcing bar. A certified test report shall be submitted to the Engineer for approval.

Duct for use with preinstalled prestressing steel, prior to concreting, shall be capable of withstanding the equivalent of 5 feet of concrete fluid pressure. Resistance to denting is not applicable.

Duct shall have adequate longitudinal bending stiffness for smooth, wobble free placement:

- (a) Duct with more than 2-inch diameter shall, under its own weight, not deflect more than 3 inches, when a 20-foot duct segment is supported at its ends.
- (b) Duct of 2-inch or smaller diameter shall, under its own weight, not deflect more than 3 inches, when a 10-foot duct segment is supported at its ends.
- (c) Where duct must be bent in a tight radius, more flexible duct is permitted and shall be approved by the manufacturer and the Engineer..

**Ducts (Bar Tendons).** All ducts used for post-tensioning bar tendons shall be 24 gage semi-rigid galvanized metal ducts. Ducts shall be fabricated with either welded or interlocked seams. Duct and metal connectors shall be fabricated from galvanized sheet steel meeting the requirements of ASTM A 653, Coating Designation G90. Galvanizing of welded seams will not be required. Ducts within a pier cap shall be a continuous length without couplers.

Ducts shall preferably be installed with a radius of curvature of 20 feet or more. Duct curvature with radii less than 12 feet may be approved by the Engineer based on review of test data. The confinement reinforcement for curved ducts shall be proportioned in accordance with Section 5.10.4.3 of the AASHTO LRFD Bridge Design Specifications.

All duct material shall be sufficiently rigid to withstand loads imposed during placing of concrete and internal pressure during grouting while maintaining its shape, remaining in proper alignment and remaining watertight.

Duct installed and cast into concrete must be capable to withstand at least 10 feet of concrete fluid pressure. Also, such duct shall not dent more than 1/8-inch under 100 lbs. concentrated forces applied between corrugations. The concentrated force shall be applied by a No. 4 reinforcing bar.

Duct shall have adequate longitudinal bending stiffness for smooth, wobble free placement:

HDPE ducts may be used in lieu of semi-rigid galvanized ducts. The requirements for HDPE ducts shall be the same as those described above for strand tendons.

**Duct Fittings.** Couplings and reducers for duct connections to anchorages shall provide a non-corrosive, impermeable layer between the concrete and the grout, and shall be watertight and of sufficient strength to prevent distortion or displacement of the ducts during concrete placement. Details of duct fittings including means of waterproofing shall be submitted to the Engineer for approval.

**Couplers.** Bar or strand couplers are not permitted.

**Anchorage.** All prestressing steel shall be secured at the ends by means of permanent type anchoring devices meeting the approval of the Engineer. Prestress anchorages other than special anchorage devices shall be epoxy coated and be designed to develop at least 96 percent of the actual ultimate strength of the prestressing steel. Testing of anchorage devices shall be performed using samples representing the type of prestressing steel and concrete strength to be used on the project. The test specimen shall be assembled in an unbonded state and, in testing; the anticipated anchor set shall not be exceeded. Certified copies of test results for the anchorage system shall be supplied to the Engineer at no additional cost. The anchorage system shall be so arranged that the prestressing force in the tendon may be verified prior to the removal of the stressing equipment.

For tendon anchorages, the design, furnishing, installation, and all costs associated with any reinforcement (in addition to the reinforcement shown on the plans) which is needed to resist bursting and splitting stresses imposed on the concrete by the proposed anchorage system shall be the responsibility of the Contractor. The anchorage device supplier shall specify auxiliary and confinement reinforcing, including minimum spiral offset and pitch tolerances, minimum anchorage edge distance, minimum anchor spacing and minimum concrete strength at the time of stressing, required for proper performance of the local anchorage zone.

Prestress anchorage devices shall effectively distribute prestressing loads to the concrete and shall conform to the requirements of Section 5.10.9 of the AASHTO LRFD Bridge Design Specifications, 4th Edition. All strand tendon anchorage devices shall be tested by an independent testing laboratory acceptable to the Engineer in accordance with Section 10.3.2.3 of the AASHTO LRFD Bridge Construction Specifications. Acceptance criteria specified in Section 10.3.2.3.9b shall be as stated for moderately aggressive environments.

**Sampling and Testing.** All testing shall be done by the Contractor, his subcontractor, or his supplier in accordance with the appropriate ASTM Specifications.

The Contractor at his expense shall furnish the following samples of materials and devices selected as designated by the Engineer.

- Three samples of 5-foot long prestressing strand and bar for each size from each heat number or production lot.
- Three samples of 5-foot long HDPE duct for each size that will be used on this project from each heat number or production lot.
- Three samples of 5-foot long 24 gage semi-rigid galvanized metal ducts that will be used on this project from each heat number or production lot.
- Three samples of duct couplers for each size that will be used on this project.
- Three samples of duct inlet/outlet tubes with shut-off valves and associated hardware that will be used on this project.
- Three samples of strand wedges that will be used on this project from each heat number or production lot.
- One sample of each size of strand and bar tendon anchorage that will be used on this project. This shall include the anchor body, wedge plate and anchor cap for the strand tendons, and the anchor nut and cap for the bar tendons.

Samples shall be furnished 60 days in advance of the time they are to be incorporated into the work.

The Engineer reserves the right to reject for use at any time any material or device which is obviously defective or was damaged subsequent to testing.

**Manufacturer Lots.** The manufacturer of prestressing steel, prestress anchorages, and bar couplers shall assign an individual number to each lot of strand, wire, bar, or devices at the time of manufacture. Each reel, coil, bundle, or package shipped to the project shall be identified by tag or other acceptable means as to

manufacturer lot number. The Contractor shall be responsible for establishing and maintaining a procedure by which all prestressing materials and devices can be continuously identified with the manufacturer lot number. Items which at any time cannot be positively identified as to lot number shall not be incorporated into the work.

Low relaxation strand shall be clearly identified as required by ASTM A 416. Any strand not so identified will not be acceptable.

The Contractor shall furnish manufacturer certified reports covering the tests required by this Special Provision. A certified test report stating the breaking strength, yield strength, elongation and modulus of elasticity shall be furnished for each lot of prestressing steel. When requested, typical stress-strain curves for prestressing steel shall be furnished. A certified test report stating strength when tested using the type of prestressing steel to be used in the work shall be furnished for each lot of prestress anchorage devices.

**Corrosion Preventative Coating.** The corrosion inhibitor used in packaging post-tensioning steel for shipment shall be a vapor phase inhibitor (VPI) conforming to Federal Specification MIL-P-3420 or as approved by the Engineer.

**Grout.** Refer to Special Provision, Post-Tensioning Grout.

A technical representative of the grout manufacturer shall be present on-site during the first grouting operations and up to three other times at the request of the Engineer.

**Grouting Attachments.** All grouting accessories shall be capable of withstanding at least a 200 psi pressure. All connections to ducts shall be made with metallic or plastic structural fasteners. No duct tape is allowed as permanent material.

All anchorage end caps (i.e., grout caps) shall be made of plastic and shall remain in place after grouting unless otherwise directed by the Engineer.

Plastic components, if selected and approved, shall not react with the concrete or enhance corrosion of the post-tensioning steel, and shall be free of water-soluble chlorides.

Records of all tests required herein shall be submitted to the Engineer for approval.

**Grout Vents, Injection, and Ejection Pipes:** Vents shall be 1/2-inch minimum diameter plastic pipe. Plastic components shall not react with the concrete or enhance corrosion of the prestressing steel. Plastic components shall be free of water soluble chlorides. Grout injection pipes shall be fitted with positive mechanical-shut-off valves. Vents and ejection pipes shall be fitted with valves or other devices capable of withstanding the grout pumping pressures.

**Construction Methods:**

The post-tensioning steel and ducts shall be installed, stressed, and grouted as noted on the plans and in accordance with these Special Provisions.

**Submittals.** Shop drawings and calculations shall be prepared by or under the supervision of a qualified Professional Engineer registered in the State of Delaware and drawings shall be 22 by 34 inches in size. Smaller size drawings will not be accepted.

The Contractor shall submit to the Engineer for approval not less than 45 days prior to precasting or erection of any portion of the structure detailed shop drawings. These drawings shall include, but are not necessarily

limited to, the following:

- (a)** A complete description of, and details covering, the post-tensioning system to be used. This shall include:

  - (1)** Designation of the specific post-tensioning steel, anchorage devices, duct material, and accessory items.
  - (2)** Properties of each of the components of the post-tensioning system.
  - (3)** Equipment to be used in the post-tensioning sequence.
  - (4)** Procedure and sequence of operations for post-tensioning and securing tendons.
  - (5)** Parameters to be used to calculate the typical tendon force such as: expected friction coefficients, anchor set and post-tensioning steel relaxation curves.
  - (6)** Details covering assembly of each type of post-tensioning tendon.
  - (7)** Complete details of the Contractor proposed method for preventing water and debris from entering the post-tensioning ducts. Methods shall address the protection from the time the ducts are installed until the tendons are grouted.
- (b)** A table detailing the post-tensioning jacking sequence, jacking forces, and initial elongations of each tendon.
- (c)** Complete details of the anchorage system for post-tensioning including certified copies of the reports covering tests performed on prestress anchorage devices and details for any additional reinforcing steel needed due to stresses imposed in the concrete by anchorage plates. Certified tests shall include the concrete being used and reinforcing steel, including bursting reinforcement tolerances by the manufacturer.
- (d)** For the operation of grouting post-tensioning tendons, the materials and proportions for grout, details of equipment for mixing and placing grout and methods of mixing and placing grout.
- (e)** Calculations to substantiate the post-tensioning system and procedures to be used including stress-strain curves typical of the post-tensioning steel to be furnished, required jacking forces, and elongation of tendons during tensioning. These calculations shall show a typical tendon force after applying the expected friction coefficient and anticipated losses. Elongation calculations shall be revised when necessary to properly reflect the modulus of elasticity of the tendon material as determined from in place friction tests.
- (f)** Complete horizontal and vertical geometric layouts for each post-tensioning duct and tendon. Integrated shop drawings shall not be submitted until the Engineer has approved these layouts. This drawing shall show all air vents and water/fluid drains in the ducts for approval of the Engineer. Duct and tendon layout shall be accomplished so as to cause no curvature within the longitudinal limits of the trumpet component of a tendon anchorage device.
- (g)** Fully integrated drawings showing concrete dimensions, reinforcing steel, post-tensioning duct, post-tensioning hardware, inserts, and any other items to be embedded in a segment. Details of mild steel reinforcing shall be clearly shown as to size, spacing, and location including any anchorage reinforcing not shown in the Plans, which may be required by the post-tensioning anchorage system selected by the Contractor. Details of post-tensioning ducts shall clearly indicate the size, type, horizontal and vertical profiles, duct supports, grout pipes, and concrete covers. Any drawing not showing all items to be embedded in the concrete will be returned to the Contractor for resubmittal as a part of an integrated drawing. Prior to submittal, the Contractor shall review these drawings to

determine the absence of reinforcement and tendon or embedment conflicts. Any unresolved conflicts shall be called to the attention of the Engineer at the time of submittal. The Contractor shall be solely responsible for any and all effects of conflicts found during fabrication.

- (h) Duct supports, grout tubes, vents and drains shall be clearly designed and detailed on the shop drawings, including the size, type, and locations.
- (i) Calculations prepared under the direction of, and signed and sealed by, a Delaware Registered Professional Engineer which show that the loads imposed on the permanent structure by the equipment will not adversely affect the structural adequacy of the permanent structure, nor exceed allowable stresses during the construction process.

**Execution.** The post-tensioning duct and tendons shall be installed, capped, tensioned and grouted in accordance with these Special Provisions, 4th edition of AASHTO LRFD Bridge Design Specifications, Post-Tensioning Institute (PTI) Acceptance Standards for Post-Tensioning Systems, 6th edition of PTI Post-Tensioning Manual, and Specification for Grouting of Post-Tensioned Structures. If there are any conflicts between these requirements, the more stringent will control.

### **Protection of Prestressing Steel.**

(1) **During Shipping, Handling, and Storage:** All prestressing steel shall be protected against physical damage and corrosion at all times from manufacture to final grouting. Prestressing steel that has sustained physical damage at any time shall be rejected. Any reel that is found to contain broken wires shall be rejected and the reel replaced. The strand shall be bright and uniformly colored, having no foreign matter or pitting on its surface. Storage shall be waterproof, elevated away from ponding water and convenient to the work. Proper waterproof covering shall be provided.

Prestressing steel shall be packaged in containers or shipping forms for protection of the steel against physical damage and corrosion during shipping and storage. A corrosion inhibitor which prevents rust or other results of corrosion shall be placed in the package or form, or shall be incorporated in a corrosion inhibitor carrier type packaging material, or when permitted by the Engineer, may be applied directly to the steel. (See Grouting Operations). The corrosion inhibitor shall have no deleterious effect on the steel or the concrete or bond strength of steel to concrete. Inhibitor carrier type packaging material shall conform to the provisions of Federal Specification MIL-P-3420. Packaging or forms damaged from any cause shall be immediately replaced or restored to the original condition. The shipping package or form shall be clearly marked with a statement that the package contains high-strength prestressing steel, the care to be used in handling, and the type, kind, and amount of corrosion inhibitor used, including the date when placed, safety orders and instructions for use. Each reel shall be identified with a lot number that can be easily identified at the job site. Records submitted to the Engineer shall include the lot number with the heat coil, reel or shipment of materials represented. Unidentified shipments will be rejected.

(2) **During Installation in the Structure.** At the time the prestressing steel is installed in the work, it shall be free from loose rust, loose mill scale, dirt, paint, oil, grease, or other deleterious material. Removal of tightly adhering rust or mill scale will not be required. Prestressing steel, which has experienced rusting to the extent that it exhibits pits visible to the naked eye, shall not be used in the work.

(3) **Cutting of Post-Tensioning Steel.** Post-tensioning steel shall be cut by an abrasive saw within 3/4 to 1 1/2 inches away from the anchoring device. Flame cutting of post-tensioning steel is not allowed. If tendons are not capped within 4 hours of stressing, the tails and anchorages shall be adequately protected from precipitation and runoff.

**Stressing Operations.** The post-tensioning operation shall be so conducted that the forces being applied to

the tendon and the elongation of the post-tensioning tendon can be measured at all times. The Contractor shall keep a record of the following post-tensioning operations for each tendon installed. Any other relevant information shall also be recorded. The Contractor shall provide the Engineer with a complete copy of all stressing and grouting operations.

- (a) Project name, number.
- (b) Contractor and/or subcontractor name.
- (c) Tendon location, size, and type.
- (d) Date tendon was first installed in ducts.
- (e) Heat number for bar and strand tendons (from Mill certificate).
- (f) Assumed and actual cross-sectional area (from Mill certificate).
- (g) Assumed and actual modulus of elasticity (from Mill certificate).
- (h) Date stressed.
- (i) Jack and gauge numbers per end of tendon.
- (j) Required jacking force.
- (k) Gauge pressures.
- (l) Elongations (anticipated and actual).
- (m) Anchor sets (anticipated and actual).
- (n) Stressing sequence (i.e., tendons before and after this).
- (o) Stressing mode (one end/two ends/simultaneous).
- (p) Witnesses to stressing operation (Contractor and inspector).
- (q) Date grouted, days from stressing to grouting, and grouting pressure applied at injection end.

Elongations shall be measured to the nearest 1/16-inch. For the required tendon force, the observed elongation shall agree within 7 percent of the theoretical elongation or the entire operation shall be checked and the source of error determined and remedied to the satisfaction of the Engineer before proceeding further. The tendon shall not be overstressed to achieve the theoretical elongation. In the event that agreement between the observed and theoretical elongations at the required force falls outside the acceptable tolerances, the Engineer may, at his discretion and without additional compensation to the Contractor, require additional tests for tendon Modulus of Elasticity and/or n-Place Friction. The post-tensioning operation shall be so conducted that the forces being applied to the tendon and the elongation of the post-tensioning tendon can be measured at all times. The tendon force may be verified by performing a lift-off test at the non-stressing end (dead end) of the tendon. A lift-off test at the stressing end will not be acceptable procedure to determine the tendon force.

**Friction.** The Contract Plans were prepared based on the assumed friction and wobble coefficients and

anchor set noted on the plans. The Contractor shall submit calculations and show a typical tendon force diagram, after friction, wobble, and anchor set losses, on the shop drawings based upon the expected actual coefficients and values for the post-tensioning system to be used. These coefficients and values shall be given on the shop drawings.

If, in the opinion of the Engineer, the actual friction significantly varies from the expected friction, the Contractor shall revise the post-tensioning operation such that the final tendon force is in agreement with the plans.

When friction must be reduced, water soluble oil or graphite may be used as a lubricant subject to the approval of the Engineer. Lubricants shall be flushed from the duct as soon as possible after stressing is completed by use of water pressure saturated with slack lime (calcium hydroxide) or quick lime (calcium oxide) in the amount of 0.1 pounds per gallon. These ducts shall be flushed again just prior to the grouting operations. Each time ducts are flushed, they shall be immediately blown dry with oil-free air to the satisfaction of the Engineer.

**(4) Installing Tendons:** Post-tensioning tendons may be pushed or pulled through the ducts to make up a tendon. Pushing shall be done with care so as to avoid snagging on any lips or joints in the ducts. The Contractor shall take precautions by rounding off the end of the bars or fitting it with a smooth protective cap for this purpose. Cutting shall be done with an abrasive saw or similar. Flame cutting shall not be allowed. Installation of tendons in ducts prior to concrete placement shall not be allowed. No permanent tendons shall be installed prior to the completion of testing as required by these Specifications or plans, except for the n Place Friction Test where only the tendon to be tested shall be installed prior to successful completion of the test.

**Cleaning Tendons and Ducts.** Immediately prior to grouting operations, the inside of the tendon duct shall be blown out with compressed oil-free air to the extent necessary to remove any water or debris, and to dry the post-tensioning steel and inside surfaces of the pipe.

## **FABRICATION.**

**General.** All post-tensioning anchorages, ducts, vent pipes, miscellaneous hardware, reinforcing bars, and other embedments shall be accurately and securely fastened at the locations shown on the plans or on the approved shop drawings or as otherwise approved by the Engineer.

### **Post-Tensioning Ducts.**

**(1) Ducts:** Duct shall be accurately aligned and positioned at the locations shown on the plans or according to the approved shop drawings or as otherwise approved by the Engineer. All internal ducts shall be securely fastened in position at regular intervals not exceeding 2'-0" to prevent movement, displacement or damage from concrete placement and consolidation operations. Ducts shall be attached to supporting chairs or reinforcement in such a way that the duct is not damaged. The method and spacing of duct supports shall be shown on appropriate shop drawings. All alignments of ducts, including curved and straight portions, splices, joints, and connections to anchorages shall be watertight, smooth and continuous with no lips, kinks, or dents. All splices, joints, and connections to anchorages shall be watertight and of sufficient strength to prevent distortion or displacement of the ducts during concrete placement. In the event duct alignment cannot be maintained during concrete placement, mandrels shall be used to stiffen the duct along its entire length. All ducts shall be carefully checked and repaired as necessary before the placing of any concrete commences. After installation in the forms, all ends of ducts, connections to anchorages, splices, vents, and the like shall at all times be sealed to prevent the entry of water and debris. The Contractor at no expense to the Department shall supply an additional mild reinforcing required to support post-tensioning ducts. The tolerance on the location of the tendons shall be plus or minus 1/4-inch at any point in respect to the vertical, linear, and

transverse position as shown on the plans. After installation in the forms, the ends of ducts shall, at all times, be sealed to prevent entry of water and debris.

The ducts shall be bent so as to accurately conform to the geometry shown on the plans and shall be sized to ensure that post-tensioning forces exerted by the steel enclosed in the pipe are within tolerable limits of the concrete surrounding the pipe.

The duct system, including splices and joints shall effectively prevent entrance of cement paste or water into the system and shall effectively contain pressurized grout during grouting of the tendon. The duct system shall also be capable of withstanding water pressure during flashing of a duct in the event the grouting operation is aborted.

The ducts shall be the size as shown on the plans. If the size is not shown, the interior diameter of ducts for single bar, strand or wire shall be at least 1/4-inch greater than the nominal diameter of the tendon. The interior diameter of ducts made up of multiple strands shall be large enough to cause the duct to have an interior area not less than 2.5 times the prestressing steel area.

**(2) Grout Vents, Injection, and Ejection Pipes:** All ducts or anchorage assemblies for permanent post-tensioning shall be provided with pipes or other suitable connections at each end for the injection of grout after prestressing. As a minimum, ducts shall be vented at the high points of the tendon profile when there is more than a 6-inch variation in the vertical position of the duct. The Contractor may use additional injection and vent pipes when shown on the shop drawings. All connections to ducts shall be made with plastic structural fasteners. Waterproof tape or other method approved by the Engineer shall be used at all connections to include vent and grouting pipes. No duct tape shall be allowed. Vents shall be mortar tight, taped as necessary, and shall provide means for injection of grout through the vents and for sealing the vents.

### **Placing Concrete.**

**Precautions:** The Contractor shall exercise great care when placing and consolidating concrete so as not to displace or damage any of the post-tensioning ducts, anchorage assemblies, splices and connections, reinforcement or other embedments. Direct concrete discharge onto the tendon duct shall be avoided.

**Proving of Post-Tensioning Ducts:** Upon completion of concrete placement, the Contractor shall prove that the post-tensioning ducts are free and clear of any obstructions or damage and will be able to accept the intended post-tensioning tendons by passing a torpedo through the ducts. The torpedo shall have the same cross-sectional shape as the duct, and shall be 1/4-inch smaller all around than the clear, nominal inside dimensions of the duct. No deductions to the torpedo section dimensions shall be made for tolerances allowed in the manufacture or fixing of the ducts. For straight ducts, it shall be at least 2 feet long. For curved ducts, the length shall be determined by the Contractor such that when both ends touch the outermost wall of the duct, the torpedo is 1/4-inch clear of the innermost wall. If the torpedo will not travel completely through the duct, the member shall be rejected, unless a workable repair can be made to clear the duct, to the satisfaction of the Engineer. The torpedo shall be passed through the duct easily, by hand, without resorting to excessive effort or mechanical assistance.

**Problems and Remedies:** If the ducts or any part of the work is found to be deficient, it will be rejected. No remedial or repair work will be permitted without the approval of the Engineer.

### **POST-TENSIONING OPERATIONS.**

**General.** All post-tensioning stressing operations shall be conducted under supervision of a person experienced in bridge construction post-tensioning techniques. The Contractor shall identify the experienced person and shall provide documentation showing previous experience for at least two similar projects totaling

not less than two years duration. Post-tensioning forces shall not be applied until the concrete has attained the minimum compressive strength as specified on the contract plans, determined by cylinder tests.

**Stressing Tendons:** All post-tensioning steel shall be tensioned by means of hydraulic jacks so that the post-tensioning force shall not be less than that required by the plans or approved shop drawings, or as otherwise approved by the Engineer. The maximum temporary stress (jacking stress) in the post-tensioning steel shall not exceed 78 percent of its specified minimum ultimate tensile strength. Tendons shall not be overstressed to achieve the expected elongation. During stressing of strand, individual wire failures may be accepted by the Engineer as indicated in Section 10.10.1 of the referenced AASHTO LRFD Bridge Construction Specifications. The post-tensioning steel shall be anchored at initial stresses that will result in the long term retention of permanent stresses or forces of not less than those shown on the Plans or the approved shop drawings. Unless otherwise approved by the Engineer, the initial stress at the anchorage after anchor set shall not exceed 70 percent of the specified ultimate tensile strength of the post-tensioning steel. Permanent stress and permanent force are the stress and force remaining in the post-tensioning steel after all losses, including long-term creep and shrinkage of concrete, elastic shortening of concrete, relaxation of steel, losses in the post-tensioning steel from the sequence of stressing, friction and unintentional wobble of the ducts, anchor set, friction in the anchorages, and all other losses particular to the post-tensioning system. The measurement of stress shall be in accordance with Section 10.10.1.4 of the referenced AASHTO LRFD Bridge Construction Specifications.

**Stressing Sequence:** All bar and strand tendons shall be stressed at one end as specified in the plans and shop drawings.

**Stressing Equipment:** Equipment for tensioning the tendons shall be furnished by the manufacturer of the post-tensioning system (tendons, hardware, anchorages, etc.). Each jack used to stress tendons shall be equipped with a pressure gauge for determining the jacking pressure. The pressure gauge shall have an accurate reading dial at least 6 inches in diameter. The pressure gauge shall be installed at the stressing ram. Prior to use for stressing on the project, each jack and its gauge shall be calibrated as a unit by a testing laboratory approved by the Engineer.

**Calibration of Jacks and Gauges:** Calibration shall be performed within six months of use, with the cylinder extension in the approximate position it will be in when applying the final jacking force. Calibration shall be done when the jack is connected to the equipment (pumps and gauges) in the identical configuration as it will be used on the job site (e.g., with the same length hydraulic lines). Initial calibration of the jacks and gauges shall be performed by an independent laboratory using a proven load cell. For each jack and gauge unit used on the project, certified calibration calculations and charts shall be furnished to the Engineer from the independent laboratory prior to stressing the first tendon. Any repair of the jacks, such as replacing seals or changing the length of the hydraulic lines, is cause for recalibration of the jacks using a load cell. No extra compensation shall be allowed for the initial or subsequent calibrations or for the use and required calibrations of the master gauge.

## **GROUTING OPERATIONS.**

Within fifteen (15) calendar days after installation of the post-tensioning steel strands, ducts shall be grouted in accordance with these Specifications. If the strand tendons are not grouted within fifteen calendar days after installation, then the Contractor shall de-stress, remove and replace the strand tendons in the presence of the Engineer. In lieu of this, the Contractor shall submit a written corrosion protection plan for approval by the Engineer. The plan shall include a mock-up of the proposed plan that is to be constructed at the project site at least 120 days prior to the installation of the tendons. The approved corrosion protection plan shall limit the duration between strand installation and grouting, and the mock-up shall demonstrate that this duration is acceptable to the Engineer. The duration in the approved corrosion protection plan shall not exceed ninety (90) calendar days. The corrosion protection plan shall be submitted 4 weeks prior to

constructing the mock-up. The mock-up shall be a minimum of 10 feet in length to observe the product effectiveness. Documentation shall be provided in the corrosion protection plan that demonstrates the corrosion protection material does not interfere either with the bond between the grout, steel strands, and duct or the chemical composition of the grout. Products which require flushing of the ducts should be avoided. Anti-freeze solutions are not permitted. If the protected strand tendons are not grouted within the duration specified in the approved corrosion protection plan, then the Contractor shall de-stress, remove and replace the strand tendons in the presence of the Engineer.

Within ninety (90) calendar days after installation of the post-tensioning steel bars (epoxy coated), ducts shall be grouted in accordance with these Specifications. If the bar tendons are not grouted within 90 calendar days after installation, then the Contractor shall de-stress, remove and replace the bar tendons in the presence of the Engineer.

After stressing and prior to grouting, tendons shall be protected against corrosion or harmful effects of debris in accordance with Section 10.10.5 of the referenced AASHTO LRFD Bridge Construction Specifications until the tendons are grouted. When stressing has been completed and the stressed tendons have been accepted by the Engineer, the annular space between the tendons and the duct shall be grouted.

The Contractor shall determine the exact kinds of admixtures and proportions of materials to be used to meet the requirements set under Materials, and which, from prior documented experience with similar materials, equipment and placing conditions, will result in grout which does not bleed and can be effectively placed. Grout shall be mixed in accordance with the manufacturers recommendations, consistent with the fluidity needed for placing.

After post-tensioning and anchoring of a tendon has been completed and accepted, the annular space between the post-tensioning steel and the duct shall be grouted. The grouted tendons shall not be subject to vibration until the grout reaches a minimum compressive strength of 3,000 psi. Immediately after post-tensioning, all grout vents of each tendon shall be temporarily sealed with plugs to prevent entrance of air or water and left in place until just prior to tendon grouting.

**(a) Written Grouting Procedures.** At least four weeks prior to the start of construction of prestressed elements, written procedures for grouting operations shall be submitted to the Engineer for approval. The grouting procedures shall be devised to ensure that the ducts will be properly filled by grout and shall cover in detail the following:

- (1) type, quantity, and brand of materials used in grouting including all certification required;
- (2) type of equipment needed, including capacity in relation to demand and working condition, as well as provisions for back-up equipment and spare parts;
- (3) types and locations of inlets and outlets;
- (4) types and sizes of grout hoses and connections;
- (5) duct cleaning methods and air pressure testing methods prior to grouting;
- (6) mixing and pumping procedures;
- (7) direction of grouting;
- (8) sequence of use of the inlets and outlets;

- (9) procedures for handling blockages, including flushing of ducts;
- (10) procedures for possible regrouting;
- (11) procedures for post-grouting operations and inspections; and
- (12) the names of the persons in charge and the other personnel who will perform the grouting operation, including their relevant experience and skill.

(b) **Mixing and Pumping Procedures.** The mixing and pumping procedures required in Item (a) (6) above shall include:

- (1) inspection to ensure that all materials are of the specified type and quantity;
- (2) inspection to ensure that all equipment is in satisfactory condition;
- (3) detailed plan for production testing of grout;
- (4) inspection of ducts to ensure that they are free of water, debris, and other obstructions.
- (5) inspection of ducts to ensure that there will be no grout leakage between adjacent ducts in joint areas (i.e., air pressure testing);
- (6) temperature measurement of air, water, cement, grout, and concrete elements to ensure that they are within the acceptable limits as specified in Post-Tensioning Grout;
- (7) procedures for cold and hot weather grouting; and
- (8) inspection of all cement or grout mixture packages for evidence of age and dampness, such as lumps and hardened pieces.

Grouting operations shall commence only after Engineer has approved the grouting procedures.

(c) **Records of Grouting Operations.** The Contractor shall record the progress of grouting operations for each duct and submit a written report to the Engineer within 72 hours after grouting.

Information to be noted in the records shall include but shall not necessarily be limited to the following:

- (1) identification of tendons grouted, injection end and maximum applied grouting pressure;
- (2) date grouted;
- (3) number of days from stressing to grouting;
- (4) type of grout mix used and lot number of prebagged grout;
- (5) volume of grout pumped into the duct compared to the volume of the duct adjusted for the grout displaced by the prestressing stand; and
- (6) summary of any problems encountered and corrective action taken.

**(d) Grouting Personnel.** All grouting operations shall be carried out by experienced superintendents, foremen, and workers. Grouting shall be performed under the immediate control of a person skilled in all aspects of grouting and has received certification as an American Segmental Bridge Institute Certified Grouting Technician or as approved by the Engineer. The person shall provide close observation and control of all grouting operations, as necessary for full compliance with specified requirements. This person shall be named and shall furnish proof of at least three years experience as approved by the Engineer.

**(e) Ducts.** Care shall be taken to ensure that all ducts, anchorages, block-outs, openings, inlets, and vents are kept clean and free of water, debris, fuel, oils, other contaminants and trash at all times prior to and after installing tendons. Temporary plugs, seals and covers shall be used as needed. Minor damage to ducts shall be satisfactorily and effectively repaired and sealed or by removing the locally damaged duct and splicing duct or couplers onto the damaged section prior to placing any concrete. Major damage shall require the removal and replacement of duct. Ducts shall be protected from UV damage.

Prior to grouting, the ducts shall be blown with oil free compressed air to remove water and debris. Ducts shall be dried with compressed air to remove standing water. Each tendon duct shall be air pressure tested to 50 psi to locate potential grout leaks by measuring the loss of pressure over 1 minute. The loss of pressure shall not be greater than 25 psi over 1 minute. All blockages, and leaks shall be repaired to the satisfaction of the Engineer.

**(f) Supplies.** Before grouting operations begin, an adequate supply of water and compressed air shall be available for clearing the ducts, mixing, and pumping the grout, and flushing out grouted ducts in the event of breakdowns or incomplete operations. All necessary materials shall be checked and made conveniently available for mixing.

**(g) Production Testing.** Testing equipment for flow-cone testing, and temperature measurements shall be available on-site during grouting operations. Fluidity of the grout shall be strictly maintained within the limits established by the grout manufacturer. In addition to the fluidity tests required for each tendon (see routing Operations , one fluidity test (flow cone) in accordance with C939 or C939 Modified shall be performed every two hours of grouting operations. One test shall be taken at the mixer and one at the duct outlet. The efflux times shall be within 5 seconds of the values established during laboratory testing. No grout which tests outside the allowable flow rate shall be used. In addition to the flow-cone tests described above, field trial tests and production tests shall be performed in accordance with Section 4.7 of the PTI Guide Specification for Grouting of Post-Tensioned Structures, except the mud balance test shall be performed for each tendon at the inlet and outlet.

**(h) Storage of Materials.** Grout shall be delivered in prepackaged bags and stored in a building or other location that is weatherproof. Storage in the open may be permitted by the Engineer, if a raised platform and adequate waterproof covering are provided. Care should be taken with the storage of dry grout mixtures in temperatures below 32 degrees F or as recommended by the manufacturer, whichever is more stringent.

**(i) Equipment.** Grouting equipment consists of measuring devices for water, a high speed shear colloidal mixer, a storage hopper (holding reservoir) and a pump with all the necessary connecting hoses, valves, and pressure gauges. Provide air compressor and hoses with sufficient output to perform the required functions.

Provide equipment with sufficient capacity to ensure that the post-tensioning ducts to be grouted can be filled and vented without interruption at the required rate of injection. Under normal conditions, the grout equipment shall be capable of continuously grouting the longest tendon on the project in not more than 20 minutes.

**(1) Mixer, Storage, Hopper and Screen.** Provide a two-speed high shear (colloidal) mixer capable of

continuous mechanical mixing. The mixer will produce a homogeneous and stable grout free of lumps and undispersed cement and will be able to deliver a continuous supply of grout to the pumping equipment.

The colloidal grout machinery will have charging and agitating tanks. One unit is a blender and the other a holding tank. The blending tank shall be equipped with a two-speed high shear (colloidal) mixer.

The storage hopper must be kept agitated and at least partially full at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct.

Add water to the mix by use of a flow meter or calibrated water reservoir with measuring accuracy of at least 0.1 gallon. Maintain minimum and maximum manufacturer recommended ranges.

The grouting equipment shall contain a screen having clear openings of 1/8-inch maximum size to screen the grout prior to introduction into the pump. If the grout is thixotropic, a maximum screen opening of 3/16-inch is satisfactory. The screen shall be inspected periodically during grouting operations. If lumps of cement remain on the screen, the mixture is not suitable for grouting.

Grout shall be gravity fed from hopper into pump inlet.

**(2) Grout Pumping Equipment.** Provide pumping equipment capable of continuous operation which will include a system for recirculating the grout when actual grouting is not in progress.

The equipment will be capable of maintaining pressure on completely grouted ducts and will be fitted with a valve that can be closed off without loss of pressure in the duct.

Grout pumps will be positive displacement type, will provide a continuous flow of grout and will be able to maintain an outlet pressure of at least 150 psi.

Pumps will be so constructed and have seals adequate to prevent oil, air or other foreign substances from entering the grout and to prevent loss of grout or water. The capacity will be such that an optimal rate of grouting can be achieved.

A pressure gauge having a full-scale reading of no more than 300 psi will be placed at some point in the grout line between the pump outlet and the duct inlet. If hoses longer than 100 feet are used, two gauges shall be used, one for at the pump and one at the inlet.

The diameter and rated pressure capacity of the grout hoses must be compatible with the pump output. Grout hoses will be firmly connected to pump outlets and the duct inlets.

**(3) Stand-by Equipment.** During grouting operations, provide a high pressure water pump rated at 250 psi for adequate flushing to facilitate complete removal of the grout in the event of a breakdown of the grouting equipment or other disruption before the grouting operation has been completed. At the request of the Engineer, demonstrate that this equipment is in full working order. Where water is not supplied through the public water supply system, a water storage tank of sufficient capacity is required.

As well, a backup grout mixer/hopper and pump shall be available on-site during all grouting operations to allow continuous grouting in the case of failure of the primary pump or mixer and to have the capability to run two independent grouting operations, if needed.

**(j) Grouting Operations.** Grout tendons in accordance with the procedures outlined in the approved grouting procedures when the ambient temperature is at or above the minimum temperature specified by the grout manufacturer 24 hours prior to and during the grouting operations, but not less than 40 degrees F. If

temperatures fall below the minimum specified temperature within 24 hours of completion of grouting operations, the Contractor shall provide means of and maintain the temperature of grouted ducts above the minimum specified temperature until a strength of 2500 psi is achieved.

Maximum grout temperature will not exceed 90 degrees F to avoid flash set and rapid stiffening in the duct. Use chilled water and/or pre-cooling of the bagged material to maintain mixed grout temperature below the maximum allowed temperature. Grouting operations are prohibited, if freezing temperatures are forecast. If grout manufacturer temperature restrictions are more stringent than those above, they shall be followed.

Mix the grout with the metered amount of water. The materials shall be mixed to produce a homogeneous grout. Continuously agitate the grout until it is pumped. Check the fluidity of the grout in accordance with C939 or C939 Modified. Production tests shall be performed in accordance with Section 4.7 of the PTI Guide Specification for Grouting of Post-Tensioned Structures, except the mud balance test shall be performed for each tendon at the inlet and outlet.

Open all grout outlets before starting the grouting operation. Unless otherwise approved by the Engineer, grout the tendons from the lowest inlet. Pump grout from the lowest inlet location of the tendon in an uphill direction. Use the grout within 30 minutes of mixing to ensure the flowability of the grout.

Maintain a continuous one-way flow of grout.

Unless approved by the Engineer, pump grout at a rate of between 15 linear feet and 30 linear feet of duct per minute.

The approved method of pumping grout will ensure complete filling of the ducts and complete encasement of the steel. Grout shall flow from the first and subsequent outlets until any residual flushing water or entrapped air has been removed then expel an additional 3 gallons of grout prior to closing the outlet.

Close all outlets in a similar manner one after another in the direction of the flow except at intermediate crests. Outlets placed a short distance downstream of the crest will be closed before their associated crest outlet pipe following the one way flow to avoid trapped air.

Pump grout through the duct and continuously discharge it at the anchorage and grout cap outlets until all free water and air are discharged and the consistency of the grout is equivalent to that of the grout being pumped at the inlet. In addition, discharge a minimum of 3 gallons of grout into a clean receptacle to perform a fluidity test. Close the anchorage outlet.

For each tendon, immediately after discharge, perform a fluidity test in accordance with Section 10.11.5 of the referenced AASHTO LRFD Bridge Construction Specifications. Discard grout used for fluidity testing. Conduct normal grouting operations at a pressure range of 10 psi to 50 psi measured at the grout inlet. Do not exceed the maximum pumping pressure of 150 psi at the grout inlet.

After all outlets have been bled and sealed, terminate grouting by the following procedure. Elevate the grout pressure to 75 psi and maintain for 1 minute. If leaks are present, fix the leaks. If no leaks are present, lower the pressure to 50 psi and seal the inlet valve.

If the actual grouting pressure exceeds the maximum allowed, the inlet will be closed and the grout will be pumped at the next outlet that has just been or is ready to be closed as long as a one-way flow is maintained. Grout shall not be pumped into a succeeding outlet from which grout has not yet flowed. If this procedure is used, the outlet/inlet that is to be used for pumping shall be fitted with a positive means of shut-off.

When one-way flow of grout cannot be maintained or when grouting is interrupted, immediately flush the grout from the duct with potable water saturated with slack lime or quick lime.

**(k) Post-Grouting Operations and Inspection.** Fully grouted tendons will not be subjected to vibration until the grout reaches a minimum compressive strength of 3,000 psi.

Valves, caps, and pipes at the inlets and outlets will not be removed or opened until the grout has cured for 48 hours. After the grout has cured for 48 hours, remove the ends of plastic inlets and outlets 1 inch below the surface of the concrete and fill the hole with freshly mixed post-tensioning grout or epoxy grout.

At all anchorages and, where possible, high points, drill into the grout vent to expose the duct contents within 7 days of grouting. Care shall be exercised to avoid drilling into post-tensioning steel. Jointly with the Engineer visually inspect for voids in the grout using a videoscope probe (supplied by the Contractor). If no voids are found, immediately fill the drill hole with freshly mixed post-tensioning grout or epoxy grout. If voids are detected, seal the hole until a repair procedure can be implemented. Repair procedures shall utilize the vacuum grouting method, unless otherwise approved by the Engineer. Contractor shall prepare a repair procedure and submit to the Engineer for approval. Repairs shall be implemented at no additional cost to the Department. A written report on all inspections and repairs shall be submitted to the Engineer.

If problems with grout bleed or voids in grouted ducts are discovered, the Contractor shall immediately stop all grout operations, determine the cause of the problem and submit a revised grouting procedure for approval by the Engineer. The revised procedure shall identify the causes of the problems and how the revised procedures will correct these problems.

#### **Related Work.**

Special Provision Post-Tensioning Grout

#### **References.**

- (a) American Association of State Highway and Transportation Officials (AASHTO)
  - (1) LRFD Bridge Design Specifications, 4<sup>th</sup> Edition with 2009 interim revisions.
  - (2) LRFD Bridge Construction Specifications, 2<sup>nd</sup> Edition with 2007 interim revisions.
- (b) American Society for Testing and Materials (ASTM)
- (c) Post-Tensioning Institute (PTI)
  - (1) Acceptance Standard for Post-Tensioning Systems
  - (2) 6th edition of PTI Post-Tensioning Manual
  - (3) Specification for Grouting of Post-Tensioned Structures

#### **Quality Assurance.**

**Installer Qualifications:** Engage an experienced installer who has completed prestress concrete work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.

**Fabricator Qualifications:** Engage a firm experienced in producing prestress hardware similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to supply hardware without delaying the work.

**Professional Engineer Qualifications:** A Professional Engineer registered in the State of Delaware and

experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for design and installation of prestressing for cast-in-place concrete girders or pier caps that are similar to that indicated for this project in material, design, and extent.

**Method of Measurement and Basis of Payment:**

The preparation, testing, mock-ups, furnishing, installing, stressing, grouting and anchorage protection of the post-tensioning system in the various concrete units will be paid for at the contract lump sum price for the pertinent Post-Tensioning Pier Cap Bonded System item. The payment will be full compensation for all tendons, anchorages, ducts, grout and bursting reinforcement as well as all material, labor, equipment, tools, and incidentals necessary to complete the work.

3/1/11

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**605002 - STEEL STRUCTURES**

In addition to the requirements of Section 605 the following conditions shall apply:

**NOTE:**

A breakout sheet attached to the Proposal list the Steel for the Bridges under this item. The Contractor shall fill in a unit price for each item and the cost (unit price times the proposed quantity). The lump sum bid for Item 605002 - Steel Structures shall be the sum of the cost for all items listed. The breakout sheet shall be attached to the Bid Proposal. Failure to submit the breakout sheet with the Bid Proposal will result in the Bid Proposal being declared non-responsive and rejected.

The Department reserves the right to delete from the Contract one or more of the items listed and right to add or subtract from the quantity of each item. The lump sum to be paid will be adjusted in accordance with the Contractor's unit prices as required above. There will be no extra compensation if such additions and/or deletions are made.

9/16/10

**605500 – CANTILEVER-SIGN SUPPORT AND FOUNDATION****Description:**

This work consists of furnishing all materials, fabricating and installing cantilever sign supports including foundations as called for the Contract, in accordance with the locations, details shown on the Plans and as directed by the Engineer.

The various materials and construction operations not specifically indicated on the Plans and in the specifications shall be in accordance with the latest revised AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals.

**General** - The main support and truss members of the sign support structure shall be fabricated from tubular steel whose diameters, wall thicknesses and lengths shall conform to the requirements and details shown on the Contract Plans, or as shown on approved alternate design drawings.

Alternate designs utilizing structural shapes for the main support and truss members, and which form a structure of sufficient strength and pleasing appearance will also be considered for approval when submitted in accordance with the provisions of these specifications. All submissions for approval including materials and specifications for alternate designs must be signed by a registered Professional Engineer, registered in the State of Delaware.

The bidder is cautioned that maximum consideration will be given to aesthetic considerations for all of the sign supports including, but not necessarily limited to, the general appearance, methods of fabrication and assembly, material selection, arrangement, and end finishes of the proposed structural shapes and the welding and surface finishes as required.

If the bidder elects to furnish sign supports alternate to those shown in the Contract Plans, it is a requirement that as an end result, the alternate will satisfy the requirements of the proposal.

Sign panels, electrification and luminaries are not included under this item.

The contractor shall stake each sign structure location for approval by the engineer. Upon approval, submit working drawings. Show the highest elevation of the traveled roadway and shoulder at each structure location. Upon approval of the working drawings, materials may be ordered.

**Materials:****Structural**

Main Pole, End Braces and Arm Chords:

Minimum Yield Stress = 52,000 psi (55,000 psi for tapered sections]

Structural Shapes, plates, and bars:

Under ¼" - ASTM-A575 Grade 1020

¼" to 1" - AASHTO M 270 Grade 36.

Over 1" - AASHTO M 270 Grade 50.

Web Members: ASTM-A501

Steel Castings: AASHTO M 103 Grade 65 - 35

Pole Tops: ASTM-B26, Aluminum Alloy S5A or  
ASTM-A126, Class-A Cast Iron

**Fasteners**

Clamps: ASTM-A606 Type 4

Anchor Bolts: AASHTO M314 Grade 55

Anchor Nuts: AASHTO M 291 Grade DH (Grade 2H)

Connection Bolts: AASHTO M 164

Nuts: AASHTO M291 Grade DH

Other Bolts and Nuts: ASTM-A307 Grade A

U-Bolts: ASTM-A307

**Finish**

Structural: Galvanized finish AASHTO M 111  
Fasteners: Galvanized finish AASHTO M 232  
Concrete: Portland Cement Concrete shall be 4500 psi minimum and shall conform to the material requirements of Class A, Section 812, Portland Cement Concrete of the Standard Specifications.

Bar Reinforcements: Bar reinforcements shall be epoxy coated and meet the requirements of AASHTO M31, Grade 60 and conform to Subsection 603.02 of the Standard Specifications.

**Construction Methods:**

Shop Drawings: Shop drawings shall be submitted in accordance with Subsection 105.04 of the Standard Specifications. Minor variations in details may be permitted; however, any major departure from the design will not be accepted.

The Contractor may at his/her option elect to prepare alternate design plans and specifications for the overhead sign support structures in place of the Plan construction. Detail plans, design computations, and specifications for the proposed structures shall be submitted to the Engineer for approval; and no work shall begin until the alternate design plans have been reviewed and approved, in principle, by the Engineer.

The requirements for the preparation of shop drawings for an approved alternate design (or designs), shall be similar to those specified for the Plan construction.

Fabrication. Loading, transporting, unloading and erection of structural materials shall be done so that the metal will be kept clean and free from injury in handling.

Structural materials shall be stored above the ground upon platforms, skids, or other supports and shall be kept free from accumulation of dirt, oil, acids or other foreign matter.

Structural material which has been deformed shall be straightened before begin laid out, punched, drilled or otherwise worked upon in the shop. Sharp kinks or bends will be cause for rejection.

When sign support structures are subcontracted, the subcontract shall be in accordance with Subsection 108.01 of the Standard Specifications except that the value of the subcontract will be based on the value of the work for fabrication.

Cutting, Punching, Drilling and Finishing. Material 1/2" (12 mm) thick or less may be sheared, sawed or cut with a router. Material more than 1/2" (12 mm) thick shall be sawed or routed.

Cut edges shall be true and smooth and free from excessive burrs or ragged breaks.

Edges of plates carrying calculated stresses shall be planed to a depth of 1/4" (6 mm) except in the case of sawed or routed edges of a quality equivalent to a planed edge.

Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

Structural material shall not be heated except to facilitate bending; then the structural material may be heated to a temperature not exceeding 400°F (204°C) for a period not exceeding 30 minutes. Such heating shall be done only when temperature and time requirements are observed.

Bolt holes in main members shall be subpunched or sub drilled and reamed to finished size after the parts are firmly bolted together. The amount by which the diameter of sub punched holes is less than that of the finished hole shall be at least 1/4 the thickness of the piece and in no case less than 1/32" (0.8 mm). If the metal thickness is greater than the diameter of the hole, punching shall not be used.

Bolt holes in secondary material not carrying calculated stress may be punched or drilled to finished size before assembly.

All holes shall be cylindrical and perpendicular to the principal surface. Holes shall not be drifted in such a manner as

to distort the metal. All chips lodged between contacting surfaces shall be removed before assembly.

End Post. End post shall be of galvanized steel. After fabrication the steel end post shall be hot-dip galvanized in accordance with AASHTO M111. The average thickness of coating (each side) shall be at least 5 mils (125  $\mu\text{m}$ ), but in no case less than 4 mils (100  $\mu\text{m}$ ) thickness at any location. Inspection of coating will be by magnetic thickness gauge measurements as specified in AASHTO M111 paragraph 9.3, except that the posts will be measured at the fifth points of the length at three locations around the circumference. The average thickness will be arrived at by the fifth points of the length at three locations around the circumference. The average thickness will be arrived at by the summation of all readings.

Truss Span. Truss span shall be galvanized steel. Galvanizing shall be as specified above for the end post. Galvanizing of each truss unit shall be by a single dip process. Magnetic thickness gauge measurements shall be made on each chord of each truss unit at approximately the third points of the chord length at three locations around the circumferences. Prior to shipping, the completed and accepted truss units shall be assembled in the shop and the truss span checked for dimensions, straightness, alignment and camber.

Welding. Welding shall be done in the shop before galvanizing. All welding and oxygen cutting work shall be in accordance with the ANSI/AASHTO/AWS D1.5-88 Bridge Welding Code; and shall be inspected at the Contractor's expense. The inspection results shall be submitted to the Engineer for review and approval.

Repair Galvanizing. Galvanized Surface which have been welded, abraded or damaged at any time after application of the coating shall be repaired by thoroughly wire brushing the damaged areas, removing all paint, loose and cracked coating, and treating the cleaned area with a galvanizing compound finish. However, the repair of galvanized items having one or more damaged areas larger than 1 square inch (650 square millimeters) will not be allowed.

All threading and dimensional requirements shall be in accordance with the "Fastener Standards"; published by the Industrial Fasteners Institute. All threads shall be UNC-2 and, where hot-dip galvanized, internal threads shall be oversized as specified in AASHTO M 291 to provide for proper assembly.

Erection. Material shall not be dropped, thrown or dragged over the ground. The Contractor shall supply detailed, written instructions and drawings for the erection of all sign structure components.

All signs and miscellaneous attachments shall be installed within the same 8-hour period that the trusses are erected.

Excavation and backfill shall conform to the applicable requirements of Section 207 including disposal of unsuitable and surplus material, placing and compacting of Borrow Type C of the Standard Specifications and as indicated on the Plans. Concrete, equipment, handling, measuring and batching, mixing, reinforcing steel, and construction requirements shall conform to Section 602 of the Standard Specifications. There shall be no separate payment for work done in accordance with the requirements of Section 207, and cost shall be included in this item. Payment for Borrow Type C shall be made under separate item of this Contract.

The Contractor shall obtain Engineer's approval of the field locations for the foundations before excavation is begun. Excavations for foundations shall be in accordance with the sub-section "Drilled Shaft Foundations".

End post shall not be erected upon the completed footing until authorized, but the minimum time allowed for the hardening of the concrete before any load is placed thereon shall be 7 calendar days.

Anchor bolts shall be set to template for alignment and elevation and shall be secured in position to prevent displacement while concrete is being placed. The steel reinforcement and conduit elbows shall have been placed and secured before the placing of concrete.

The top surface of the concrete pedestal or barrier shall be leveled off 3" (75 mm) below the elevation of the base of the vertical members of the structure, to provide room for the lower leveling nuts.

Post shall be erected in position to engage the anchor bolts on top of the concrete pedestal or barrier. The entire structure, including truss arm and sign panels, shall be erected and adjusted for plumbness, grades and alignment by manipulation of the leveling nuts on the anchor bolts.

After the cantilever sign structure has been erected and fully loaded including sign panels, the foundation anchorage nuts shall be retightened in accordance with the applicable requirements of Section 605 of the Standard Specifications.

Before final acceptance, all metal surfaces shall be cleaned free of oil, grease, soil or other discoloration. Cleaning shall be done with suitable solvents or by other approved means, and shall be to the satisfaction of the Engineer. If cleaning is necessary after erection over roadways in use, approved suitable means shall be provided for the protection of traffic during cleaning operation.

## **DRILLED SHAFT FOUNDATIONS:**

### **I. DESCRIPTION**

This work shall consist of all labor, materials, equipment, and services necessary to perform all operations to complete the installation of drilled shafts. The work shall be completed in accordance with the plans, Delaware Department of Transportation's *Specifications for Road and Bridge Construction* dated August 2001 (Standard Specifications), and this Special Provision. The work involves installing constant-diameter drilled shafts through Coastal Plain sediments and Piedmont Residuum. High water tables may be present.

### **II. Materials**

Materials shall meet the following requirements:

#### **A. Portland Cement Concrete**

Portland cement concrete shall be 4500 psi minimum (Class A) and shall meet the requirements specified in Section 602 and 812, in the Delaware Department of Transportation's *Specifications for Road and Bridge Construction* (August 2001). Where not otherwise specified, ACI 336.1-94 shall be followed. Water used in mixing concrete shall conform to Section 803 of the Standard Specifications.

Concrete shall remain workable and maintain a 4-inch slump for up to four hours after placing. If free fall methods are utilized for placement, the maximum coarse aggregate size shall be reduced to 3/8-inch. A slump value range of  $5 \pm 1$  inch shall be provided for all uncased holes and a slump range of  $6 \pm 1.5$  inch shall be provided for cased holes. A minimum slump of 6-inch with the addition of a retarder is required when a casing is being withdrawn. An acceptable water reducing and retarding admixture shall be added to the concrete to produce the specified slump. Under no circumstances shall the admixture cause segregation of the concrete. If any admixtures are added to the concrete at the site, the admixture must be added to the concrete by a qualified Contractor-furnished technician. Immediately after the addition of the admixture, the drum shall be turned a minimum of thirty revolutions, at mixing speed, until the concrete is thoroughly mixed. The technician shall then test the slump and consistency of the concrete mixture. Under no circumstances shall the Contractor add additional water to the concrete mixture to reach the desired slump.

#### **B. Reinforcing Steel**

Deformed reinforcing bars shall be in accordance with the sizes, spacing, dimensions, and details shown on the plans and shall conform to AASHTO M31, Grade 60, and the requirements of Section 603 and 604 of the Specifications.

#### **C. Casing**

Casing shall be metal, smooth, clean, watertight, and of ample strength to withstand both handling and driving stresses and the pressure of both concrete and the surrounding earth materials. Thickness of the casings shall not be less than 0.25-inch. The inside diameter of casing shall not be less than the specified size of the shaft. No extra compensation will be allowed for concrete required to fill an oversized casing or oversized excavation. All casings shall be removed from shaft excavations. Permanent steel casings shall not be used.

#### **D. Slurry**

Use of slurry shall not be permitted.

### **III. CONTRACTOR QUALIFICATIONS**

This work shall be performed under the supervision of the contractor's superintendent, who will be fully knowledgeable and experienced, as defined herein, in the construction of drilled shaft foundations of similar sized shafts and geotechnical conditions using both cased and slurry methods. Further, the Contractor and the Contractor's superintendent performing the work shall have at least five years previous experience within the last eight years constructing drilled shafts, with at least two years at the current firm. The Contractor's equipment shall have the capacity to undertake the work and shall be sufficient to complete the work within the specified contract time.

The Contractor shall provide documentation of his qualifications, experience record, prior project references, and the availability of the equipment needed to perform the required work. All prior project references shall be currently available personnel who can verify the quality of the contractor's previous work and shall include current name, address, and telephone number. This documentation shall reference the experience of the drilled shaft contractor and the drilled shaft contractor's superintendent in responsible charge of the drilled shaft operations. This documentation shall reference successful construction of similar sized shafts in the following conditions:

Experience in successfully installing drilled shafts of the size shown in the plans. The minimum experience shall consist of ten similar-sized projects in the past five years. Descriptions of projects must include a point of contact with the owner that is familiar with the project.

Experience in cleaning shaft bottoms when working under wet conditions.

#### **IV. EQUIPMENT**

The Contractor shall furnish all equipment and instrumentation necessary for installation of the shafts. The excavation and drilling equipment shall have adequate capacity including power, torque, and down thrust to excavate a hole of the maximum diameter shown on the plans and to a depth of 15-feet or 20 percent beyond the depths shown in the contract documents, whichever is greater.

The excavation and tools shall be of adequate design, size, and strength to perform the work shown in the contract documents or described herein. When the material encountered cannot be drilled using conventional earth augers with soil or rock teeth, drilling buckets, and/or overreaming tools, the Contractor shall provide special drilling equipment including but not limited to: rock core barrels, rock tools, air tools, blasting materials, and other equipment as necessary to construct the shaft excavation to the size and depth required. Approval of the Engineer is required before excavation by blasting is permitted.

Provide a descriptive listing of available equipment that is fully capable of cleaning shaft bottoms when shafts are excavated under wet conditions.

#### **V. SITE INFORMATION**

Test Boring Log sheets are included in the contract documents for use by the Contractor. Data on subsurface conditions is not intended as representations or warranties of continuity of such conditions. It is expressly understood that the Department will not be responsible for interpretations or conclusions drawn there from by the Contractor. The data is made available for the convenience of the Contractor. The Contractor may make additional test borings and other exploratory operations at no additional cost to the Department.

Three separate geotechnical data reports titled *Delaware Turnpike Improvements, Report No.1 Mainline Improvements*, dated September 26, 2005, *Delaware Turnpike Improvements, Report No. 2 SR1 Interchange*, dated September 26, 2005 and *Delaware Turnpike Improvements Report No.4 Northbound Widening* dated June 21, 2005 have also been prepared by RK&K for this project. These reports were prepared to establish design guidelines only and should not be considered part of the contract documents nor as a warranty of subsurface conditions. These reports may not be sufficient for use by specialty contractors. Contractors or prospective bidders may contact the Delaware Department of Transportation to review a copy of these reports.

#### **VI. SUBMITTALS**

The Contractor shall submit to the Engineer for review and approval, an installation plan for the construction of drilled shafts not less than thirty days before the start of work as detailed in this Special Provision. The submittal shall include the following:

- A. List of proposed equipment to be used including cranes, drills, augers, bailing buckets, final cleaning equipment, tremie or concrete pumps, casing, and other appurtenances.
- B. Details of overall construction operation sequence and the sequence of shaft construction in bents or groups, including scaled plan and profile showing the location, size and movements of equipment setup and operations. The completion of any required integrity and loading tests shall be noted in this construction operation sequence.
- C. Submit project experience and resumes in accordance with Section III.- Contractor Qualification.
- D. Details of shaft excavation and stabilization methods.
- E. Method of monitoring verticality of the shaft excavation during excavation and details of proposed corrective measures to be implemented as necessary.
- F. Very specific details of methods to clean the shaft excavation. Details shall include at least three alternative bottom cleaning methods with descriptions of equipment to be used when installing drilled shafts with wet methods. Include details of method for identifying type of bearing material for consistency with design assumptions prior to placement of concrete.
- G. Details of reinforcement placement including support and centralization methods.
- H. The concrete mix design, including admixtures to be used. Details of concrete placement, curing, and protection.
- I. A copy of the proposed report format for planned shaft inspections. Record information for each shaft and details of any required load or integrity tests.
- J. Other information shown on the plans or requested by the Engineer.

The Contractor will not be permitted to start construction of any drilled shaft, until the complete installation plan submittal as described above has been received, reviewed and written approval to begin construction has been issued by the Engineer. The Contractor will not be permitted to start the construction of drilled shafts for which working drawings are required until the Engineer has approved such drawings. Such approval will not relieve the Contractor of responsibility for results obtained by the use of these drawings or any of his other responsibilities under the contract. Submittals during construction shall include record information for each shaft and details of any required loading or integrity tests as required.

## **VII. CONSTRUCTION METHODS**

### **A. Protection of Existing Structures**

All reasonable precautions shall be taken to prevent damage to all existing structures, utilities, and the public. These measures shall include but are not limited to, selecting construction methods and procedures that will prevent excessive caving of the shaft excavation, monitoring, and controlling the vibrations from the driving of casing or sheeting, drilling of the shaft, or from blasting, if permitted. The Contractor shall verify that there are no subsurface utilities in close proximity of each shaft before beginning excavation activities.

### **B. Construction Sequence**

Where drilled shafts are to be installed in conjunction with embankment placement, they shall be constructed after the placement of the fill. Excavation of adjacent drilled shafts or other structures or utilities within a radius of three shaft diameters will not be permitted until concrete has been in place for at least 48 hours.

### **C. Methods of Construction**

Excavations required for shafts shall be performed through whatever materials are encountered, to the dimensions and elevations shown on the plans or otherwise required by the Standard Specifications and Special Provisions. The method

used shall be suitable for the intended purpose and materials encountered. The dry method or temporary casing method will be used as necessary to produce sound, durable concrete foundation shafts that are free of any defects. Wet method may only be used after the Engineers approval. The Engineer shall only permit blasting if specifically stated in the contract documents or authorized in writing. When a particular method of construction is required in the contract documents, that method shall be used. If no particular method is specified for use, the Contractor shall select and use the method, as determined by site conditions, subject to approval of the Engineer, which is needed to properly accomplish the work. All shafts shall extend and bear approximately one-half diameter into rock except those shafts noted on the plans that terminate and bear in decomposed rock. In the event competent bedrock is not encountered during the drilled shaft excavation, the shaft shall be extended to bear at lower level elevations as determined by the Engineer. The estimated lengths shown on the plans and in the geotechnical reports should be considered approximate. Additional shaft lengths might be required depending on actual subsurface conditions. Shorter shaft lengths than indicated on the plans or in the geotechnical reports may only be constructed with the written approval of the Engineer.

#### **1. Dry Construction Method**

The dry construction method shall be used only at sites where the ground-water table and site conditions are suitable to permit construction of the shaft in a relatively dry excavation (i.e., less than 3-inch of water accumulates above the final base elevation over a one-hour period when no pumping is permitted), and where the sides and bottom of the shaft are stable and may be visually inspected prior to placing the concrete.

The dry method consists of drilling the shaft excavation, removing accumulated water and loose material from the excavation, placing temporary casing, inspecting the bearing stratum, removing temporary casing, placing the reinforcing steel if required, and placing the shaft concrete in a relatively dry excavation. If caving occurs or if there is excess seepage into the drilled shaft, the drilling should be continued using a casing to maintain the integrity of the hole. Concrete shall be placed in accordance with Section VII.I.

#### **2. Wet Construction Method**

The wet construction method shall not be used.

#### **3. Temporary Casing Construction Method**

The temporary casing construction method shall be used at all sites where excessive caving or seepage could occur. When a nearly impervious formation is reached, a temporary casing shall be placed in the hole and sealed in the nearly impervious formation. As an alternative to use of the wet excavation method, temporary casing may be installed by drilling, driving, or vibratory procedures in advance of excavation to the lower limits of the caving material. Slurry may not be considered. Significant caving shall be considered to be more than 50% increased volume over theoretical shaft volume, for a section exceeding 10-feet of shaft. Casing shall be installed to the final base elevation to allow inspection of the bearing stratum.

After the reinforcing steel cage has been placed, fill the excavation with concrete. Before the casing is withdrawn and while the casing is being withdrawn, the level of fresh concrete in the casing shall be at such a level that all the fluid trapped behind the casing is displaced upward without contaminating the shaft concrete. Placement of the concrete and pulling of the temporary casing shall be conducted in accordance with Sections VII.I and VII.J.

#### **4. Alternative Construction Methods**

The Contractor may propose alternative methods to prevent caving and control ground water. Such proposals, accompanied by supporting technical data, shall be submitted in accordance with Section VI, Submittals. Written approval from the Engineer is required before the use of alternative construction methods.

### **D. Excavations**

The bottom elevation of drilled shafts shown on the plans may be adjusted during construction if the Engineer determines that the foundation material encountered during excavation is unsuitable or differs from that anticipated in the design of the drilled shaft. The Contractor shall take soil samples when shown on the plans or as directed by the Engineer to determine the character of the material directly below the shaft excavation. The Engineer will inspect the samples or

cores and determine the final depth of required shaft excavation.

The Contractor shall maintain a construction method log during shaft excavation. The log shall contain information such as the description and approximate top and bottom elevation of each soil or rock material, seepage or groundwater, and remarks.

Excavated materials, which are removed from the shaft excavation and any drilling fluids used, shall be disposed of off site in accordance with local environmental regulations and the contract documents or as directed by the Engineer.

#### **1. Unclassified Excavation**

Drilled shaft excavation is designated as unclassified; the Contractor shall provide the necessary equipment to remove and dispose of any materials encountered in forming the drilled shaft excavation to the dimensions shown on the plans or as directed by the Engineer. No separate payment will be made for excavation of materials of different densities and character.

The Contractor shall provide tools such as augers fitted with either soil or rock teeth, and drilling buckets attached to drilling equipment of the size, power, torque, and down thrust approved for use by the Engineer. Material normally classified as decomposed rock, weathered, rock, disintegrated rock, or rock shall be considered as unclassified excavation. The Contractor shall provide appropriate tools such as, but not limited to, equipment listed in Section IV of these provisions in order to install the drilled shafts to their design depths.

#### **E. Obstructions**

The Contractor shall remove surface and subsurface obstructions at drilled shaft locations. Such obstructions may include man-made materials, such as old concrete foundations, and natural materials, such as boulders. Boulders are defined as stones with a least dimension greater than 1-foot. Special tools and/or procedures shall be employed by the Contractor after the hole cannot be advanced more than 1-foot in thirty minutes using approved equipment operating at maximum power, torque, and down thrust, using conventional augers fitted with soil or rock teeth, drilling buckets, and/or under-reaming tools. Such special procedures/tools may include but are not limited to: chisels, boulder breakers, core barrels, air tools, hand excavation, temporary casing, and increasing hole diameter. Blasting shall not be permitted unless specifically approved in writing by the Engineer.

#### **F. Lost Tools**

Drilling tools that are lost in the excavation shall not be considered obstructions and shall be promptly removed by the Contractor without compensation. All costs due to lost tool removal shall be borne by the Contractor including but not limited to costs associated with hole degradation due to removal operations or the time the hole remains open.

#### **G. Excavation Inspection**

The Contractor shall provide details of shaft construction to the Engineer for review. The Contractor shall provide equipment for checking the dimensions and alignment of each shaft excavation. The Contractor shall determine the shaft dimensions and alignment under the observation and/or direction of the Engineer. Final shaft depth shall be measured after final cleaning. Shaft cleanliness and the bearing surface condition will be evaluated and approved by the Engineer. The Contractor shall provide safe access and egress to the Engineer for inspection of the bottom of the excavation prior to placement of reinforcing steel and concrete. After the Contractor has prepared the bottom of the shaft excavation, the Contractor shall notify the Engineer. The Contractor shall coordinate schedules for excavation inspection by the Engineer.

The Contractor shall not permit any worker to enter the shaft excavation for any reason unless: both a suitable casing has been installed and the water level has been lowered and stabilized below the level to be occupied, and adequate safety equipment and procedures have been provided to workers entering the excavation. The Contractor shall follow OSHA guidelines for confined space entry. Prior to placement of reinforcing steel and concrete, the Contractor shall ensure that loose material from the bottom and sides of excavation have been removed and that shaft is within the specified tolerances. Specified tolerances are listed in Section VII.K of this Special Provision. The shaft excavation shall be cleaned to remove all accumulated sediment and water. The Contractor shall be responsible for correcting drilled shafts that are not constructed within the specified tolerances. Remedial measures, including engineering analysis and

redesign, to correct for out-of-tolerance drilled shaft foundations, shall be performed at no additional cost to the Department.

#### **H. Reinforcing Steel Cage Construction and Placement**

The reinforcing steel cage consisting of the steel shown on the plans plus cage stiffener bars, spacers, centralizers, and other necessary appurtenances shall be completely assembled and placed as a unit immediately after the shaft excavation is inspected and accepted and prior to shaft concrete placement. Prior to installation of the steel cage in the shaft excavation, inspect and clean the reinforcing steel of materials that prevent effective bonding. Clear spacing between bars of the rebar cage shall be at least five times the size of the maximum coarse aggregate. Hooks at the top of the rebar cage shall not be bent outward if temporary casing will be used. Similarly, interior hooks must be designed to permit adequate clearance for a concrete tremie pipe (i.e., 12-inch minimum), if concrete is to be tremied into place. Where clearance is a problem, hooks may be placed on dowels that may be rotated after concrete placement or casing removal and repositioned after the tremie is removed. The concrete must remain fluid during dowel repositioning. Shafts that require a large amount of reinforcing steel shall use bundled longitudinal bars to maintain the minimum clear spacing requirement. The assembled rebar cage outside diameter shall be at least 6-inches smaller than the drilled hole diameter, which corresponds to at least 3-inches of concrete cover over the rebar on all sides.

The reinforcing steel in the shaft shall be tied and supported so that the reinforcing steel will remain within allowable tolerances until the concrete will support the reinforcing steel. When concrete is placed by tremie methods, temporary hold-down devices shall be used to prevent uplifting of the steel cage during concrete placement. Concrete spacers or other approved noncorrosive spacing devices shall be used at sufficient intervals not exceeding 5-feet along the shaft excavation. At least three spacers shall be evenly distributed around the circumference of the reinforcing steel at each elevation where used.

#### **I. Concrete Placement, Curing, and Protection**

All concrete placement, consolidation and curing activities shall conform to the recommendations of Section 602 and 812, of the Standard Specifications, except as otherwise specified herein.

Concrete shall be placed as soon as possible after reinforcing steel cage placement. Concrete placement shall be continuous in the shaft to the top elevation of the shaft. Placement shall continue after the shaft is full until good quality concrete is evident at the top of the shaft.

Concrete to be placed in dry shafts less than 100-feet in length may be placed by allowing the concrete to free fall into the excavation. This is subject to performance satisfactory to the Engineer during construction. Limit the segregation of the concrete by placing the concrete through the use of a centering tube, sectionalized pipe or other means to direct the free fall of the concrete so that it does not strike the sides or reinforcement of the shaft. If water has infiltrated the base of the excavation, it shall be removed prior to placement of the concrete. No more than 1-inch of standing water shall be allowed in the base of an excavation at the time of concrete placement to prevent segregation of the concrete. The Engineer shall have the final decision as to the allowable amount of water in the base of the excavation. The Engineer may require the Contractor to have a small sump pit in the base of the excavation to allow removal of any accumulated water.

Concrete to be placed in water shall be placed through a tremie or concrete pump. The tremie shall be supported so as to permit free movement or permit rapid lowering when necessary to retard or stop the flow of concrete. The discharge end shall be sealed closed at the start of work so as to prevent water or slurry from entering the tube before the tube is filled with concrete. After placement has started the tremie tube shall be kept full of concrete to the bottom of the hopper. If water enters the tube after placement is started, the tremie shall be withdrawn, the discharge end resealed, and the placement restarted. The flow of concrete shall be continuous until the work is completed. The discharge end of the tremie shall always be located a minimum of 5-feet below the level of the already placed concrete. As concrete is placed in the excavation, the slurry shall be collected and properly disposed of as approved by the Engineer.

Tremie pipes shall be a minimum of 10-inch diameter. Tremie pipes shall not have aluminum parts that will react with concrete. Pump hoses shall be a minimum of 4-inch diameter. All tremie pipe or pump hoses and connections shall be watertight.

The concrete placing rate shall be not less than 30 cubic yards of concrete per each one-hour period. The concrete mix

shall be of such design that the concrete remains in workable plastic state throughout the placement of the concrete for the entire drilled shaft.

All concrete, except for that placed under water, shall be vibrated to a depth of 5-feet below the ground surface except where soft uncased soil remaining in the excavation will possibly mix with the concrete. After placement, any exposed surfaces of the shaft concrete shall be protected to allow proper curing.

For at least forty-eight hours after shaft concrete has been placed, no construction operations that will cause soil movement adjacent to the shaft, other than mild vibration, shall be conducted.

#### **J. Casings and Forms**

When the shaft extends above ground or through a body of water, the portion of the shaft exposed above ground or through a body of water may be formed with removable concrete forms except when a permanent form is specified. Removable forms shall be stripped from the shaft in a manner that will not damage the concrete. Forms can be removed when the concrete has attained sufficient strength provided: curing of the concrete is continued for the full seventy-two-hour period in accordance with the specifications and the concrete has reached 75-percent of its design compressive strength as determined from concrete cylinder breaks.

Temporary casings shall be removed while the concrete remains workable. The removal of temporary casing shall not be allowed until the level of the concrete placed in the shaft is great enough to withstand the pressure exerted by the surrounding soil, water or drilling fluid. After concreting begins, removal of the casing should begin within one hour, before the concrete begins to set. Telescoping casing may be used but the bottom end of the temporary casing shall be located a minimum of 5-ft below the level of already placed concrete. If the concrete begins to set prior to removal of the casing, the removal of the casing should cease, and the casing should be cut off at its current elevation and remain in the ground permanently. No payment shall be given for any casing not retrieved.

Movement of the casing by rotating, exerting downward pressure and tapping to facilitate extraction or extraction with a vibratory hammer will not be permitted. Casing extraction shall be at a slow, uniform rate with the pull in line with the shaft axis. Do not damage or displace reinforcing cage when withdrawing casing.

#### **K. Construction Tolerances**

The following construction tolerances shall be maintained in constructing drilled shafts.

1. The center of the drilled shaft shall be within 3-inches of the plan position in the horizontal plane at the plan elevation for the top of the shaft.
2. The vertical alignment of the shaft excavation shall not vary from the plan alignment by more than 0.25-inch per foot.
3. After all the shaft concrete is placed; the top of the reinforcing steel cage shall be no more than 6-inches above and no more than 3-inches below plan position.
4. When casing is used, the inside diameter of the casing shall not be less than the shaft diameter shown on the plans. When casing is not used, the minimum diameter of the drilled shaft shall not be more than 1-inch less than the diameter shown on the plans.
5. The top elevation of the shaft shall be within 1-inch of the plan top of shaft elevation.
6. The bottom of the shaft excavation shall be normal to the axis of the shaft within 1-inch per foot of shaft diameter.
7. The reinforcing steel shall be placed so that the outer edges of the reinforcing cage are located uniformly a minimum of 3-inches inside the perimeter of the design shaft size.

Drilled shaft excavations constructed in such a manner that the concrete shaft cannot be completed within the required tolerances are unacceptable. Correction methods shall be submitted by the Contractor for the Engineer's approval.

Approval will be obtained before continuing with the drilled shaft construction. Materials, engineering and work necessary to effect correction for out-of-tolerance drilled shaft excavations shall be furnished at no cost to the Department.

#### **L. Record Information**

The Contractor shall provide the following minimum record information. For each drilled shaft foundation installed, record on drilled shaft installation logs the location, alignment, dimensions, elevation of the top and bottom, depth of the bearing stratum penetration, description of the materials encountered at all elevations, elevation of the water table during excavation, condition of the bottom of the excavation, slurry test data, concrete data, verticality and deviation of shaft or reinforcing steel from the plan location, and other data called for on the report form or pertinent to the drilled shaft. Record the theoretical volume of excavation, volume of concrete placed versus depth, and total volume of concrete placed. Report observed irregularities to the Engineer within eight hours of discovery.

Minimum Record Information shall be in accordance with FHWA Publication No. IF-99-025 "Drilled Shafts" or Association of Drilled Shaft Contractors' "Drilled Shaft Inspector's Manual" (1989). A copy of the inspection report planned for use shall be submitted to the Engineer for approval. Submit draft record information for each completed shaft to the Engineer within twenty-four hours of completion. Submit final record drawings of each drilled shaft installed no more than three weeks after completion of the work. Submit records on a weekly basis, or more frequently if variation occurs.

#### **M. Site Operations**

The Contractor shall conduct his operations in a neat and orderly manner. Equipment and materials shall not be placed or stored beyond limits approved by the Engineer and shall promptly be removed when no longer needed. All materials, water, slurry, and auger cuttings shall be confined to the specified work area so as not to migrate from the specified work area.

#### **N. Construction Adjacent to Freshly Drilled Shafts**

No construction activity, including drilling, within a radius of three shaft diameters of a freshly drilled shaft shall take place until the concrete shaft has cured for at least twenty-four hours and the Engineer has provided written approval.

#### **Method of Measurement:**

The quantity of cantilever sign supports and foundations will not be measured, but will be paid for at the contract lump sum price bid for "Cantilever-Sign Supports and Foundations."

#### **Basis of Payment:**

The payment for the item "Cantilever Sign Supports and Foundations" as called for by the contract shall be made at the contract price(s) bid per Lump Sum complete in place and accepted, which price and payment will constitute full compensation for furnishing all materials, fabricating and erecting the structure(s) at designated location(s), including clearing and reinforcing bars, construction of foundations, backfilling and compaction, grading, sodding if required to restore the site to existing condition, for all labor, equipment, tools, and all incidentals necessary to complete the work. Payment for Borrow Type C shall be made under separate item of this Contract. If obstruction removal/excavation is encountered, including rock excavation, payment shall be made at a fixed price of \$150.00 per cubic yard for a quantity up to and including 15 cubic yards. For quantity exceeding 15 cubic yards, the unit price shall be negotiated with the Contractor.

#### **NOTE**

Since more than one structure is required, the Contractor shall submit a cost breakdown of his Lump Sum price bid for this item showing the dollar value amount for each cantilever-sign support structure with foundation, the sum of which to equal the lump sum price bid.

The Department reserves the right to delete from the contract, construction of one or more individual sign structure(s), and the lump sum price to be paid will be reduced in accordance with the Contractor's itemized bid price

list for that individual sign structure. There shall be no extra compensation to the Contractor if such deletion is made.

4/6/11

- 605510 - PREFABRICATED EXPANSION JOINT SYSTEM 2"**
- 605511 - PREFABRICATED EXPANSION JOINT SYSTEM 3"**
- 605512 - PREFABRICATED EXPANSION JOINT SYSTEM 4"**
- 605513 - PREFABRICATED EXPANSION JOINT SYSTEM 5"**
- 605647 - PREFABRICATED EXPANSION JOINT SYSTEM 1 1/2"**

**Description:**

This work consists of furnishing of all materials and necessary labor to fabricate, assemble, construct and install prefabricated strip seal expansion joint systems of the size(s) specified on the Plans, including extrusions, neoprene strip seal, angles, studs, and sliding plates on roadway and/or sidewalks as specified on the Plans, in accordance with these Specifications.

**Materials:**

Steel members of the types, size and configurations shown on the plans shall conform to AASHTO M 270/M 270M Grade 36 (Grade 250) or Grade 50 (Grade 345) or Grade 50W (Grade 345W), unless specified otherwise on the Plans. All steel of the joint system shall be painted with the 3 coat urethane paint system with a minimum total thickness of 9 mils (225 µm), and all screws shall be stainless steel ASTM A276, Type 304.

The elastomeric material shall be 100% virgin Polychloroprene (Neoprene). The strip seal shall be an extruded neoprene material meeting the requirements of AASHTO M 220 modified to omit the recovery test. The elastomeric material shall have the following physical properties as determined by applicable ASTM tests:

<u>ASTM Standard</u>	<u>Physical Properties</u>	<u>Performance Requirements</u>
D2240 (Modified) D412	Hardness Tensile Strength	60±7 points, Durometer (Type A) 2000 psi (13.8 MPa), min. 250%, min.
D395 (Method B)	Ultimate Elongation Compressive Set 70 hr. @ 212°F (100°C).	40%, max.
D573	Compressive Set 212°F (100°C)	40%, max.
D1630 D1149	Abrasion Resistance Oxone Resistance 20 percent strain 300 pphm in air, 70h @ 140°F (60°C) (wiped) with toluene to remove surface contamination)	Index of 200 or greater Permissible          No cracks
D471	Oil Swell, ASTM Oil #3, 70 h @ 212°F (100°C), Weight change	45%, max.
D2240	Low Temperature Stiffening max. 7 days @ 14°F (-10°C)	+15 points Durometer (Type A)

**Construction Methods:**

Installation of the prefabricated expansion joint system, to include strip seal, steel extrusion and application of adhesives, shall be in accordance with the manufacturer's written recommendations and instructions and as specified herein. Special tools for insertion of seals shall be provided by the manufacturer as may be required. The Contractor shall make arrangements for a technical representative of the manufacturer to be available for advice and inspection during construction of strip seals to ensure satisfactory installation. The strip seal shall be furnished in one piece for the full length of the joint.

Welding shall conform to all applicable requirements of AWS D1.5, including qualifications of welders. Shop drawings and welding procedures must be submitted to the Bridge Engineer for approval prior to any fabrication. Welds at mitered joints in steel extrusions and between steel extrusions and plates and between studs and plates shall be tested by magnetic particle tests methods by a testing laboratory approved by the State. All welds, fabrication and testing will be visually inspected by the Department or its approved representative. The Contractor shall submit the manufacturer's certification for quality of materials and the result of welding inspection to the Engineer. Mill test reports must be supplied for all steel. Where, in the opinion of the Engineer, welds are defective, they shall be rewelded or repaired in a manner acceptable to the Engineer.

The installation procedure as described here, shall be adhered to unless modified by the Engineer.

The prefabricated sealing system shall be shop assembled as a unit including the neoprene strip seal, and preset prior to shipment, using prestressing bolts and adjustable temporary connections between positioning steel members. The opening of the joint shall be set at the width required for the seal at a temperature of 68°F (20°C).

The prefabricated joint assembly shall be positioned and attached to the structure by anchorages. Width adjustments shall be made at the discretion of the Engineer and manufacturer's representative. All movements due to shrinkage, creep, mid-slab deflections, and other factors shall be considered.

The prefabricated joint shall be set normal to the grade and the deck concrete slab graded to meet flush with the edge of the joint plates.

Before placing the deck slab, the anchorage attached to the abutment backwall, or adjacent steel or concrete stringers shall be released by loosening the bolts in the slotted anchorage connections. The prestressing bolts and adjustable temporary connections shall remain in place. After the deck slab has cured the width of joint shall be checked and again adjusted if necessary. The released anchorage shall be tightened, welded and the prestressing bolts and temporary connections removed. The backwall or deck on this side of the joint may then be poured after sealing the openings left by removal of prestressing bolts.

**Method of Measurement:**

The quantity of the specified size(s) prefabricated expansion joint system will be measured as the actual number of the linear feet (linear meters) furnished and installed, measured along the centerlines of the slab joints.

**Basis of Payment:**

The quantity of prefabricated expansion joint system will be paid for at the Contract price per linear foot (linear meter). Price and payment will constitute full compensation for fabricating, furnishing, and installing all materials, labor, equipment and all else necessary therefor and incidental thereto.

Payment for erection angles and other components not specifically part of the prefabricated strip seal joint system shall be included in Prefabricated Expansion Joint System.

10/29/01

**605523 - BOX TRUSS TYPE OVERHEAD SIGN SUPPORTS AND FOUNDATIONS****Description:**

This work consists of furnishing all material and fabricating and erecting box truss type overhead sign support structure(s) and concrete foundations, in accordance with these specifications, details and notes on the Plans and as directed by the Engineer.

The various materials and construction operations not specifically indicated on the Plans and in the specifications shall be in accordance with the latest revised AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals.

**General:**

The main support and truss members of the sign support structure shall be fabricated from tubular steel whose shapes could be circular, square or rectangular as applicable to the Contract, wall thicknesses and lengths shall conform with the requirements and details shown on the Contract Plans, or as shown on approved alternate design drawings.

Alternate designs utilizing structural shapes for the main support and truss members, which form a structure of sufficient strength as required by AASHTO standard and Plans will also be considered for approval when submitted in accordance with the provisions of these specifications. All submissions for approval including material specifications and alternate designs must be signed by a registered Professional Engineer registered in the State of Delaware.

The Contractor is informed that consideration will be given to aesthetics for all of the sign supports including, but not limited to, the general appearance, methods of fabrication and assembly, material selection, arrangement, end finishes of the proposed structural shapes, the welding, and the surface finishes as required. The span type structure carrying Variable Message Signs shall be 4-chord structure.

If the bidder elects to furnish sign supports alternate to those shown in the Contract Plans, the alternate design shall meet the requirements of the approved drawings and any other requirements specified on the Plans and these specifications.

If the bidder elects to furnish sign supports alternate to those shown in the Contract Plans, it is a requirement that as an end result, the alternate will satisfy the requirements of the proposal.

Sign panels, electrification and luminaries are not included under this item.

The contractor shall stake each sign structure location for approval by the engineer. Upon approval, submit working drawings. Show the highest elevation of the traveled roadway and shoulder at each structure location. Upon approval of the working drawings, materials may be ordered.

**Materials:****Structural**

Main Poles, End Braces and Arm Chords:

Minimum Yield Stress = 52,000 psi (55,000 psi for tapered sections]

Structural Shapes, plates, and bars:

Under ¼" - ASTM-A575 Grade 1020

¼" to 1" - AASHTO M 270 Grade 36.

Over 1" - AASHTO M 270 Grade 50.

Web Members: ASTM-A501

Steel Castings: AASHTO M 103 Grade 65 - 35

Pole Tops: ASTM-B26, Aluminum Alloy S5A or  
ASTM-A126, Class-A Cast Iron

**Fasteners**

Clamps: ASTM-A606 Type 4  
 Anchor Bolts: AASHTO M314 Grade 55  
 Anchor Nuts: AASHTO M 291 Grade DH (Grade 2H)  
 Connection Bolts: AASHTO M 164  
 Nuts: AASHTO M291 Grade DH  
 Other Bolts and Nuts: ASTM-A307 Grade A  
 U-Bolts: ASTM-A307

**Finish**

Structural: Galvanized finish AASHTO M 111  
 Fasteners: Galvanized finish AASHTO M 232

Concrete: Portland Cement Concrete shall be 4500 psi minimum and shall conform to the material requirements of Class A, Section 812, Portland Cement Concrete of the Standard Specifications.

Bar Reinforcements: Bar reinforcements shall be epoxy coated and meet the requirements of AASHTO M31, Grade 60 and conform to Subsection 603.02 of the Standard Specifications.

**Construction Methods:**

Shop Drawings. Shop drawings shall be submitted in accordance with Subsection 105.04 of the Standard Specifications. Minor variations in details may be permitted; however, any major departure from the design will not be accepted.

The Contractor may at his/her option elect to prepare alternate design plans and specifications for the overhead sign support structures in place of the Plan construction. Detail plans, design computations, and specifications for the proposed structures shall be submitted to the Engineer for approval; and no work shall begin until the alternate design plans have been reviewed and approved, in principle, by the Engineer.

The requirements for the preparation of shop drawings for an approved alternate design (or designs), shall be similar to those specified for the Plan construction.

Fabrication. Loading, transporting, unloading and erection of structural materials shall be done so that the metal will be kept clean and free from injury in handling.

Structural materials shall be stored above the ground upon platforms, skids, or other supports and shall be kept free from accumulation of dirt, oil, acids or other foreign matter.

Structural material which has been deformed shall be straightened before begin laid out, punched, drilled or otherwise worked upon in the shop. Sharp kinks or bends will be cause for rejection.

When sign support structures are subcontracted, the subcontract shall be in accordance with Subsection 108.01 of the Standard Specifications except that the value of the subcontract will be based on the value of the work for fabrication.

Cutting, Punching, Drilling and Finishing. Material 1/2<sup>2</sup> (12 mm) thick or less may be sheared, sawed or cut with a router. Material more than 1/2<sup>2</sup> (12 mm) thick shall be sawed or routed.

Cut edges shall be true and smooth and free from excessive burrs or ragged breaks.

Edges of plates carrying calculated stresses shall be planed to a depth of 1/4<sup>2</sup> (6 mm) except in the case of sawed or routed edges of a quality equivalent to a planed edge.

Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

Structural material shall not be heated except to facilitate bending; then the structural material may be heated to a temperature not exceeding 400BOL176f"Symbol"\s10F (204°C) for a period not exceeding 30 minutes. Such heating shall be done only when temperature and time requirements are observed.

Bolt holes in main members shall be subpunched or subdrilled and reamed to finished size after the parts are firmly bolted together. The amount by which the diameter of subpunched holes is less than that of the finished hole shall be at least 1/4 the thickness of the piece and in no case less than 1/32<sup>2</sup> (0.8 mm). If the metal thickness is greater than the diameter of the hole, punching shall not be used.

Bolt holes in secondary material not carrying calculated stress may be punched or drilled to finished size before assembly.

All holes shall be cylindrical and perpendicular to the principal surface. Holes shall not be drifted in such a manner as to distort the metal. All chips lodged between contacting surfaces shall be removed before assembly.

End Post Assemblies. End post assemblies shall be of galvanized steel. After fabrication the steel end post assemblies shall be hot-dip galvanized in accordance with AASHTO M111. The average thickness of coating (each side) shall be at least 5 mils (125 μm), but in no case less than 4 mils (100 μm) thickness at any location. Inspection of coating will be by magnetic thickness gauge measurements as specified in AASHTO M111 paragraph 9.3, except that 25 percent of the horizontal and diagonal struts will be measured, and the posts will be measured at the fifth points of the length at three locations around the circumference. The average thickness will be arrived at by the fifth points of the length at three locations around the circumference. The average thickness will be arrived at by the summation of all readings.

Truss Spans. Truss spans shall be galvanized steel. Galvanizing shall be as specified above for end post assemblies. Galvanizing of each truss unit shall be by a single dip process. Magnetic thickness gauge measurements shall be made on each chord of each truss unit at approximately the third points of the chord length at three locations around the circumferences. Prior to shipping, the completed and accepted truss units shall be assembled in the shop and the truss span checked for dimensions, straightness, alignment and camber.

Welding. Welding shall be done in the shop before galvanizing. All welding work shall be done in accordance with the requirements of ANSI/AASHTO/AWS D1.5-88, and shall be inspected at Contractor's expense. The inspection results shall be submitted to the Engineer for approval.

Repair Galvanizing. Galvanized areas damaged during shipping or erection shall be repaired by any of the three methods specified under ASTM A780. In all cases, the repair shall achieve the minimum coating thickness specified.

Erection. Material shall not be dropped, thrown or dragged over the ground. The Contractor shall supply detailed, written instructions and drawings for the erection of all sign structure components.

All signs and miscellaneous attachments shall be installed within the same 8-hour period that the trusses are erected.

Excavation and backfill shall conform to the applicable requirements of Section 207 including disposal of unsuitable and surplus material, placing and compacting of Borrow Type C of the Standard Specifications and as indicated on the Plans. Concrete, equipment, handling, measuring and batching, mixing, reinforcing steel, and construction requirements shall conform to Section 602 of the Standard Specifications. Cost for work done in accordance with Section 207 shall be included in this item 605523; however, payment for Borrow Type C shall be made under separate item of this Contract.

The Contractor shall obtain Engineer's approval of the field locations of the foundations before excavation is begun. Excavations for foundations shall be in accordance with the sub-section "Drilled Shaft Foundations".

End posts shall not be erected upon the completed footing until authorized, but the minimum time allowed for the hardening of the concrete before any load is placed thereon shall be 7 calendar days.

Anchor bolts shall be set to template for alignment and elevation and shall be secured in position to prevent displacement while concrete is being placed. The steel reinforcement and conduit elbows shall have been placed and secured before the placing of concrete.

The top surface of the concrete pedestal or barrier shall be leveled off 3/8" (75 mm) below the elevation of the base of the vertical members of the structure, to provide room for the lower leveling nuts.

Posts shall be erected in position to engage the anchor bolts on top of the concrete pedestal or barrier. The entire structure, including truss arms and sign panels, shall be erected and adjusted for plumbness, grades and alignment by manipulation of the leveling nuts on the anchor bolts.

## **DRILLED SHAFT FOUNDATIONS:**

### **I. DESCRIPTION**

This work shall consist of all labor, materials, equipment, and services necessary to perform all operations to complete the installation of drilled shafts. The work shall be completed in accordance with the plans, Delaware Department of Transportation's Specifications for Road and Bridge Construction dated August 2001 (Standard Specifications), and this Special Provision. The work involves installing constant-diameter drilled shafts through Coastal Plain sediments and Piedmont Residuum. High water tables may be present.

### **II. Materials**

Materials shall meet the following requirements:

#### **A. Portland Cement Concrete**

Portland cement concrete shall be 4500 psi minimum (Class A) and shall meet the requirements specified in Section 602 and 812, in the Delaware Department of Transportation's Specifications for Road and Bridge Construction (August 2001). Where not otherwise specified, ACI 336.1-94 shall be followed. Water used in mixing concrete shall conform to Section 803 of the Standard Specifications.

Concrete shall remain workable and maintain a 4-inch slump for up to four hours after placing. If free fall methods are utilized for placement, the maximum coarse aggregate size shall be reduced to 3/8-inch. A slump value range of 5 ±1-inch shall be provided for all uncased holes and a slump range of 6 ±1.5-inch shall be provided for cased holes. A minimum slump of 6-inch with the addition of a retarder is required when a casing is being withdrawn. An acceptable water reducing and retarding admixture shall be added to the concrete to produce the specified slump. Under no circumstances shall the admixture cause segregation of the concrete. If any admixtures are added to the concrete at the site, the admixture must be added to the concrete by a qualified Contractor-furnished technician. Immediately after the addition of the admixture, the drum shall be turned a minimum of thirty revolutions, at mixing speed, until the concrete is thoroughly mixed. The technician shall then test the slump and consistency of the concrete mixture. Under no circumstances shall the Contractor add additional water to the concrete mixture to reach the desired slump.

#### **B. Reinforcing Steel**

Deformed reinforcing bars shall be in accordance with the sizes, spacing, dimensions, and details shown on the plans and shall conform to AASHTO M31, Grade 60, and the requirements of Section 603 and 604 of the Specifications.

#### **C. Casing**

Casing shall be metal, smooth, clean, watertight, and of ample strength to withstand both handling and driving stresses and the pressure of both concrete and the surrounding earth materials. Thickness of the casings shall not be less than 0.25-inch. The inside diameter of casing shall not be less than the specified size of the shaft. No extra compensation will be allowed for concrete required to fill an oversized casing or oversized excavation. All casings shall be removed from shaft excavations. Permanent steel casings shall not be used.

**D. Slurry**

Use of slurry shall not be permitted.

**III. CONTRACTOR QUALIFICATIONS**

This work shall be performed under the supervision of the contractor's superintendent, who will be fully knowledgeable and experienced, as defined herein, in the construction of drilled shaft foundations of similar sized shafts and geotechnical conditions using both cased and slurry methods. Further, the Contractor and the Contractor's superintendent performing the work shall have at least five years previous experience within the last eight years constructing drilled shafts, with at least two years at the current firm. The Contractor's equipment shall have the capacity to undertake the work and shall be sufficient to complete the work within the specified contract time.

The Contractor shall provide documentation of his qualifications, experience record, prior project references, and the availability of the equipment needed to perform the required work. All prior project references shall be currently available personnel who can verify the quality of the contractor's previous work and shall include current name, address, and telephone number. This documentation shall reference the experience of the drilled shaft contractor and the drilled shaft contractor's superintendent in responsible charge of the drilled shaft operations. This documentation shall reference successful construction of similar sized shafts in the following conditions:

- a) Experience in successfully installing drilled shafts of the size shown in the plans. The minimum experience shall consist of ten similar-sized projects in the past five years. Descriptions of projects must include a point of contact with the owner that is familiar with the project.
- b) Experience in cleaning shaft bottoms when working under wet conditions.

**IV. EQUIPMENT**

The Contractor shall furnish all equipment and instrumentation necessary for installation of the shafts.

The excavation and drilling equipment shall have adequate capacity including power, torque, and down thrust to excavate a hole of the maximum diameter shown on the plans and to a depth of 15-feet or 20 percent beyond the depths shown in the contract documents, whichever is greater.

The excavation and tools shall be of adequate design, size, and strength to perform the work shown in the contract documents or described herein. When the material encountered cannot be drilled using conventional earth augers with soil or rock teeth, drilling buckets, and/or over-reaming tools, the Contractor shall provide special drilling equipment including but not limited to: rock core barrels, rock tools, air tools, blasting materials, and other equipment as necessary to construct the shaft excavation to the size and depth required. Approval of the Engineer is required before excavation by blasting is permitted.

Provide a descriptive listing of available equipment that is fully capable of cleaning shaft bottoms when shafts are excavated under wet conditions.

**V. SITE INFORMATION**

Test Boring Log sheets are included in the contract documents for use by the Contractor. Data on subsurface conditions is not intended as representations or warranties of continuity of such conditions. It is expressly understood that the Department will not be responsible for interpretations or conclusions drawn there from by the Contractor. The data is made available for the convenience of the Contractor. The Contractor may make additional test borings and other exploratory operations at no additional cost to the Department.

Three separate geotechnical data reports titled Delaware Turnpike Improvements, Report No.1 Mainline Improvements, dated September 26, 2005, Delaware Turnpike Improvements, Report No. 2 SR1 Interchange, dated September 26, 2005 and Delaware Turnpike Improvements Report No.4 Northbound Widening dated June 21, 2005 have also been prepared by RK&K for this project. These reports were prepared to establish design guidelines only and should not be considered

part of the contract documents nor as a warranty of subsurface conditions. These reports may not be sufficient for use by specialty contractors. Contractors or prospective bidders may contact the Delaware Department of Transportation to review a copy of these reports.

## **VI. SUBMITTALS**

The Contractor shall submit to the Engineer for review and approval, an installation plan for the construction of drilled shafts not less than thirty days before the start of work as detailed in this Special Provision. The submittal shall include the following:

- A. List of proposed equipment to be used including cranes, drills, augers, bailing buckets, final cleaning equipment, tremie or concrete pumps, casing, and other appurtenances.
- B. Details of overall construction operation sequence and the sequence of shaft construction in bents or groups, including scaled plan and profile showing the location, size and movements of equipment setup and operations. The completion of any required integrity and loading tests shall be noted in this construction operation sequence.
- C. Submit project experience and resumes in accordance with Section III.- Contractor Qualification.
- D. Details of shaft excavation and stabilization methods.
- E. Method of monitoring verticality of the shaft excavation during excavation and details of proposed corrective measures to be implemented as necessary.
- F. Very specific details of methods to clean the shaft excavation. Details shall include at least three alternative bottom cleaning methods with descriptions of equipment to be used when installing drilled shafts with wet methods. Include details of method for identifying type of bearing material for consistency with design assumptions prior to placement of concrete.
- G. Details of reinforcement placement including support and centralization methods.
- H. The concrete mix design, including admixtures to be used. Details of concrete placement, curing, and protection.
- I. A copy of the proposed report format for planned shaft inspections. Record information for each shaft and details of any required load or integrity tests.
- J. Other information shown on the plans or requested by the Engineer.

The Contractor will not be permitted to start construction of any drilled shaft, until the complete installation plan submittal as described above has been received, reviewed and written approval to begin construction has been issued by the Engineer.

The Contractor will not be permitted to start the construction of drilled shafts for which working drawings are required until the Engineer has approved such drawings. Such approval will not relieve the Contractor of responsibility for results obtained by the use of these drawings or any of his other responsibilities under the contract.

Submittals during construction shall include record information for each shaft and details of any required loading or integrity tests as required.

## **VII. CONSTRUCTION METHODS**

### **A. Protection of Existing Structures**

All reasonable precautions shall be taken to prevent damage to all existing structures, utilities, and the public. These measures shall include but are not limited to, selecting construction methods and procedures that will prevent excessive

caving of the shaft excavation, monitoring, and controlling the vibrations from the driving of casing or sheeting, drilling of the shaft, or from blasting, if permitted. The Contractor shall verify that there are no subsurface utilities in close proximity of each shaft before beginning excavation activities.

## **B. Construction Sequence**

Where drilled shafts are to be installed in conjunction with embankment placement, they shall be constructed after the placement of the fill.

Excavation of adjacent drilled shafts or other structures or utilities within a radius of three shaft diameters will not be permitted until concrete has been in place for at least 48 hours.

## **C. Methods of Construction**

Excavations required for shafts shall be performed through whatever materials are encountered, to the dimensions and elevations shown on the plans or otherwise required by the Standard Specifications and Special Provisions. The method used shall be suitable for the intended purpose and materials encountered. The dry method or temporary casing method will be used as necessary to produce sound, durable concrete foundation shafts that are free of any defects. Wet method may only be used after the Engineers approval. The Engineer shall only permit blasting if specifically stated in the contract documents or authorized in writing. When a particular method of construction is required in the contract documents, that method shall be used. If no particular method is specified for use, the Contractor shall select and use the method, as determined by site conditions, subject to approval of the Engineer, which is needed to properly accomplish the work.

All shafts shall extend and bear approximately one-half diameter into rock except those shafts noted on the plans that terminate and bear in decomposed rock. In the event competent bedrock is not encountered during the drilled shaft excavation, the shaft shall be extended to bear at lower level elevations as determined by the Engineer. The estimated lengths shown on the plans and in the geotechnical reports should be considered approximate. Additional shaft lengths might be required depending on actual subsurface conditions. Shorter shaft lengths than indicated on the plans or in the geotechnical reports may only be constructed with the written approval of the Engineer.

### **1. Dry Construction Method**

The dry construction method shall be used only at sites where the ground-water table and site conditions are suitable to permit construction of the shaft in a relatively dry excavation (i.e., less than 3-inch of water accumulates above the final base elevation over a one-hour period when no pumping is permitted), and where the sides and bottom of the shaft are stable and may be visually inspected prior to placing the concrete.

The dry method consists of drilling the shaft excavation, removing accumulated water and loose material from the excavation, placing temporary casing, inspecting the bearing stratum, removing temporary casing, placing the reinforcing steel if required, and placing the shaft concrete in a relatively dry excavation. If caving occurs or if there is excess seepage into the drilled shaft, the drilling should be continued using a casing to maintain the integrity of the hole. Concrete shall be placed in accordance with Section VII.I.

### **2. Wet Construction Method**

The wet construction method shall not be used.

### **3. Temporary Casing Construction Method**

The temporary casing construction method shall be used at all sites where excessive caving or seepage could occur. When a nearly impervious formation is reached, a temporary casing shall be placed in the hole and sealed in the nearly impervious formation. As an alternative to use of the wet excavation method, temporary casing may be installed by drilling, driving, or vibratory procedures in advance of excavation to the lower limits of the caving material. Slurry may not be considered. Significant caving shall be considered to be more than 50% increased volume over theoretical shaft volume, for a section exceeding 10-feet of shaft. Casing shall be installed to the final base elevation to allow inspection of the bearing stratum.

After the reinforcing steel cage has been placed, fill the excavation with concrete. Before the casing is withdrawn and while the casing is being withdrawn, the level of fresh concrete in the casing shall be at such a level that all the fluid trapped behind the casing is displaced upward without contaminating the shaft concrete. Placement of the concrete and pulling of the temporary casing shall be conducted in accordance with Sections VII.I and VII.J.

#### **4. Alternative Construction Methods**

The Contractor may propose alternative methods to prevent caving and control ground water. Such proposals, accompanied by supporting technical data, shall be submitted in accordance with Section VI, Submittals. Written approval from the Engineer is required before the use of alternative construction methods.

#### **D. Excavations**

The bottom elevation of drilled shafts shown on the plans may be adjusted during construction if the Engineer determines that the foundation material encountered during excavation is unsuitable or differs from that anticipated in the design of the drilled shaft. The Contractor shall take soil samples when shown on the plans or as directed by the Engineer to determine the character of the material directly below the shaft excavation. The Engineer will inspect the samples or cores and determine the final depth of required shaft excavation.

The Contractor shall maintain a construction method log during shaft excavation. The log shall contain information such as the description and approximate top and bottom elevation of each soil or rock material, seepage or groundwater, and remarks.

Excavated materials, which are removed from the shaft excavation and any drilling fluids used, shall be disposed of off site in accordance with local environmental regulations and the contract documents or as directed by the Engineer.

##### **1. Unclassified Excavation**

Drilled shaft excavation is designated as unclassified; the Contractor shall provide the necessary equipment to remove and dispose of any materials encountered in forming the drilled shaft excavation to the dimensions shown on the plans or as directed by the Engineer. No separate payment will be made for excavation of materials of different densities and character.

The Contractor shall provide tools such as augers fitted with either soil or rock teeth, and drilling buckets attached to drilling equipment of the size, power, torque, and down thrust approved for use by the Engineer. Material normally classified as decomposed rock, weathered, rock, disintegrated rock, or rock shall be considered as unclassified excavation. The Contractor shall provide appropriate tools such as, but not limited to, equipment listed in Section IV of these provisions in order to install the drilled shafts to their design depths.

#### **E. Obstructions**

The Contractor shall remove surface and subsurface obstructions at drilled shaft locations. Such obstructions may include man-made materials, such as old concrete foundations, and natural materials, such as boulders. Boulders are defined as stones with a least dimension greater than 1-foot. Special tools and/or procedures shall be employed by the Contractor after the hole cannot be advanced more than 1-foot in thirty minutes using approved equipment operating at maximum power, torque, and down thrust, using conventional augers fitted with soil or rock teeth, drilling buckets, and/or under-reaming tools. Such special procedures/tools may include but are not limited to: chisels, boulder breakers, core barrels, air tools, hand excavation, temporary casing, and increasing hole diameter. Blasting shall not be permitted unless specifically approved in writing by the Engineer.

#### **F. Lost Tools**

Drilling tools that are lost in the excavation shall not be considered obstructions and shall be promptly removed by the Contractor without compensation. All costs due to lost tool removal shall be borne by the Contractor including but not limited to costs associated with hole degradation due to removal operations or the time the hole remains open.

**G. Excavation Inspection**

The Contractor shall provide details of shaft construction to the Engineer for review. The Contractor shall provide equipment for checking the dimensions and alignment of each shaft excavation. The Contractor shall determine the shaft dimensions and alignment under the observation and/or direction of the Engineer. Final shaft depth shall be measured after final cleaning.

Shaft cleanliness and the bearing surface condition will be evaluated and approved by the Engineer. The Contractor shall provide safe access and egress to the Engineer for inspection of the bottom of the excavation prior to placement of reinforcing steel and concrete. After the Contractor has prepared the bottom of the shaft excavation, the Contractor shall notify the Engineer. The Contractor shall coordinate schedules for excavation inspection by the Engineer.

The Contractor shall not permit any worker to enter the shaft excavation for any reason unless: both a suitable casing has been installed and the water level has been lowered and stabilized below the level to be occupied, and adequate safety equipment and procedures have been provided to workers entering the excavation. The Contractor shall follow OSHA guidelines for confined space entry.

Prior to placement of reinforcing steel and concrete, the Contractor shall ensure that loose material from the bottom and sides of excavation have been removed and that shaft is within the specified tolerances. Specified tolerances are listed in Section VII.K of this Special Provision. The shaft excavation shall be cleaned to remove all accumulated sediment and water.

The Contractor shall be responsible for correcting drilled shafts that are not constructed within the specified tolerances. Remedial measures, including engineering analysis and redesign, to correct for out-of-tolerance drilled shaft foundations, shall be performed at no additional cost to the Department.

**H. Reinforcing Steel Cage Construction and Placement**

The reinforcing steel cage consisting of the steel shown on the plans plus cage stiffener bars, spacers, centralizers, and other necessary appurtenances shall be completely assembled and placed as a unit immediately after the shaft excavation is inspected and accepted and prior to shaft concrete placement. Prior to installation of the steel cage in the shaft excavation, inspect and clean the reinforcing steel of materials that prevent effective bonding. Clear spacing between bars of the rebar cage shall be at least five times the size of the maximum coarse aggregate. Hooks at the top of the rebar cage shall not be bent outward if temporary casing will be used. Similarly, interior hooks must be designed to permit adequate clearance for a concrete tremie pipe (i.e., 12-inch minimum), if concrete is to be tremied into place. Where clearance is a problem, hooks may be placed on dowels that may be rotated after concrete placement or casing removal and repositioned after the tremie is removed. The concrete must remain fluid during dowel repositioning. Shafts that require a large amount of reinforcing steel shall use bundled longitudinal bars to maintain the minimum clear spacing requirement. The assembled rebar cage outside diameter shall be at least 6-inches smaller than the drilled hole diameter, which corresponds to at least 3-inches of concrete cover over the rebar on all sides.

The reinforcing steel in the shaft shall be tied and supported so that the reinforcing steel will remain within allowable tolerances until the concrete will support the reinforcing steel. When concrete is placed by tremie methods, temporary hold-down devices shall be used to prevent uplifting of the steel cage during concrete placement. Concrete spacers or other approved noncorrosive spacing devices shall be used at sufficient intervals not exceeding 5-feet along the shaft excavation. At least three spacers shall be evenly distributed around the circumference of the reinforcing steel at each elevation where used.

**I. Concrete Placement, Curing, and Protection**

All concrete placement, consolidation and curing activities shall conform to the recommendations of Section 602 and 812, of the Standard Specifications, except as otherwise specified herein.

Concrete shall be placed as soon as possible after reinforcing steel cage placement. Concrete placement shall be continuous in the shaft to the top elevation of the shaft. Placement shall continue after the shaft is full until good quality

concrete is evident at the top of the shaft.

Concrete to be placed in dry shafts less than 100-feet in length may be placed by allowing the concrete to free fall into the excavation. This is subject to performance satisfactory to the Engineer during construction. Limit the segregation of the concrete by placing the concrete through the use of a centering tube, sectionalized pipe or other means to direct the free fall of the concrete so that it does not strike the sides or reinforcement of the shaft. If water has infiltrated the base of the excavation, it shall be removed prior to placement of the concrete. No more than 1-inch of standing water shall be allowed in the base of an excavation at the time of concrete placement to prevent segregation of the concrete. The Engineer shall have the final decision as to the allowable amount of water in the base of the excavation. The Engineer may require the Contractor to have a small sump pit in the base of the excavation to allow removal of any accumulated water.

Concrete to be placed in water shall be placed through a tremie or concrete pump. The tremie shall be supported so as to permit free movement or permit rapid lowering when necessary to retard or stop the flow of concrete. The discharge end shall be sealed closed at the start of work so as to prevent water or slurry from entering the tube before the tube is filled with concrete. After placement has started the tremie tube shall be kept full of concrete to the bottom of the hopper. If water enters the tube after placement is started, the tremie shall be withdrawn, the discharge end resealed, and the placement restarted. The flow of concrete shall be continuous until the work is completed. The discharge end of the tremie shall always be located a minimum of 5-feet below the level of the already placed concrete. As concrete is placed in the excavation, the slurry shall be collected and properly disposed of as approved by the Engineer.

Tremie pipes shall be a minimum of 10-inch diameter. Tremie pipes shall not have aluminum parts that will react with concrete. Pump hoses shall be a minimum of 4-inch diameter. All tremie pipe or pump hoses and connections shall be watertight.

The concrete placing rate shall be not less than 30 cubic yards of concrete per each one-hour period. The concrete mix shall be of such design that the concrete remains in workable plastic state throughout the placement of the concrete for the entire drilled shaft.

All concrete, except for that placed under water, shall be vibrated to a depth of 5-feet below the ground surface except where soft uncased soil remaining in the excavation will possibly mix with the concrete. After placement, any exposed surfaces of the shaft concrete shall be protected to allow proper curing.

For at least forty-eight hours after shaft concrete has been placed, no construction operations that will cause soil movement adjacent to the shaft, other than mild vibration, shall be conducted.

## **J. Casings and Forms**

When the shaft extends above ground or through a body of water, the portion of the shaft exposed above ground or through a body of water may be formed with removable concrete forms except when a permanent form is specified. Removable forms shall be stripped from the shaft in a manner that will not damage the concrete. Forms can be removed when the concrete has attained sufficient strength provided: curing of the concrete is continued for the full seventy-two-hour period in accordance with the specifications and the concrete has reached 75-percent of its design compressive strength as determined from concrete cylinder breaks.

Temporary casings shall be removed while the concrete remains workable. The removal of temporary casing shall not be allowed until the level of the concrete placed in the shaft is great enough to withstand the pressure exerted by the surrounding soil, water or drilling fluid. After concreting begins, removal of the casing should begin within one hour, before the concrete begins to set. Telescoping casing may be used but the bottom end of the temporary casing shall be located a minimum of 5-ft below the level of already placed concrete. If the concrete begins to set prior to removal of the casing, the removal of the casing should cease, and the casing should be cut off at its current elevation and remain in the ground permanently. No payment shall be given for any casing not retrieved.

Movement of the casing by rotating, exerting downward pressure and tapping to facilitate extraction or extraction with a vibratory hammer will not be permitted. Casing extraction shall be at a slow, uniform rate with the pull in line with the shaft axis. Do not damage or displace reinforcing cage when withdrawing casing.

**K. Construction Tolerances**

The following construction tolerances shall be maintained in constructing drilled shafts.

1. The center of the drilled shaft shall be within 3-inches of the plan position in the horizontal plane at the plan elevation for the top of the shaft.
2. The vertical alignment of the shaft excavation shall not vary from the plan alignment by more than 0.25-inch per foot.
3. After all the shaft concrete is placed; the top of the reinforcing steel cage shall be no more than 6-inches above and no more than 3-inches below plan position.
4. When casing is used, the inside diameter of the casing shall not be less than the shaft diameter shown on the plans. When casing is not used, the minimum diameter of the drilled shaft shall not be more than 1-inch less than the diameter shown on the plans.
5. The top elevation of the shaft shall be within 1-inch of the plan top of shaft elevation.
6. The bottom of the shaft excavation shall be normal to the axis of the shaft within 1-inch per foot of shaft diameter.
7. The reinforcing steel shall be placed so that the outer edges of the reinforcing cage are located uniformly a minimum of 3-inches inside the perimeter of the design shaft size.

Drilled shaft excavations constructed in such a manner that the concrete shaft cannot be completed within the required tolerances are unacceptable. Correction methods shall be submitted by the Contractor for the Engineer's approval. Approval will be obtained before continuing with the drilled shaft construction. Materials, engineering and work necessary to effect correction for out-of-tolerance drilled shaft excavations shall be furnished at no cost to the Department.

**L. Record Information**

The Contractor shall provide the following minimum record Information. For each drilled shaft foundation installed, record on drilled shaft installation logs the location, alignment, dimensions, elevation of the top and bottom, depth of the bearing stratum penetration, description of the materials encountered at all elevations, elevation of the water table during excavation, condition of the bottom of the excavation, slurry test data, concrete data, verticality and deviation of shaft or reinforcing steel from the plan location, and other data called for on the report form or pertinent to the drilled shaft. Record the theoretical volume of excavation, volume of concrete placed versus depth, and total volume of concrete placed. Report observed irregularities to the Engineer within eight hours of discovery.

Minimum Record Information shall be in accordance with FHWA Publication No. IF-99-025 "Drilled Shafts" or Association of Drilled Shaft Contractors' "Drilled Shaft Inspector's Manual" (1989). A copy of the inspection report planned for use shall be submitted to the Engineer for approval. Submit draft record information for each completed shaft to the Engineer within twenty-four hours of completion. Submit final record drawings of each drilled shaft installed no more than three weeks after completion of the work. Submit records on a weekly basis, or more frequently if variation occurs.

**M. Site Operations**

The Contractor shall conduct his operations in a neat and orderly manner. Equipment and materials shall not be placed or stored beyond limits approved by the Engineer and shall promptly be removed when no longer needed. All materials, water, slurry, and auger cuttings shall be confined to the specified work area so as not to migrate from the specified work area.

**N. Construction Adjacent to Freshly Drilled Shafts**

No construction activity, including drilling, within a radius of three shaft diameters of a freshly drilled shaft shall take place until the concrete shaft has cured for at least twenty-four hours and the Engineer has provided written approval.

**Method of Measurement:**

The quantity of box truss type overhead sign supports and foundations will not be measured, but will be paid for at the contract lump sum price bid for "Box Truss Type Overhead Sign Supports and Foundations."

**Basis of Payment:**

The payment for the item "Box Truss Type Overhead Sign Supports and Foundations" as called for by the contract shall be made at the contract price(s) bid per Lump Sum complete in place and accepted, which price and payment will constitute full compensation for furnishing and fabricating and placing all materials, clearing and grubbing the areas, normal excavation in accordance with Section 207, concrete and reinforcing bars, construction of foundations, backfilling and compaction, grading, sodding if required to restore the site to its original condition or as required by the Plan, and for all labor, equipment, tools and incidentals necessary to complete the work. Payment for Borrow Type C shall be made under separate item of this Contract. If obstruction removal/excavation is encountered, including rock excavation, payment shall be made at a fixed price of \$150.00 per cubic yard for a quantity up to and including 15 cubic yards. For quantity exceeding 15 cubic yards (meters), the unit price shall be negotiated with the Contractor.

**NOTE**

Since more than one structure is required, the Contractor shall submit a cost breakdown of his Lump Sum price bid for this item showing the dollar value amount for each box truss type overhead sign support structure with foundation, the sum of which to equal the lump sum price bid.

The Department reserves the right to delete from the Contract, construction of one or more individual sign structure(s), and the lump sum price to be paid will be reduced in accordance with the Contractor's itemized bid price list for that individual sign structure. There shall be no extra compensation to the Contractor if such deletion is made.

4/6/11

**605537 - URETHANE PAINT SYSTEM, NEW STEEL****Description:**

The item shall consist of shop cleaning, and shop application of the coating system on new structural steel and fasteners with the provision for field application of the topcoat at the option of the Contractor. Included is the cleaning and repair of surfaces damaged in shipping, handling and erecting the structural steel in accordance with this Specification and as directed by the Engineer.

The coating system shall consist of a coat of inorganic zinc-rich primer, a coat of high-build epoxy, and a urethane topcoat. Terminology used herein is in accordance with the definitions used in Volume 2, Systems and Specifications of the SSPC Steel Structures Painting Manual (1982 Edition).

**Materials:**

The Contractor shall select a complete coating system from one manufacturer. This selected coating system must be submitted to the Department's Materials and Research Section for approval prior to coating.

Individual coats shall consist of an inorganic zinc-rich primer meeting the requirements of AASHTO M300 Type I or II; an epoxy-polyamide intermediate coat meeting the requirements of SSPC - Paint 22 (pigmented to contrast with both the primer and topcoat); and an aliphatic urethane topcoat meeting the requirements of SSPC - PS Guide 17.00 Type II.

The topcoat color of the structural steel shall be the color number 10076 (brown) of Federal Standard Number 595 A dated January 2, 1968, unless otherwise indicated on the Plans. The Contractor shall supply the Engineer with the product data sheets before any painting is done. The product data sheets shall indicate the mixing and thinning directions, the recommended spray nozzles and pressures and all other coating related information.

**Construction Methods:**

**Provisions for Inspection** - During fabrication and shop coating, scaffolding shall be furnished and erected, meeting the approval of the Engineer to permit inspection of the steel prior to and after coating.

Rubber rollers, or other protective devices meeting the approval of the Engineer shall be used on scaffold fastenings. Metal rollers or clamps and other types of fastenings which will mar or damage freshly coated surfaces shall not be used.

**Preparation for Shop Coating** - All areas shall be blast cleaned to a near-white finish as defined in SSPC-SP10 for which reference should be made to SSPC Visual Standards. Areas of oil and grease on surfaces to be coated shall be cleaned with clean petroleum solvents prior to blast cleaning. Prior to blast cleaning a beam, the top of the bottom flange shall be scraped to remove any accumulated dirt.

All fins, tears, slivers and burred or sharp edges that are present on any steel member, or that appear during the blasting operations, shall be removed by grinding and the area reblasted to give a 1 to 2.5 mil surface profile. Scaling hammers may be used to remove heavy scale, but heavier type chipping hammers which would excessively scar the metal shall not be used.

The abrasive used for blast cleaning shall be in accordance with Delaware Standard Specifications Subsection 605.45, and shall have a gradation such that the abrasive will produce a uniform profile of 1 to 2.5 mils, as measured with Testex Replica Tape.

All abrasive and paint residue shall be removed from steel surfaces with a good commercial grade vacuum cleaner equipped with a brush-type cleaning tool, or by double blowing. If the double blowing method is used, the exposed top surfaces of all structural steel, including flanges, longitudinal stiffeners, splice plates, hangers, etc., shall be vacuumed after the double blowing operations are completed. The air line used for blowing the steel clean shall have an in-line water trap and the air shall be free of oil and water as it leaves the air line. The steel shall then be kept dust free, and primed within 8 hours after blast cleaning.

Care shall be taken to protect freshly coated surfaces from subsequent blast cleaning operations. Blast damaged primed surfaces shall be thoroughly wire brushed or, if visible rust occurs, reblasted to a near-white condition. The wire brushed or blast cleaned surfaces shall be vacuumed and reprimed.

All areas where field welding is required, shall be masked prior to applying the primer. Areas where shear stud connectors will be welded to the top flange shall be masked after the primer coat has been applied, but before the epoxy coat is applied.

**Mixing the Paint** - The paint shall be mixed with a high shear mixer such as Jiffy Mixer, in accordance with the manufacturer's directions, to a smooth, lump-free consistency. Paddle mixers or paint shakers are not allowed. Mixing shall be done thoroughly, in the original containers, and shall be continued until all the metallic powder or pigment are in suspension.

Care shall be taken to ensure that all of the paint solids that may have settled to the bottom of the container are thoroughly dispersed. The paint shall then be strained through a screen having openings no larger than those specified for a No. 50 sieve in ASTM E 11. After straining, the mixed paint shall be kept under continuous agitation up to and during the time of application.

**Thinning the Paint** - In general the paints are supplied for normal use without thinning. If it is necessary to thin the paint for proper application in cool weather, or to obtain better coverage of the urethane topcoat, the thinning shall be done in accordance with the manufacturer's recommendations and shall be subject to the Department's approval.

**Conditions for Painting** - Paint shall be applied only when the following conditions have been met:

- A. Temperature - The temperature of the air and the steel shall be above 50 degrees F. for paint other than the topcoat. This 50 degrees F. minimum temperature shall be maintained throughout the minimum time between coats as listed in the Qualified Products List. For the urethane topcoat, the temperature of the air and steel shall be above 40 degrees F. Coatings shall not be applied if the temperature is high enough to cause blistering. The surface temperature of the steel shall be at least 5 degrees F. higher than the dew point.
- B. Humidity - The paint shall not be applied when the relative humidity is greater than 90 percent, nor when a combination of temperature and humidity conditions are such that moisture condenses on the surface being painted.

**Applying the Paint** - After the surface to be coated has been cleaned and approved by the Engineer, the primer shall be applied so as to produce a uniform even coating bonded with the metal. Succeeding coats shall be applied when approved by the Engineer. The minimum curing time between coats shall be according to the manufacturer's specifications. Depending on site conditions, additional time may be required for proper curing before applying succeeding coats. Cure time for proper application of succeeding coats shall not be less than the minimum nor exceed the maximum as recommended by the paint manufacturer. The Contractor shall provide the Engineer written documentation of manufacturer recommended cure times and any pre-treatments of existing coats prior to application of succeeding coats. It is the applicator's responsibility to determine the condition of each coat prior to application of succeeding coats. Any oxidation products, chalking, salts, residue or other surface condition that form on existing paint surfaces and interfere with proper adhesion shall be completely removed in accordance with manufacturer recommendations or as directed by the Engineer. Removal shall be accomplished through water blasting, solvent wiping, brush-off blasting or other means as necessary to properly prepare the surface for coating.

The coatings shall be applied with the spray nozzles and pressures recommended by the producer of the coating system, so as to attain the film thicknesses specified. All surfaces, including faying (contact) surfaces, and flange tops, shall be shop primed by spray in accordance with SSPC-PA1, Shop, Field and Maintenance Painting. The intermediate coat shall also be applied in the shop in accordance with SSPC-PA1. The topcoat shall be shop applied or field applied after steel erection at the Contractor's option. Faying surfaces and surfaces to be in contact with Portland cement concrete shall not receive the intermediate and topcoats.

Flange tops shall receive a fog coat of between 0.50 and 0.75 mils of inorganic zinc primer. The dry

film thickness of the primer coat on the bolted friction splices on the main members shall not be less than 1 mil or greater than 2.5 mils. The faying surfaces of bolted field splices, bolted shop splices, or any other bolted faying surfaces, shall be masked during subsequent coating operations. In the areas of field bolted connections (including the outside surface of splice plates), the outside surfaces shall be primed a minimum of 4 mils. On all other areas, the minimum dry film thickness for the primer coat shall also be 4 mils, for the epoxy coat it shall be 3.5 mils, and for the urethane protective coat it shall be sufficient to provide a uniform color and appearance but in no case shall be less than 1.0 mil.

The dry film thickness will be determined by the use of a magnetic dry film thickness gage. The gage shall be calibrated on the blasted steel with plastic shims approximately the same thickness as the minimum dry film thickness. A Tooke film thickness gage may be used to verify the coating thickness when requested by the Engineer. If the Tooke gage shows the primer coat to be less than the specified minimum thickness, the total coating system will be rejected even if the total dry film thickness exceeds the total of the minimum for each coat of the 3-coat system.

All bolted shop connections and shop bolted cross frames or diaphragms shall be removed and disassembled prior to the blasting and coating of the girders or beams. The parts shall be blasted separately, primed, then reassembled and the bolts fully tightened in accordance with the applicable specifications.

All galvanized components in bolted shop connections, including mechanically galvanized nuts, bolts, and washers, shall be solvent cleaned, given a tie coat, if recommended by the paint manufacturer, and then coated with both the epoxy coat and the urethane protective coat.

If the application of the coating at the required thickness in one coat produces runs, bubbles, or sags, the coating shall be removed and reapplied in multiple passes of the spray gun, the passes separated by several minutes. Where excessive coating thickness produces "mud-cracking", such coating shall be scraped back to soundly bonded coating and the area recoated to the required thickness.

In areas of deficient primer thickness, the areas shall be thoroughly cleaned with power washing equipment, as necessary, to remove all dirt; the areas shall then be wire brushed, vacuumed, and recoated.

All coating shall be done in a neat and workmanlike manner as described in SSPC-PA1, producing a uniform, even coating which is bonded to the underlying surface.

Erection marks, for the field identification of members, and weight marks shall be transferred or preserved.

All metal coated with impure, unsatisfactory, or unauthorized coating material, or coated in an unworkmanlike or objectionable manner, shall be thoroughly cleaned and recoated or otherwise corrected as directed by the Engineer.

All dry spray shall be removed, by sanding if necessary, prior to the application of the succeeding coat.

Material shall not be loaded for shipment until the shop coating has been adequately cured and inspected. The components will be stamped "Recommended for Use" only after the loading has been completed and approved.

**Stenciling Requirement** - At the completion of the painting work, the completion date (month and year) and the bridge number, shall be stenciled on the structure in 3 inch numbers. The paint used for this marking shall be the same as the topcoat except the color shall be black. The numbers shall be stenciled on the outside of each fascia beam at the approaching traffic end of the structure, on a location designated by the Engineer.

**Handling Steel** - Extreme care shall be exercised in handling the steel in the shop, during shipping, during erection, and during subsequent construction of the bridge. The steel shall be insulated from the binding chains by softeners approved by the Engineer. Hooks and slings used to hoist steel shall be padded. Diaphragms and similar pieces shall be spaced in such a way that no rubbing will occur during shipment that may damage the coatings. The steel shall be stored on pallets at the job site, or by other means approved by the Engineer, so that it does not rest on the dirt or so that components do not fall or rest on each other. All shipping and job site storage details shall be presented to the Engineer at the "Post-Award Painting

Conference" and they must be approved prior to shipping the steel.

**Field Repair and Field Coating** - The Contractor shall furnish and erect scaffolding meeting the approval of the Engineer and shall provide a time mutually agreed upon for inspecting the structural steel prior to and after coating.

Rubber rollers, or other protective devices meeting the approval of the Engineer, shall be used on scaffold fastenings. Metal rollers or clamps and other types of fastenings which will mar or damage freshly coated surfaces shall not be used.

All field repairs shall be made in strict accordance with the coating supplier's recommendations and shall be approved by the Engineer. All coatings applied to repair areas shall be applied using recommended spray equipment only. The coating supplier's recommendations are to be supplied to the field personnel by the fabricator of the steel. Such field repairs shall include the application of the following coating system; e.g. on rusted areas: the zinc-rich primer, the epoxy intermediate coat, and the urethane protective coat; on non-rusted areas (where the primer is at least equal to the minimum required dry film thickness): the epoxy intermediate coat and the urethane protective coat; and on galvanized components: the tie coat, the epoxy intermediate coat, and the urethane protective coat.

Surfaces which will be inaccessible for coating after erection shall be repaired and/or recoated prior to erection.

When the erection work has been completed, including all connections and the straightening of any bent metal, the steel shall be prepared for repairs. All adhering scale, dirt, grease, form oil, or other foreign matter shall be removed by appropriate means and any rusted or uncoated areas blast cleaned to a near-white finish in accordance with SSPC-SP 10. All abrasive and paint residue shall be removed from steel surfaces by vacuuming or by double blowing, except that if the double blowing method is used, the top surfaces of all structural steel, including top and bottom flange, splice plates, hangers, etc., shall be vacuumed after the double blowing operations are completed. The coating surrounding the blasted area shall be thoroughly wire brushed, vacuumed, and the area recoated with the same coating system used in the shop. When spraying a blasted area or an area of insufficient primer thickness, the surrounding area will be coated with primer. Prior to the application of the intermediate coat, the area around the area where the primer has been repaired shall be adequately rubbed to remove the primer from the surrounding epoxy or urethane. The requirements specified herein for provisions for inspection, mixing the coating, thinning the coating, temperature, and humidity requirements for coating, and applying the coatings, shall govern application of the topcoat and application of the coating to the repaired areas. The requirements for the dry film thickness of the topcoat and the repair coats are the same as for the shop coats. Proper curing conditions will be required prior to application of the topcoat and between applications of the repair coats as previously specified herein.

Mechanically galvanized nuts, bolts, and washers shall be coated in accordance with the recommendations of the manufacturer of the coating system. This procedure shall include the removal of any lubricant or residuals on the surface and the application of a tie coat prior to application of the field coats. This tie coat shall be brushed or sprayed as specified by the manufacturer. The epoxy and urethane shall then be applied to the bolts and the surrounding connection surfaces.

Any temporary attachments or supports for scaffolding or forms shall not damage the coating system. (In particular, on the fascias where bracing is used, sufficient size support pads must be used.) Any damage that occurs from such devices shall be repaired by the same procedure as for a field repair.

If the stenciling which was applied at the completion of the shop coating is marred or damaged, the marking shall be repaired as directed by the Engineer. The paint used for this marking repair shall be the same as the urethane protective coat used in the field repairs except the color shall be black.

**Protection of the Work** - Pedestrian, vehicular and other traffic upon or underneath the structure shall be protected as provided under Section 107 of the Delaware Standard Specifications. All portions of the structures (superstructure, substructure, slope protection and highway appurtenances) shall be protected against splatter, overspray splashes, and smirches of coating or coating material by means of protective covering suitable for the purpose. The Contractor shall be responsible for any damage caused by his operations to vehicles, persons or property.

Whenever the intended purposes of the protective devices are not being accomplished, work shall be suspended until corrections are made.

**Summary** - The Special Provision supersedes Subsection 605.43 through 605.48 of the Standard Specifications, with the exception of the "Post-Award Painting Conference" which is described in Subsection 605.47, and the protection of machine finished surfaces described in Subsection 605.46.

All structural steel painting will be performed in the shop, except the final coat (topcoat) may be applied in the field after erection. There will be no separate payment for any additional costs of any kind associated with field painting.

The painting shall consist of, but not be limited to, the following:

- Internal surfaces of connections shall receive 1 to 2.5 mils of inorganic zinc-rich primer.
- The top of top flange shall receive 0.5 to 0.75 mils of inorganic zinc-rich primer.
- All other surfaces shall receive a minimum of 4 mils of inorganic zinc-rich primer followed by a minimum of 3.5 mils of epoxy coat and a minimum of 1.0 mil of urethane.

**Basis of Payment:**

The work performed under this item "Urethane Paint System, New Steel" shall not be measured for payment but the cost associated shall be included in the Lump Sum bid price for items 605001 or 605002 "Steel Structures", as required by the contract, which price and payment shall constitute full compensation for furnishing all materials for painting, shop preparation and painting, field preparation and painting, stenciling, field repair, scaffolding, labor, equipment, tools, and all necessary incidentals to complete the work.

3/1/11

**605581 - ELASTOMERIC BEARING PADS**

**Description:**

The item shall consist of installing new elastomeric bearings in accordance with the locations, notes on the plans and as directed by the Engineer.

**Materials:**

The bearing pads shall conform to the requirements of elastomeric bearing pads as described under Section 605 of the Standard Specifications and AASHTO Standard Specifications for Highway Bridges, Section 18, Division II.

**Construction Methods:**

The bearing pad shall be installed in accordance with the requirements of Section 605 and AASHTO Standard Specifications for Highway Bridges, Section 18, Division II.

**Basis of Payment:**

The payment for the bearing pad shall be made for at the contract unit price bid per Each for "Elastomeric Bridge Bearing Pads", which price and payment shall constitute full compensation for furnishing and installing all material, for all labor, tools, equipment and necessary incidentals to complete the work.

8/20/10

**605657 - STRIP SEAL EXPANSION JOINT 1 1/2"**  
**605658 - STRIP SEAL EXPANSION JOINT 2"**  
**605659 - STRIP SEAL EXPANSION JOINT 3"**  
**605660 - STRIP SEAL EXPANSION JOINT 4"**  
**605661 - STRIP SEAL EXPANSION JOINT 5"**

**Description:**

This work consists of furnishing of all materials and necessary labor to remove existing strip seals, clean the joints, and install prefabricated neoprene strip seals of the sizes specified on the Plans in existing expansion joint systems on roadway and installing a new strip seal and strip seal assembly at locations specified on the Plans and in accordance with these specifications.

**Materials:**

The elastomeric material shall be 100% virgin Polychloroprene (Neoprene). The strip seal shall be an extruded neoprene material meeting the requirements of ASTM D 2628 modified to omit the recovery test. The elastomeric material shall have the following physical properties as determined by applicable ASTM tests:

<b><u>ASTM STANDARD</u></b>	<b><u>PHYSICAL PROPERTIES</u></b>	<b><u>PERFORMANCE REQUIREMENTS</u></b>
D2240 (Modified)	Hardness	60±7 points, Durometer (Type A)
D412	Tensile Strength Ultimate Elongation	2000 psi (14 MPa), min. 250%, min.
D395 (method B)	Compressive Set 70 hr. @ 212°F (100° C).	40%, max.
D573	Compressive Set 212°F (100° C).	40%, max.
D1630	Abrasion Resistance	Index of 200 or greater Permissible
D1149	Oxone Resistance 20% strain 300 pphm in air, 70h @ 140°F (60° C). (wiped) with toluene to remove surface contamination)	No cracks
D471	Oil Swell, ASTM Oil #3, 70 h @ 212°F (100° C)., Weight change	45%, max.
D2240	Low Temperature Stiffening max. 7	+15 points Durometer (Type A)
D2240 (Modified)	Hardness 7 days @ 14°F (-10° C).	60±7 points, Durometer (Type A)

**Construction Methods:**

Installation of the prefabricated strip seal, and application of adhesives, shall be in accordance with the manufacturer's written recommendations and instructions and as specified herein. Special tools for insertion of seals shall be provided by the manufacturer as may be required. The strip seal shall be furnished in one piece for the full width of the joint.

**Method of Measurement:**

The quantity of strip seal installed will be measured in linear feet. Rehabilitation of the existing joint seal assembly and installation of new compression seal within the existing joint seal assembly will not be measured but will be incidental to the price per linear foot of new strip seal assembly.

**Basis of Payment:**

The quantity of strip seal installed will be paid for at the Contract unit price per linear foot of new strip seal assembly. Price and payment will constitute full compensation for furnishing all materials, surface preparation concrete and/or steel as applicable, installation of the seal, for all labor, equipment, tools, and all necessary incidentals to complete the work.

4/21/10

**605750 - NON-GUIDED POT BEARING AT ABUTMENT**  
**605751 - GUIDED POT BEARING AT ABUTMENT**  
**605752 - NON-GUIDED POT BEARING AT PIER**  
**605753 - GUIDED POT BEARING AT PIER**  
**605754 - FIXED POT BEARING AT PIER**

**Description:**

This work is the fabrication of pot bearings, as indicated.

**Materials:**

Use new material at all times, with no reclaimed material incorporated in the finished bearing.

(a) Steel. Conform to AASHTO M 270 (ASTM A 709), Grade 50W.

Coat all exposed steel surfaces with a thermal sprayed coating (metallization). Blast clean surfaces with grit abrasive in accordance with Steel Structures Painting Council Surface Preparation Specification No. 10, SSPC-SP10, Near-White Blast Cleaning, to a surface profile of .002-.004 inch. Use the electric arc spraying process. Provide wire material for the metalized primer consisting of 85% zinc and 15% aluminum, each being 99.9% pure metal. Apply the metalized primer to obtain a thickness of 0.01 inch minimum and 0.02 inch maximum. Do not apply when the surface temperature of the steel is less than 5°F above the dew point. Prepare a sample coupon using the same processes used to prepare the surface and apply the coating to the bearing. Test the coating bond strength on the coupon in accordance with ASTM D-4541. The bond strength must be a minimum of 700 psi. If the bond strength of the coating on the coupon is deficient, test the coating on the bearing. If the required bond strength is achieved, repair the coating. Provide the Engineer with a certified statement that the coating applicator has performed successful thermal spray operations within the last 12 months.

Perform any required touchup repair and field metalizing after any field welding with the appropriate materials and procedures in accordance with manufacturer recommendations.

Furnish guide bars as specified by the manufacturer and that are approved.

(b) Elastomeric Disc. Provide Shore A 50 to 60 Durometer and conform to the following requirements:

Furnish only virgin, crystallization-resistant polychloroprene (neoprene) or virgin, natural polyisoprene (natural rubber) as the raw polymer for the elastomeric rotational element used in the construction of pot bearings. Use individually molded and one-piece elastomers. Provide neoprene and natural rubber used in these bearings with physical properties, which conform to the following ASTM or AASHTO requirements, with the modification noted:

Compound	ASTM Requirement	AASHTO Requirement
Neoprene	ASTM D 2000, Line Call Out M2BC520A14B14	AASHTO M 251
Natural Rubber	ASTM D 2000, Line Call Out M4AA520A13B33	AASHTO M 251

**Modification:**

- 1) Samples for compression set tests shall be prepared using a type 2 die.
- 2) Shore A durometer hardness = 50 ± 10 Points

(c) Sliding Surfaces.

1. General. Provide polytetrafluoroethylene (PTFE) resin sheets, PTFE fabric, interlocked bronze and PTFE structures, PTFE-perforated metal composite, back-up materials and all other parts of fixed or expansion bearings containing PTFE materials having the friction, mechanical, physical, and weathering properties as specified or indicated.

2. PTFE Resin. Furnish virgin PTFE resin (not reprocessed) conforming to the requirements of ASTM D4894. Provide resin with specific gravity of 2.13 to 2.18 and melting point of 628°F±50°F.

3. Filler Material. When filler material is used, furnish milled glass fibers (15% maximum filler percent by mass (weight)), carbon (25% maximum filler percent by mass (weight)) or fabric containing PTFE fibers, or other approved inert filler materials.

4. Adhesive Material. Use heat cured, high temperature epoxy capable of withstanding temperatures of 385°F to 500°F when bonding the PTFE to its steel substrate. Provide adhesive material in epoxy resin conforming to the requirements of Federal Specification MMM-A-134 FEP film or approved equal.

5. Unfilled PTFE Sheet. Make finished unfilled PTFE sheet from virgin PTFE resin and ensure that it conforms to the following requirements:

Tensile Strength (minimum)	ASTM D 4894	2,500 psi
Elongation (minimum)	ASTM D 4894	200%

6. Filled PTFE Sheet. Make filled PTFE sheet from virgin PTFE resin uniformly blended with inert material. Ensure that finished filled PTFE sheets containing glass fiber or carbon conform to the following requirements:

Requirement	ASTM Method	15% Glass Fibers	25% Carbon
<b>Mechanical</b>			
Tensile Strength(minimum)	D 1457	2,000 psi	1,300 psi
Elongation (minimum)	D 1457	150%	75%
<b>Physical</b>			
Specific Gravity (minimum)	D 792	2.20	2.10
Melting Point	D 1457	620°F±18°F	620°F±18°F

7. Fabric Containing PTFE Fibers. Use manufactured fabric produced from oriented, multifilament, PTFE, fluorocarbon fibers and other fibers as required by proprietary designs. Use PTFE fibers with the following typical physical properties:

Physical Requirement	ASTM Method	PTFE Fibers
Tensile Strength (minimum)	D 2256	24,000 psi
Elongation (minimum)	D 2256	75%

8. Interlocked Bronze and Filled PTFE Structures. Supply interlocking bronze and filled PTFE structures consisting of a phosphor bronze plate with a 0.010 inch thick porous bronze surface layer into which is impregnated a lead/PTFE compound. Provide an overlay of compounded PTFE not less than 0.001 inch thick. Ensure that the phosphor bronze back plate conforms to ASTM B 100 and the porous bronze layer conforms to ASTM B 103.

9. PTFE Metal Composite. Supply PTFE metal composite consisting of virgin PTFE molded on each side and completely through a 1.32-inch perforated stainless steel ASTM A 240, Type 304 sheet.

10. Surface Treatment. Where PTFE sheets are to be epoxy bonded, have an approved manufacturer factory treat one side of the PTFE sheet using the sodium naphthalene or sodium ammonia process.

11. Stainless Steel Mating Surface. Furnish stainless steel sliding surfaces conforming to ASTM A 167 or A 240, Type 304 with an ANSI 0.02 mil surface finish or less. Attach a stainless steel sheet by an approved welding procedure, which keeps the sheet in contact with the substrate, or weld a stainless steel overlay using

Type 309L electrodes. Use 0.05-inch minimum thickness stainless steel.

12. Manufacturing Requirements. Manufacture the expansion bearing to the dimensions of and to conform to the requirements of the method of fastening to the structure as indicated.

Attachment of PTFE Material. Factory-bond, mechanically connect, or recess into the back-up material PTFE material as indicated.

Bonding. Perform the bonding at the factory of the manufacturer of the fixed or expansion bearings under controlled conditions and according to the written instructions of the manufacturer of the approved adhesive system. Ensure that after completion of the bonding operation, the PTFE surface is smooth and free from bubbles. Then polish filled PTFE surfaces.

Mechanically Fastened. If mechanically fastened, fasten PTFE sheet as indicated with the size, type, and number of fasteners required, taking care to have full bearing of the fastener used in the PTFE sheet and back-up material.

Fabric Containing PTFE Fibers. Bond or mechanically attach the fabric to a rigid-substrate. Supply fabric capable of carrying unit loads of 10,000 pounds per square inch without cold flow. Provide a fabric-substrate bond capable of withstanding a shear force equal to 10% of the perpendicular or normal application loading without delamination in addition to the shear force developed as a result of the natural bearing friction shear force.

(d) Sealing Rings.

1. Rings with Rectangular Cross Sections. Furnish brass sealing rings conforming to ASTM B 36.

2. Rings with Circular Cross Sections. Furnish round cross section metal sealing rings conforming to Federal Specifications QQ-B-626, composition 22, half hard.

(e) Bronze Elements. Ensure that bronze bearing and expansion plates conform to the specification for Bronze Castings for Bridges and Turntables, AASHTO M 107 (ASTM B 22). Furnish alloy C91100 unless otherwise specified. Cast bronze plates according to the indicated details. Plane sliding surfaces parallel to the movement of the spans and polish them unless otherwise indicated.

(f) Lubricant. Furnish solid lubricant consisting of a combination of solids having non-deteriorating characteristics as well as lubricating qualities and capable of withstanding long term atmospheric exposure, de-icing materials, and water. Do not use molybdenum disulfide and other ingredients, which promote electrolytic or chemical action between the bearing elements. Do not use shellac, tars and asphalts, or petroleum solvents as binders.

**Construction Methods:**

(a) Rotational Elements. Furnish elements conforming to the following requirements:

Manufacture from a solid plate by machining or fabricate by welding a flame-cut shape to a plate. Test all welded areas by the magnetic particle method meeting AWS D1.5, Section 6 requirements. Welding is as specified in standard specifications.

Machine inside diameter (ID) of pots to a tolerance of  $\pm 0.005$  inch up to 20 inches ID and  $\pm 0.007$  inch over 20 inches ID.

Pots machined parallel to the inside to Class "A" tolerance.

Machined surfaces to an ANSI 125 micro-inch rms finish or better.

Elastomeric discs with tolerances as follows:

- Diameters up to 20 inches,  $\pm 1/16$  inch.
- Diameters greater than 20 inches,  $\pm 3/32$  inch.
- Total thickness of all pieces, -0 inch, +1/8 inch.

- Mold discs in one piece, do not layer elastomer.

Pistons with tolerances as follows:

- Diameters up to 20 inches,  $\pm 0.005$  inch.
- Diameters greater than 20 inches,  $\pm 0.007$  inch.
- Upper side, Class "A" tolerance. Lower side, Class "B" tolerance.

(b) Non-Rotational Elements. Furnish elements conforming to the following requirements:  
Furnish masonry and distribution plates with tolerances as follows:

- Plan dimensions up to 30 inches, -0 inch,  $+3/16$  inch.
- Plan dimensions over 30 inches, -0 inch,  $+1/4$  inch.
- Thickness tolerance, -0.030 inch,  $+0.060$  inch.
- Masonry plates used with pot, disc, or spherical bearings, Class "C" tolerance for the underside and Class "A" tolerance for the upper side.

Provide PTFE sliding surfaces with tolerances as follows:

- Plan dimensions "total design area",  $+5\%$ ,  $-0\%$
- Substrate flatness: Class "A" tolerance for pot and disc bearings, Class "B" tolerance for spherical bearings.

Seal weld the stainless steel sheet around the entire perimeter using techniques, which ensure it will remain in contact with the backing plate.

Provide an ANSI 20 micro-inch rms finish or better. Flatness to Class "A" tolerance. Furnish sole plates with tolerances as follows:

- Plan dimensions up to 30 inches, -0 inch,  $+3/16$  inch.
- Plan dimensions over 30 inches, -0 inch,  $+1/4$  inch.
- Center line thickness,  $-1/32$  inch,  $+1/8$  inch.
- Flatness of surface in contact with steel beams, Class "B" tolerance; in contact with fresh concrete, none; in contact with stainless steel sliding surface, Class "A" tolerance; in contact with another steel plate, Class "B" tolerance.
- Minimum edge thickness,  $3/4$  inch.
- Machined bevels to an angular tolerance of  $\pm 0.002$  rad
- Flatness of bevelled surfaces, Class "A" tolerance

Provide guide bar with tolerances as follows:

- Length, unless integral with plate,  $\pm 1/8$  inch.
- Section dimensions,  $\pm 1/16$  inch.
- Flatness where it bears on another plate, Class "A" tolerance
- Bar-to-bar, nominal dimension  $\pm 1/32$  inch.
- Not more than  $1/32$  inch out of parallel

Overall bearing height not more than  $1/8$  inch or less than 0 inch from nominal dimension. Chamfer all edges.

(c) Determination of Flatness and Tolerances. Furnish bearings with flatness determined by the following method:

Place a precision straightedge, longer than the nominal dimension to be measured, in contact with the surface to be measured or as parallel to it as possible.

Select a feeler gage having a tolerance of  $\pm 0.001$  inch and attempt to insert it under the straightedge using the least number of blades.

Flatness is acceptable if the feeler gage does not pass under the straightedge.

Flatness tolerances are arranged in the following classes:

Class "A" = 0.0005 inch x "Nominal Dimension"

Class "B" = 0.001 inch x "Nominal Dimension"

Class "C" = 0.002 inch x "Nominal Dimension"

"Nominal Dimension" is defined as the actual dimension of the plate, in inches, under the straightedge.

In determining flatness, the straightedge may be located in any position on the surface being evaluated and not necessarily at 90 degrees to the edges.

Ignore a 1-inch wide border around the plate in determining flatness.

(d) Painting. Do not paint before completion of welding.

If the time of exposure before welding is to exceed 90 calendar days, provide metal surfaces with a protective coating of clear lacquer or other approved coating.

Paint all steel surfaces as indicated and according to recommendations of the coating manufacturer.

(e) Testing. Conduct the following tests before installation of the bearings, and in the presence of the Representative.

1. Sampling. Select one sample, for testing purposes, at random from each "lot" of completed bearings at the manufacturer's plant.

A "lot" consists of one of the following:

- No more than 25 fixed bearings of one "load category"
- No more than 25 expansion bearings of one "load category"

One "load category" may consist of bearings of differing vertical force capacity but the bearings may not exceed a range of capacity differing by more than 300 kips.

2. Friction Test. Test only those bearings actually fabricated for the project.

Test a sample from each lot of expansion bearings. For all guided and non-guided expansion type bearings, measure the sliding coefficient of friction at the bearing's design capacity as specified in below and on the fifth and fiftieth cycles, at a sliding speed of 1 inch per minute.

Calculate the sliding coefficient of friction as the horizontal force necessary to maintain continuous sliding of one bearing, divided by the bearing's vertical design capacity.

The test results will be evaluated as follows:

- Measured sliding coefficients of friction not to exceed 3%.
- Visually examine the bearing both during and after the test. Any resultant visual defects, such as bond failure, physical destruction, cold flow of TFE to the point of debonding, or damaged components will cause rejection of the lot.

Test Method. Obtain approval of the test method and equipment and comply with the following requirements:

- Arrange the test so that the coefficient of friction on the first movement of the manufactured bearing can be determined.
- Clean the bearing surface before testing.
- Conduct the test at maximum working stress for the TFE surface with the test load applied continuously for 12 hours before measuring friction.
- Determine the first movement static and dynamic coefficient of friction of the test bearing at a sliding speed of less than 1 inch per minute, which is not to exceed the coefficient of friction for design.
- Subject the bearing specimen to 100 movements of at least 1 inch of relative movement and, if the test facility allows, the full design movement at a speed of less than 1 foot per minute. Following this test, determine the static and kinetic coefficient of friction again, which is not to exceed the values specified above. Verify that the bearing or specimen shows no appreciable sign of bond failure or other defects.

Bearings represented by test specimens passing the above requirements will be approved for use in the structure subject to on-site inspection for visible defects.

Bearings not damaged during the testing of performance characteristics may be used in the work.

### 3. Proof Load Test.

Test one bearing from each production "lot" of fixed and expansion bearings. Load a test bearing to 150% of the bearing's rated design capacity and simultaneously subject it to a rotational range of 0.02 radians (1.146 degrees) or design rotation, whichever is greater, for a period of 1 hour.

Visually examine the bearing both during the test and upon disassembly after the test. Any resultant visual defects, such as extruded or deformed elastomer, polyether urethane or TFE, damaged seals or limited or cracked steel, will cause rejection of the lot.

During the test, for pot bearings maintain continuous and uniform contact between the steel bearing plate and steel piston for the duration of the test. For disc bearings maintain continuous and uniform contact between the polyether urethane element and the bearing plates and between the sliding steel top plate and the upper bearing plate for the duration of the test. Any observed lift-off will cause rejection of the lot.

### 4. Material Tests.

Submit one sample of elastomer and one sample of PTFE from each "lot of material" to MTD for material testing to ensure compliance with appropriate material specifications.

### (f) Packing and Shipping.

#### 1. Packaging and Handling.

Ensure that the bearings are securely banded together as units by fabricator, shipped to the job site, and stored without relative movement of the bearing parts or disassembly at any time. Wrap bearings in moisture resistant and dust resistant material to protect against shipping and job site conditions. Match mark the bearings to indicate normal position of each bearing.

Take care to ensure that bearings are stored at the job site in a dry sheltered area free from dirt or dust until installation. Inspect bearings within one week after arriving on the project. Do not disassemble unless the fabricator's representative is present. Following inspection, rewrap the bearings to keep them clean until installation.

Do not remove the sole and top plates of bearings for separate attachment to the structure except under the direct supervision of the fabricator.

With each shipment, enclose a copy of the materials, fabrication, and testing compliance certifications.

### (g) Shop Drawings.

Submit as specified in standard specification section 105 and include the following information:

- The total quantity of each kind of bearing required (fixed and expansion), grouped first according to type (load range) and then by actual design capacity.
- Plan view and section elevation including all relative dimensions.
- Details of all components and sections showing all materials incorporated into the bearing.
- All ASTM, AASHTO, and other material designations.
- The maximum design coefficient of friction as indicated.
- Clearly describe and detail any welding process used in the bearing manufacture that does ~~not conform~~ to the approved processes of the AWS code.
- Vertical, horizontal, rotation, movement, and load capacity.
- A schedule of all bearing offsets, if required by the project.
- Alignment plans.
- Paint or coating requirements.
- Installation scheme.

- Complete design calculations verifying conformance with the provisions of this specification. Stress analysis and the mechanics of standard bearing details are not required.
- Anchorage details.
- Bearing pre-set details.
- Location of the fabrication plant.
- The manufacturer's name and the name of its representative responsible for coordinating production, sampling, and testing.

(h) Certification.

Ensure that the fabricator provides a certification package as specified in standard Section 106.03 and containing the following:

- Material test reports for all steels used except AISI C1018 and C1020 for which a mill conformance certificate is acceptable.
- Certificate of Compliance for all non-ferrous metals.
- Material test reports for any elastomeric components.
- Certificate of Compliance for PTFE and any adhesive used.
- A Certificate of Compliance for the bearings, executed by an officer of the manufacturing company.
- Certificate of Compliance for any dowels or bolts supplied.
- Test reports for the performance tests.

**Method of Measurement and Basis of Payment:**

The quantity of pot bearings will be paid for at the Contract lump sum price. Price and payment will constitute full compensation for all labor, materials, equipment, and transportation required for furnishing, fabricating, transporting, erecting, and shop and field painting to complete the work.

**NOTE:**

A breakout sheet attached to the Proposal list the bridges under this item. The Contractor shall fill in a unit price for each item and the cost (unit price times the proposed quantity). The lump sum bid for Items 605750-54 - Non-Guided Pot Bearings shall be the sum of the cost for all items listed. The breakout sheet shall be attached to the Bid Proposal. Failure to submit the breakout sheet with the Bid Proposal will result in the Bid Proposal being declared non-responsive and rejected.

The Department reserves the right to delete from the Contract one or more of the items listed and right to add or subtract from the quantity of each item. The lump sum to be paid will be adjusted in accordance with the Contractor's unit prices as required above. There will be no extra compensation if such additions and/or deletions are made.

9/16/10

**605757 – HIGH PERFORMANCE STEEL****Description:**

Under this work, the Contractor shall fabricate, furnish and erect high performance structural steel in accordance with the Contract documents.

This specification applies to the fabrication of structural components for bridges using high performance steel plates furnished in one of the following conditions: as-rolled, controlled rolled, thermo-mechanical-controlled-processed (TMCP) with or without accelerated cooling, or quenched and tempered (Q&T), or hybrid/mixed design structural components using high performance steel plates in combination with high strength, low alloy steel plates and shapes, for welded or bolted applications in bridge construction.

All provisions of Section 605 of the Standard Specifications shall apply, except as modified on the plans or in this specification.

**Materials:**

All steel, including high performance steel, must comply with all provisions of AASHTO M270, *Standard Specification for Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates and Bars, and Quenched and Tempered Alloy Structural Steel Plates for Bridges*, except as modified herein. Supplementary Requirement S83, Non-Fracture Critical, T, Material; Toughness Tests and Marking, or S84, Fracture Critical, F, Material; Toughness Testing and Marking will apply, as appropriate, and must be specified with the mill order.

The Contractor is advised that quenched and tempered AASHTO M270, Grade HPS70W steel plates are limited to a 50 feet maximum delivery length from the United States mills. Alternatively, AASHTO M270, Grade HPS70W TMCP or other manufacturing options may be available in longer lengths, but with restrictions on thickness, depending on mill capabilities.

**Fabrication:**

All fabrication must conform to the latest edition of the AASHTO *Guide Specifications for Highway Bridge Fabrication with HPS70W Steel*, an addendum to ANSI/AASHTO/AWS D1.5-95, except as modified herein.

**Restrictions:**

Short term application of heat for purposes of heat curving, heat straightening, camber and sweep adjustment, or other reasons, is limited and not to exceed 1100° F maximum. All applications of heating must be done by procedures approved by the Chief Engineer or his authorized representative.

**Welding:**

All welding must conform to the latest edition of the AASHTO/ AWS *D1.5 Bridge Welding Code*, except as modified herein and by the latest edition of the AASHTO *Guide Specifications for Highway Bridge Fabrication with HPS70W Steel*, an addendum to AASHTO/AWS D1.5-95.

Only submerged arc welding (SAW) and shielded metal arc welding (SMAW) processes will be permitted when welding high performance steel. Consumable handling requirements shall be in accordance with AWS D1.5, Sections 12.6.5 and 12.6.6 when using reduced preheat as described in Table 3 of the guide, except that SAW consumables for matching weld metal shall meet the hydrogen control level of H4 as discussed in AWS D1.5, Section 12, Article 12.6.2. Consumable handling requirements must meet the provisions of AWS D1.5, Section 4 when using the preheat requirements of AWS D1.5, Table 4.4, except that the diffusible hydrogen level must never exceed H8. SMAW consumables can meet diffusible hydrogen levels of either H4 or H8 except the higher preheat and interpass temperatures as noted in Table 3 of the AASHTO *Guide Specifications for Highway Bridge Fabrication with HPS70W Steel* apply to H8 conditions.

Filler metals used to make single pass fillet welds for web to flange applications which join HPS70W steel plates to Grade 50W plates and for attaching stiffeners and connection plates to Grade HPS70W webs

and flanges, must be in conformance with AWS D1.5, Table 4.1 for AASHTO M270, Grade 50W base metal. Filler metals for single pass 5/16" fillet welds need not meet the requirements for exposed bare applications.

Filler metals used for all complete penetration groove welds joining Grade HPS70W plate to AASHTO M270, Grade HPS50W or Grade 50W plate must conform to the requirements for welding Grade 50W base metal.

Filler metals used for all complete penetration groove welds joining Grade HPS70W plates to Grade HPS70W plates shall conform to the requirements for HPS70W base metal as follows:

1. Submerged Arc Welding process:  
Bare electrodes and flux shall conform to the requirements of the latest edition of AWS A5.17, Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding or AWS A5.23, Specification for Low Alloy Steel Electrodes and Fluxes for Submerged Arc Welding.
2. Shielded Metal Arc Welding process:  
Matching - E9018MR\*  
Undermatching - E7018MR\*

\* The designator 'MR', for moisture resistant coating, is required for all SMAW electrodes used for welding HPS70W steels.

The Contractor must request approval of consumables for matching strength welds of the above filler metals for SAW. The request for approval must include documentation of successful welding in accordance with the AWS D1.5 Bridge Welding Code, and include diffusible hydrogen tests as described in AWS D1.5.

All welding procedures must be qualified in accordance with AWS D1.5, Section 5, Qualification. In general, the provisions of Article 5.12 shall apply. Qualification tests shall measure strength, toughness and ductility, with results evaluated in accordance with Article 5.19 of the AWS D1.5 Code. If specified on the plans, additional tests shall measure the Charpy V-notch toughness of the coarse grained area of the heat affected zone (HAZ). The notch in the specimens shall be carefully located in the coarse grained area of the HAZ, as determined by macroetching the specimens prior to machining and testing. The toughness requirement for the HAZ shall be the same as the weld metal.

All procedure qualification tests must be ultrasonically tested in conformance with the requirements of AWS D1.5-95, Section 6, Part C. Evaluation must be in accordance with AWS D1.5-95, Table 9.1, Ultrasonic Acceptance - Rejection Criteria - Tensile Stress. Indications found at the interface of the backing bar may be disregarded, regardless of the defect rating.

A representative of the owner must witness all welding procedure specification qualification tests.

Results of the welding procedure specification qualification tests and final welding procedure specifications must be submitted to the Chief Engineer or his authorized representative for review and approval.

In general, post weld heat treatment shall not be required. The use of such post weld heat treatment shall require additional qualification testing.

Welders and welding operators must be qualified in accordance with the provisions of the AASHTO/AWS D1.5 *Bridge Welding Code*.

### **Construction:**

All structural steel work, including but not limited to shop drawings, fabrication, inspection, transportation and erection must be done in accordance with the provisions of the Standard Specifications, except as modified by the Contract documents.

Only fabricators meeting the requirements of the AISC Quality Certification Program, "Major Steel Bridges (Cbr)" with "Fracture Critical Members Endorsement (F)", or approved equal, may be used to fabricate using high performance steel conforming to AASHTO M270, Grade HPS70W. Prior to approval

for fabrication, the results of the latest AISC certification review shall be made available to the owners representative to determine if items critical to successful fabrication meet the needs of the specific work.

Whenever magnetic particle testing is done, only the yoke technique will be allowed, as described in Section 6.7.6.2 of the AASHTO/ AWS D1.5 *Bridge Welding Code*, modified to test using alternating current only. The prod technique will not be allowed.

**Method of Measurement:**

The quantity of High Performance Steel will not be measured.

**Basis of Payment:**

The quantity of High Performance Steel will be paid for at the Contract unit price per lump sum. Price and payment will constitute full compensation for all labor, materials, equipment, and transportation required for furnishing, fabricating, transporting, erecting, and shop and field painting to complete the work.

The Contract price for High Performance Steel shall include all weld metal used to join Grade HPS70W steel to Grade HPS70W steel and Grade HPS70W steel to Grade 50W steel. All other weld metal and all Grade 50W steel shall be included in the price for item 605002. All metal parts such as anchor bolts and nuts, bearing and slab plates, pins and pilot and driving nuts, expansion dams, roadway drains and scuppers, bolts embedded in concrete, cradles and brackets, blast plates, and waterstops shall not be paid for under this item but shall be paid for as part of item 605002 unless otherwise stipulated. Steel reinforcement for concrete is not included in this Section and will be paid separately under the appropriate section.

Payment for painting of High Performance Steel shall be in accordance with Section 605 of the Standard Specifications.

**NOTE:**

A breakout sheet attached to the Proposal list the Steel for the Bridges under this item. The Contractor shall fill in a unit price for each item and the cost (unit price times the proposed quantity). The lump sum bid for Item 605757 - High Performance Steel shall be the sum of the cost for all items listed. The breakout sheet shall be attached to the Bid Proposal. Failure to submit the breakout sheet with the Bid Proposal will result in the Bid Proposal being declared non-responsive and rejected.

The Department reserves the right to delete from the Contract one or more of the items listed and right to add or subtract from the quantity of each item. The lump sum to be paid will be adjusted in accordance with the Contractor's unit prices as required above. There will be no extra compensation if such additions and/or deletions are made.

3/01/11

**612529 - PIPE VIDEO INSPECTION**

**Description:**

This work consists of the video inspection of the storm drain systems, and/or sanitary sewer systems (all pipe sizes included) in accordance with these Specifications, and the details and locations shown on the Plans and by the Engineer.

**Construction Methods:**

The entire system(s) involved shall be numbered and then inspected by means of a closed-circuit television. The inspection will be done one section at a time in the presence of the Department's inspector. This work shall not be performed until just prior to the placement of the final pavement surface in case repairs need to be done. But, shall be done no sooner than thirty days from the date of pipe placement.

The television camera used for the inspection shall be specifically designed and constructed for such inspection, capable of producing color video. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera shall be equipped with Pan and Tilt, capable of scanning 360° to view the entire joint. The camera, television monitor, and other components of the video system shall be capable of producing quality to the satisfaction of the Department. If unsatisfactory, the equipment shall be removed and replaced.

The condition of the entire pipe run shall be documented by moving the camera through the pipe in either direction. At each joint the camera shall stop and pan the entire circumference of the joint. Between joints, the camera shall move at a nominal speed of 10 to 15 feet (3 to 4.5 m) per minute never exceeding 30 feet (9 m) per minute. Manual winches, power winches, television cable and power rewinds or other devices shall not obstruct the camera view or interfere with proper documentation of the pipe condition.

The technician operating the camera shall be experienced and qualified in conducting video pipe inspections. The technician shall have the capability of controlling the movement of the television camera, adjusting the brightness of the built-in lighting system and focusing the television camera by remote control. The importance of accurate distance measurements is emphasized. A distance meter and location indicator shall appear on the monitor and video indicating the exact location of the camera in the pipe between (2) structures.

The view scanned by the television camera shall be transmitted to a color monitor of not less than 12 in. (300 mm), measured diagonally across the screen. The monitor shall be located such that the State inspector has full visual access.

**Documentation:**

Television Inspection Logs: Typed reports shall be submitted to the Department for each location clearly showing the relation to the video meter at each problem point observed during inspection. In addition, other points of significance such as locations of catch basins, junction boxes, manholes, open joints, areas of settlement, misaligned pipe, unplugged lift holes, unusual conditions such as a change of pipe size or type within a run, roots, laterals, storm sewer connections, broken or spalled pipe, presence of scale or corrosion and other discernible features shall be recorded and a copy of such records shall be supplied to the Department.

For the purposes of documentation of a storm drain system, the following criteria shall be used to determine if a joint shall be considered an open joint:

ALL PIPE TYPES	MAXIMUM JOINT OPENING ALLOWED
12-36" (300 - 900 mm) ROUND	0.75" (19 mm)
42" (1050 mm) & LARGER	1.25" (32 mm)
ALL ELLIPTICAL	1.50" (38 mm)

DVD Recordings: The Contractor shall supply a visual and audio record of the drainage and/or sanitary

system that may be replayed. A minimum of one video shall be submitted for each location but separate locations shall not be combined on the same DVD. Video recording playback shall be at the same speed that it was recorded. Good quality labeled DVDs in a hard plastic case shall be submitted and become the property of The Delaware Department of Transportation.

The separate typed report shall list the Delaware State Plane NA D 83 Coordinates for each structure within the drainage system including catch basins, manholes and all inlet and outlet ends of pipes. This record shall be listed by structure number and record each structure's Northing and Easting coordinates along with street address. This report is to be forwarded to the Department's NPDES after review by the construction staff.

**Method of Measurement:**

The quantity of pipe video inspection will be measured by the linear feet (linear meter) as indicated on the video monitor and verified by the Engineer.

**Basis of Payment:**

The quantity of pipe video inspection will be paid for at the Contract unit price per linear foot (linear meter). Price and payment will constitute full compensation for furnishing all materials and equipment, obtaining coordinate and elevations, typed reports, DVD recordings, safety equipment, and for all labor, tools and incidentals necessary to complete the work.

8/13/07

**612535 - CLEANING DRAINAGE PIPE, 15" - 24" DIA.**  
**612536 - CLEANING DRAINAGE PIPE, GREATER THAN 24" DIA.**

**Description:**

This work consists of cleaning existing drainage pipe. It is the intent that equipment and cleaning methods used to perform this work conform to Specification Guidelines prepared by the National Association of Sewer Service Companies (NASSCO) hereinafter referred to as the NASSCO Specifications.

**Materials and Construction Methods:**

Water used for cleaning shall be safe for all downstream environments. The source for the cleaning water shall be approved by the Engineer.

Equipment and construction methods shall be in accordance with the requirements under Sewer Line Cleaning, High-Velocity Jet (Hydrocleaning) found in the NASSCO Specifications. Equipment shall be operated in accordance with the manufacturer's instructions. The cleaning operation shall consist of up to three passes of the hydrocleaning equipment. If three passes do not adequately clean the pipe, the Engineer may direct the Contractor to use other procedures covered by other item(s) of work.

Material removed during the pipe cleaning operation shall be disposed of at a site approved by the Engineer.

**Method of Measurement:**

The quantity of drainage pipe cleaned will be measured as the actual number of linear feet (linear meters) of pipe cleaned and accepted measured from end to end.

**Basis of Payment:**

The quantity of pipe cleaned will be paid for at the Contract unit price per linear foot (linear meter). Price and payment will constitute full compensation for furnishing equipment and water, and for all labor, equipment, tools and incidentals to complete the work.

9/25/02

**612537 - HEAVY CLEANING OF DRAINAGE PIPE**

**Description:**

This work consists of cleaning existing drainage pipe that is blocked by deposits, roots, etc. that cannot be removed by normal hydrocleaning procedures. It is the intent that equipment and methods used to perform this work conform to the Specification Guidelines prepared by the National Association of Sewer Service Companies (NASSCO) hereinafter referred to as the NASSCO Specifications.

**Materials and Construction Methods:**

Equipment and construction methods shall be in accordance with the guidelines under Sewer Line Cleaning found in the NASSCO Specifications. The method(s) to be employed under this item of work shall address the situation encountered and shall be approved by the Engineer before starting work.

**Method of Measurement:**

The quantity of heavy pipe cleaning will be measured as the actual number of hours the Contractor is actively engaged in heavy pipe cleaning work.

**Basis of Payment:**

The quantity of heavy pipe cleaning will be paid for at the Contract price per hour. Price and payment will constitute full compensation for furnishing all labor, equipment, tools and incidentals required to complete the work.

9/25/02

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614589 - STEEL CASING PIPE, 10"  
614602 - STEEL CASING PIPE, 16"  
614603 - STEEL CASING PIPE, 20"  
614605 - STEEL CASING PIPE, 12"  
614660 - STEEL CASING PIPE, 24"  
614661 - STEEL CASING PIPE, 26"  
614662 - STEEL CASING PIPE, 28"  
614663 - STEEL CASING PIPE, 32"  
614678 - STEEL CASING PIPE, 14"  
614744 - STEEL CASING PIPE, 18"  
614746 - STEEL CASING PIPE, 48"  
614777 - STEEL CASING PIPE, 6"  
614778 - STEEL CASING PIPE, 8"  
614783 - STEEL CASING PIPE, 30"  
614825 - STEEL CASING PIPE, 36"

**Description:**

This work consists of furnishing all materials and encasing existing and/or proposed facilities such as water main pipe, sanitary sewer pipe, or telephone/electric duct as applicable to the Contract with steel pipe of specified diameter in accordance with the details, notes on the Plans and as directed by the Engineer.

**Materials and Construction Methods:**

Casing pipe shall be A-53 grade B black steel pipe with 3/8" (9 mm) wall thickness for pipes 30" (750 mm) diameter and less, and 1/2" (13 mm) wall thickness for pipes larger than 30" (750 mm) diameter, and shall conform to the requirements of API-5L, Grade B. Casing pipe shall be bituminous coated inside and outside, and joints shall be welded in accordance with requirements of AWWA C-206. After welding or cutting the pipe, the welded and cut section shall be recoated with bituminous material to the satisfaction of the Engineer or the Owner of the Utility.

The pipe/duct being encased shall be supported by treated lumber, or other device, sitting on the bottom of the casing pipe or other device as shown on the Plans and/or as directed by the Engineer. Space between the casing pipe and the pipe/duct being encased shall be closed with 12" (300 mm) thick Class B concrete at each end of the casing pipe or closed by an alternative method if shown on the Plans.

As shown on the Plans or as directed by the Engineer, a galvanized steel pipe of 1" (25 mm) diameter shall be installed through the concrete seal at the bottom of the down grade end of the casing pipe for draining the entrapped water.

**Method Measurement:**

The quantity of steel casing pipe will be measured as the actual number of linear feet (linear meters) of each size placed and accepted. Measurement will be made along the centerline from end to end of the steel casing pipe.

**Basis of Payment:**

The quantity of steel casing pipe will be paid for at the Contract unit price per linear foot (linear meter) for each size of casing pipe. Price and payment will constitute full compensation for furnishing all materials, welding, coating, closing the ends with concrete, galvanized steel pipe for drainage, backfill Borrow Type C, backfilling; and for all labor, equipment, tools and incidentals necessary to complete the work.

For pipe under 24" (600 mm), internal diameter, the excavation (excluding rock), backfill and backfilling shall be included in the price for this item unless otherwise excavation has been included in the pipe item being encased. For pipe of internal diameter 24" (600 mm) and over, payment for excavation and backfill shall be in accordance with Section 208. Furnishing of borrow type C for pipe with inside diameter of 24" (600 mm) and over will be paid for under Section 210.

**617515 - HEADWALL**

**Description:**

This work consists of furnishing and placing a concrete drainage headwall as shown on the Plans.

**Materials:**

Materials shall conform to the requirements of Section 612, 812 and 824 of the Standard Specifications.

**Construction Methods:**

Concrete headwalls shall be placed in conformance with the details, dimensions, and notes as shown in the details found in the Plans and at the location shown on the Plans.

**Method of Measurement and Basis of Payment:**

The quantity of headwalls will be measured and paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing, hauling, and installing materials, including concrete and bar reinforcement; for excavating, backfilling, and compacting; for cribbing, shoring, and sheeting; and for all labor, equipment, tools, and incidentals required to complete the work.

**618540 – FURNISH STEEL PIPE PILES, 24”**  
**618541 – FURNISH STEEL PIPE PILES, 30”**  
**618542 – FURNISH STEEL PIPE PILES, 36”**  
**618543 – FURNISH STEEL PIPE TEST PILES, 24”**  
**618544 – FURNISH STEEL PIPE TEST PILES, 30”**  
**618545 – FURNISH STEEL PIPE TEST PILES, 36”**

**Description:**

This work shall consist of furnishing steel pipe piles and steel pipe test piles.

**Materials:**

Steel pipe piles shall conform to ASTM A 252, Grade 50.

Pile Materials: Section 618  
Structural Steel: Section 826

**Construction Methods:**

All construction shall be performed in accordance with Section 618 & 619 of the Standard Specifications and as modified herein.

**Method of Measurement:**

The quantity of steel pipe piles shall be measured in accordance with Section 618.22 of the Standard Specifications except as modified herein.

**Basis of Payment:**

The quantity of steel pipe piles shall be paid in accordance with Section 618.23 of the Standard Specifications except as modified herein.

9/16/10



**619501 - PRODUCTION PILE RESTRIKE**  
**619502 - TEST PILE RESTRIKE**

**Description:**

Under certain pile driving conditions it may become necessary to restrike various production piles and test piles, of the sizes and type called for by the Contract, in order to verify the pile capacities. Some of the pile driving conditions that could result in the need for pile restrikes include; bearing capacities are not achieved by the initial driving, Contract Plans for driving based on tip elevation (bearing achieved by freeze), and dynamic analysis procedures require extended waiting times for restrike.

**Note:** These Special Provisions replace Subsection 619.14 of the Standard Specifications.

**Procedure:**

All test piles shall be restruck and dynamically tested by the Contractor. The Engineer may direct the Contractor to restrike selected production piles to verify capacities.

-The Engineer will attempt to schedule the pile restrike so as to cause minimal, if any, delay to the overall driving operation.

-Prior to restrike, the Contractor shall mark the pile in 1-inch increments for the first 1-foot and 1-foot increments thereafter. The pile restrikes shall be in accordance with the plans.

-All restrikes shall be performed using the same pile hammer, helmet, and cushion material used to install the piles during initial driving.

-The pile hammer shall be fully warmed up and operated at full stroke, or as otherwise specified by the Engineer, during the pile restrike. The warm-up procedure shall consist of a minimum of 25 blows of the hammer at full stroke at locations other than the piles to be restruck.

-The elevation of the top of the pile shall be established prior to performing the restrike.

-The hammer shall be carefully lowered and positioned on the pile. The hammer shall restrike the pile 20 blows at the required stroke height.

-The hammer shall be removed from the pile, and the new top of the pile elevation shall be established.

If for any reason, the pile hammer malfunctions, the helmet fails, the cushioning materials fail, or any other component of the pile driving system does not function properly during the pile restrike, the Contractor shall wait up to two (2) calendar days and perform additional restrikes at no additional cost to the Engineer or The Department until the pile driving system operates properly through a complete continuous restrike procedure.

**Method of Measurement/Basis of Payment:****Production Pile Restrike:**

This item shall be measured and paid for on a per each basis and payment will constitute full compensation for performing restrikes of selected production piles. The Engineer will work jointly with the Contractor to establish a sequencing of production pile restrikes to minimize impact to the Contractor's driving schedule. Any perceived mobilization costs, set-up costs, delay costs, etc. anticipated by the Contractor shall be incidental to the price for this item.

Payment for "Production Pile Restrikes" shall be made at the fixed price of \$500.00 Each if it is requested by the Department within five (5) working days of the completion of the initial driving of the pile to be restruck. Payment for "Production Pile Restrikes" with requested restrike wait time exceeding five (5) working days will be made at the fixed price of \$500.00 Each for each working day exceeded, starting on the sixth day, in addition to the fixed price of \$500.00 Each. An example of this case would be, if the Engineer directs a production pile restrike to be performed six (6) working days following the completion of the initial driving, two (2) units will be paid. Similarly, if the restrike is ordered to be performed eight (8) working days following the completion of the initial driving, four (4) units will be paid. No payment will be made for additional days if the Contractor elects to wait longer to perform the restrike than the time frame as directed by the Engineer. Any overlapping days due to multiple production piles will be paid for only one day.

**Test Pile Restrike:**

This item will be measured on an Each Day basis. Test pile restrikes will not be paid for under this item unless the restrike waiting time is greater than five (5) working days following the completion of the initial driving. All test pile restrikes requested by the Department within the first five (5) working days following the completion of the initial driving shall be incidental to the installation of the test pile. An example of this case would be, if the Engineer directs a test pile restrike to be performed six (6) working days following the completion of the initial driving, one (1) unit will be paid. Similarly, if the restrike is ordered to be performed eight (8) working days following the completion of the initial driving, three (3) units will be paid. No payment will be made for additional days if the Contractor elects to wait longer to perform the restrike than the time frame as directed by the Engineer.

Payment for "Test Pile Restrike" on test piles with requested restrike wait time exceeding five (5) working days will be made at the fixed price of \$1,000.00 per Each Day. Any overlapping days due to multiple test piles will be paid for only one day.

Price and payment will constitute full compensation for all equipment, labor and materials necessary to perform a Test Pile Restrike as described above. Also included in the payment is the cost of any idle equipment, labor, etc. during the prescribed waiting period between initial driving and performance of the restrike.

4/29/11

**619519 – DYNAMIC PILE TESTING BY CONTRACTOR**  
**619539 – SIGNAL MATCHING ANALYSIS BY CONTRACTOR**

**Description:**

This item shall consist of furnishing all materials, equipment, access, reporting of results, and qualified personnel necessary to perform all wave equation analysis, high-strain dynamic testing and signal matching, and monitoring of driven piles at the locations designated on the Plans or as directed by the Engineer. The work shall also include analysis and report preparation in accordance with this Special Provision.

High-strain dynamic testing and signal matching shall be performed on all test piles for the entire duration of the test pile installation, re-strikes, and as indicated in the Plans.

The Contractor shall notify the Engineer of the proposed pile driving schedule at least two working days prior to driving piles at any location where high-strain dynamic testing will be conducted.

**Submittals:**

The Contractor shall engage the services of a specialty subcontractor, the Dynamic Testing Consultant (DTC), experienced in high-strain dynamic monitoring of driven piles to perform dynamic testing and signal matching analysis and to evaluate and report results to the Department. The Dynamic Testing Consultant shall have at least five (5) years of documented experience in the performance and interpretation of dynamic pile testing, including dynamic pile testing on open ended pipe piles. The Dynamic Testing Consultant's field engineer or technician, who will be operating the instrumentation and collecting the data, shall have documented experience on at least ten (10) prior projects with similar pile requirements, including pipe piles. All projects submitted as evidence of experience shall include the client and owner, points of contact, and a description of the pile type. The field engineer or technician responsible for operating the instrumentation shall be fully capable of understanding and interpreting the data being collected during driving. The Dynamic Testing Consultant shall be selected by the Contractor and submitted at the pre-construction meeting for approval by the Department.

a. Qualifying Experience

The Contractor shall submit proof of three or more projects of similar size and complexity where the DTC and personnel assigned to this project have successfully performed similar services and analyses within the last three years. The Contractor shall present the following information for each project listed as a reference at or prior to any preconstruction meetings:

1. Project Name, Location, Project Description, and Completion Date.
2. Surface and Subsurface Conditions.
3. Type and number of instruments installed.
4. Installation equipment and techniques utilized when applicable.
5. Provide names, current phone numbers, and current business addresses for the owner/designer, geotechnical consultant, and contract manager.

b. Wave Equation Analysis

The Contractor shall submit the completed Pile and Driving Equipment data form to the Department 30 to 45-days before mobilization to the site. The wave equation analysis of the proposed driving system shall be submitted to the Department at least 10-days prior to driving of the piles. The results of the wave equation analysis using the GRLWEAP program or other software approved by the Department shall be submitted in a bound report for review and approval. The wave equation analysis shall be performed at each test pile location and for each test pile type and driving equipment. Approval of the proposed driving system by the Department will be based on DelDOT Standard Specifications for Road and Bridge Construction, 2001, Section 619.09, Bearing Values.

c. Reports

The Dynamic Testing Consultant shall direct the progress of the testing work and shall obtain and record the test data. The Dynamic Testing Consultant shall prepare a daily field report summarizing the high-strain dynamic test results and pile driving data. At a minimum, the daily report shall include the calculated driving stresses, transferred energy, and estimated pile capacity at the time of testing. Pile driving logs shall be included with the submittal. Variations from previous trends in the dynamic test data shall also be noted. Daily field reports shall be faxed or transmitted electronically to the Engineer within 24-hours of the end of the shift.

The Dynamic Testing Consultant shall prepare a written report presenting the results of the pile program in accordance with the requirements of ASTM D4945 including specific discussion of the pile capacity obtained from the dynamic testing, the performance of the hammer and driving system, driving stress levels, and pile integrity. The following data shall also be provided in the report for the full length of driving at intervals of not more than 10 hammer blows: bearing capacity from the Case Goble method, bearing capacity from at least one additional recognized method, input and reflection values of force and velocity, maximum transferred energy, maximum compressive stress, maximum tensile stress, blows per minute, values of upward and downward traveling force wave, ram stroke, pile penetration depth and corresponding blow sequence.

Signal matching analyses shall be performed for all initial drives and restrikes of dynamically tested piles. A minimum of one (1) signal matching analysis shall be performed for a representative blow near the end of each initial drive and a minimum of one (1) representative blows shall be analyzed towards the beginning of the restrike.

Within three (3) working days of the completion of each dynamic test, the Contractor's specialty subcontractor shall submit to the Department a report meeting the requirements of this Special Provision that is signed and sealed by a Professional Engineer licensed in the State of Delaware. In addition to the raw data and ASTM D4945 requirements, the report shall include detailed results of the signal matching analyses including, but not limited to, pile driving log, all extrema tables; pile profile and pile model tables; simulated load test curves for the tip and top of the pile; the soil parameters used in the analysis by matching the measured and computed values of forces, velocities, and displacements; and static resistance distribution along the length of the pile, in a format approved by the Department. The Contractor is to develop the driving criteria for the production piles based on the results of the high strain dynamic testing with signal matching analysis. The Contractor shall submit the driving criteria for review and approval of the Engineer prior to installation of production piles. The driving criteria shall be summarized in the format provided by the Engineer after award of the contract.

All raw data and computer analyses shall be provided in electronic format to the Department for additional analysis.

**Materials and Construction Methods:**

All equipment, testing and reporting procedures shall be provided and performed in strict accordance with ASTM D4945 - *Standard Test Method for High-Strain Dynamic Testing of Piles*.

The Contractor shall maintain a stock of at least four working accelerometers and strain transducers at the job site whenever high-strain testing is being performed. All repair or replacement costs shall be performed at no additional cost to the Engineer or The Department.

The Contractor shall provide the Engineer and The Department reasonable inspection access along the full length and circumference of all piles prepared for instrumentation attachment prior to the piles being lifted and located in the leads.

Dynamic monitoring instrumentation, including all gages and cables, shall not be installed on the pile until the pile has been lifted and aligned in the leads and the hammer and helmet have been properly set.

The Dynamic Testing Consultant shall perform dynamic testing during the entire initial drive and restrike of all piles so designated on the Plans or as otherwise directed by the Engineer or The Department. The dynamic testing firm shall continuously monitor the tensile and compressive stresses during driving to ensure that the permissible stress limits provided by the Engineer are not exceeded during driving. Should the driving operation result in stresses that approach or exceed the permissible limits, the dynamic testing firm's equipment operator shall immediately have the hammer stroke reduced or the driving operation stopped in order to prevent pile damage. If non-axial driving is indicated by dynamic test measurements, pile driving shall be stopped immediately and the Contractor shall realign the driving system or take other corrective action, as necessary, before resuming driving.

If the top of pile is damaged or becomes deformed at any time during the dynamic testing of the piles, pile driving shall be stopped and the damaged area cut off in accordance with Section 619 of the Standard Specifications. The remaining pile section shall be properly prepared for gauge installation and inspected by the Department prior to the continuation of driving.

All dynamically tested piles shall be driven in accordance with the Plans. Should the field data indicate the hammer system is not transferring to the pile the full energy anticipated at the end of initial drive, the Contractor shall increase the hammer stroke and/or driving resistance until the minimum initial drive capacity is displayed on the dynamic testing apparatus. However, in no case shall the permissible stress limits be exceeded.

The Contractor shall maintain a minimum distance of 1-foot between the pile monitoring gages and the ground surface, water surface, or pile template. If additional ground penetration is required, the driving shall be halted, the gages removed and the pile spliced before proceeding with additional driving and monitoring. Prior to splicing, the pile splice segment shall be properly prepared for gage installation in accordance with ASTM D4945 and made accessible to the Department for inspection. After the pile has been properly spliced and the hammer and leads have been reset, the gages shall be reattached to the new pile segment and the drive continued.

Restriking of all test piles as indicated on the plans or directed by the Department shall be dynamically tested by the Contractor. Dynamic testing of production piles shall be at the request of the Department based on actual field conditions.

**Method of Measurement:**

High-Strain Dynamic Pile Testing by Contractor authorized and found acceptable by the Department will be measured on an Each basis upon receipt and acceptance of the associated dynamic testing report(s). Each initial drive and each restrike dynamically monitored by the Contractor shall be measured as separate units.

Signal Matching Analysis will be measured for at the Contract unit price per each.

**Basis of Payment:**

Payment for High-Strain Dynamic Pile Testing by Contractor authorized and found acceptable by the Department will be made at the Contract unit price per Each for Item 619519. Payment for Signal Matching Analysis by Contractor and found acceptable by the Engineer will be made at the Contract unit price per Each for Item 619539. The payment will also be full compensation for preparing the preconstruction wave equation analyses, and preparation of reports.

Price and Payment will constitute full compensation for furnishing tools, labor, specialty subcontractor, materials, equipment, analyses, reports, and incidental work required to perform high-strain dynamic pile testing during initial driving and restrikes including providing inspection access to the Engineer and the Department.

4/29/11

**708500 - REPLACING CATCH BASIN GRATES**  
**708504 - REPLACING CATCH BASIN FRAMES**

**Description:**

This work consists of furnishing and installing catch basin (inlet) grates and catch basin (inlet) frames at the locations shown on the Plans and/or as directed by the Engineer.

**Materials and Construction Methods:**

The catch basin (inlet) grates and catch basin (inlet) frames shall conform to the materials and the dimensions Construction Details or as noted in the Contract Plans. The Contractor shall make field measurements to determine the exact sizes of the grates and frames prior to placing order; and make necessary masonry adjustment to accommodate the prescribed frames. All existing grates and/or frames conforming to the requirements of the Standard Construction Details shall be left in place, or reused after making necessary masonry adjustment. The cost of adjustment to match proposed grades as indicated on the Plans and/or as directed by the Engineer, shall be included in the cost of the item 708504.

**Method of Measurement:**

The quantity of grates and/or frames replaced will be measured as the actual number of each, installed and accepted.

**Basis of Payment:**

The quantity of grates and/or frames replaced will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing, hauling, installing, making necessary masonry adjustment, for all labor, tools, equipment, and incidentals to complete the job.

Also included in the unit bid price shall be the payment for transporting the old grates, and/or old frames, to the Department's District Maintenance Yard as specified on the Plans, or as directed by the Engineer.

8/28/01

**708512 – DRAINAGE INLET, SPECIAL I**  
**708513 – DRAINAGE INLET, SPECIAL II**  
**708514 – DRAINAGE INLET, SPECIAL III**  
**708515 – DRAINAGE INLET, SPECIAL IV**  
**708516 – DRAINAGE INLET, SPECIAL V**  
**708517 – DRAINAGE INLET, SPECIAL VI**  
**708518 – DRAINAGE INLET, SPECIAL VII**  
**708653 – DRAINAGE INLET, SPECIAL VIII**  
**708654 – DRAINAGE INLET, SPECIAL IX**  
**708655 – DRAINAGE INLET, SPECIAL X**  
**708656 – DRAINAGE INLET, SPECIAL XI**  
**708657 – DRAINAGE INLET, SPECIAL XII**

**Description:**

This work consists of furnishing and placing a reinforced concrete drainage inlet at the locations shown on the Plans.

**Materials:**

Materials shall conform to the requirements of Section 611, 612, 708, 812 and 824 of the Standard Specifications.

**Construction Methods:**

Special inlets shall be placed in conformance with the requirements of Sections 602 and 708 of the Standard Specifications, and with the details, dimensions, and notes as shown in the details found in the Plans and at the location shown on the Plans.

**Method of Measurement:**

The quantity of inlets will be measured as the actual number of each type installed and accepted. Inlet and outlet pipe will not be measured under this item, but will be measured with the adjoining pipe under the appropriate item for the size and type of pipe installed.

**Basis of Payment:**

The quantity of inlets will be measured and paid for at the Contract unit price per each, installed and accepted. Price and payment will constitute full compensation for furnishing, hauling, and installing all materials, including concrete and bar reinforcement, any necessary fittings, frames, and grates; for excavating, backfill, backfilling, compacting, roadway patching materials, roadway patching, and disposing of surplus materials; for cribbing, shoring, and sheeting; and for all labor, equipment, tools, and incidentals required to complete the work. If rock is encountered, rock excavation will be paid under Section 206.

Inlet and outlet pipe will be paid for under the appropriate item for the size and type of pipe installed.

9/16/10

**708537 - REMOVE CATCH BASIN**

**Description:**

This work consists of removal and disposal of existing catch basins and manholes where specified on the Plans.

**Material and Construction Methods:**

The existing catch basin and manholes shall be removed entirely where specified on the Plans. This may require removal of a portion of pipe connected to the catch basin or manhole. The pipe shall be removed to the nearest joint or cut as directed by the Engineer. The existing pipe shall be plugged with concrete where specified on the Plans. The catch basin or manhole, including grates and excess pipe, shall be disposed of by the Contractor. The hole where the catch basin or manhole was removed shall be backfilled with Type 'C' borrow and compacted in accordance with Section 208.04.

**Method of Measurement:**

The quantity of catch basins and manholes removed will be measured as the actual number of catch basins and manholes removed and accepted.

**Basis of Payment:**

The quantity of catch basins and manholes removed will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for removal and disposal of the catch basin or manhole, including grates, excavation; backfilling the hole, patching the hole with roadway patching materials, all materials, including backfill and roadway patching materials, plugging the existing pipes, and for all labor, equipment, tools and incidentals necessary to complete the item.

9/16/10

**708579 – ABANDON EXISTING MANHOLE**

**Description:**

This work consists of abandoning existing manholes and catch basins in accordance with these specifications, Plans and as directed by the Engineer and the Owner of the Utility.

**Material:**

Portland Cement Concrete Masonry for pipe plug shall conform to Class C, Section 812, and Borrow Type B shall conform to Section 209 of the Standard Specifications.

**Construction Methods:**

The existing walls of the manhole and catch basins shall be removed to a minimum depth of 2 feet (0.6 m) below proposed ground elevation. All existing pipes leaving or entering the manhole or catch basins shall be satisfactorily plugged with P.C.C. Masonry as detailed on the Plans and/or as directed. After plugging of the pipes, the remaining manhole or catch basins structure shall be filled with Borrow Type B, and satisfactorily compacted. The frame and cover shall be disposed of as directed by the Engineer.

The pavement surface shall be restored if required to a condition compatible with the surrounding area as directed by the Engineer.

**Method of Measurement:**

The quantity of manholes and catch basins abandoned will be measured as the actual number of manholes and catch basins abandoned and accepted by the Engineer.

**Basis of Payment:**

The quantity of manholes and catch basins abandoned will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for removal and disposal of materials, furnishing and placing concrete and Borrow Type B, plugging the pipes, roadway patching materials, and for all labor, equipment, tools and incidentals necessary to complete the item.

9/16/10

**708582 – MANHOLE, SPECIAL I**  
**708596 - MANHOLE, SPECIAL II**  
**708597- MANHOLE, SPECIAL III**

**Description:**

This work consists of furnishing and placing a reinforced concrete manhole at the locations shown on the Plans.

**Materials:**

Materials shall conform to the requirements of Section 611, 612, 708, 812 and 824 of the Standard Specifications.

**Construction Methods:**

Manholes shall be placed in conformance with the requirements of Sections 602 and 708 of the Standard Specifications, and with the details, dimensions, and notes as shown in the details found in the Plans and at the location shown on the Plans.

**Method of Measurement:**

The quantity of manholes will be measured as the actual number of each type installed and accepted. Inlet and outlet pipe will not be measured under this item, but will be measured with the adjoining pipe under the appropriate item for the size and type of pipe installed.

**Basis of Payment:**

The quantity of manholes will be measured and paid for at the Contract unit price per each, installed and accepted. Price and payment will constitute full compensation for furnishing, hauling, and installing all materials, including concrete and bar reinforcement, any necessary fittings, frames, and grates; for excavating, backfill, backfilling, compacting, roadway patching materials, roadway patching, and disposing of surplus materials; for cribbing, shoring, and sheeting; and for all labor, equipment, tools, and incidentals required to complete the work. If rock is encountered, rock excavation will be paid under Section 206.

Inlet and outlet pipe will be paid for under the appropriate item for the size and type of pipe installed.

9/16/10

**708583 - PERSONNEL GRATE FOR PIPE INLET**

**Description:**

This work consists of furnishing all materials, fabricating, delivering and constructing personnel grates for pipe inlets in accordance with the Standard Details, at locations as shown on the Plans, as directed by the Engineer and as required by these Special Provisions.

**Materials:**

Materials shall conform to the requirements of Sections 603 and 612 and shall be galvanized in accordance with Subsection 826.07 including all rebar, hardware and fasteners as shown on the Standard Details.

Working drawings shall be submitted in accordance with Subsection 105.04.

**Construction Methods:**

Personnel grates for pipe inlets shall be constructed based on the Standard Details and at the size and locations shown on the Plans.

**Method of Measurement:**

The number of inlet grates to be paid for under this item shall be the actual number of inlet grates installed and accepted.

**Basis of Payment:**

The quantity of personnel grate for pipe inlet will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing, hauling and installing materials, including bar reinforcement; for excavating including removal and disposal of existing end sections, backfilling, and compacting; for cribbing, shoring, sheeting, coating, and paving; and for all labor, materials, equipment, tools, and incidentals required to complete the work. Design services for the personnel grate for pipe inlet including the preparation and submittal of working drawings shall be incidental to this item.

8/23/10

**712531 - CHANNEL BED FILL**

**Description:**

This work consists of salvaging, stockpiling and placing natural channel bed fill (on-site material) or the furnishing, hauling, and placing similar natural channel bed fill (off-site material) in accordance with the notes and details on the Plans, the Special Provisions, and as directed by the Engineer.

**Materials and Construction Methods:**

The plan quantity includes the total volume of material necessary for Channel Bed Fill at the locations and dimensions as shown on the plans. This volume will be provided from on-site material, off-site material or a combination thereof. However, all on-site material must be utilized as Channel Bed Fill before any off-site material may be used. Off-site material shall not be used without the approval of the Engineer. It is the Contractor's responsibility to determine if sufficient quantity of Channel Bed Fill will be available on-site and to furnish additional materials as needed.

The material to be used for Channel Bed Fill shall be determined from the native channel bed material present at the project site and in portions of the existing stream immediately upstream and downstream. The existing natural channel bed material may consist of, but not limited to, natural sediments, silt, sand, gravel, pebbles, small stones and all like material and shall constitute the on-site material to be used as Channel Bed Fill. Any existing riprap material shall be excluded from use as Channel Bed Fill. The depth of material acceptable as Channel Bed Fill shall be determined in the field. The existing natural channel bed material shall be excavated from the existing channel bottom within the project limits prior to the removal of any existing substructure elements. Excavation shall be paid under its respective item, but completed in accordance with this item. On-site channel bottom materials shall be stockpiled on-site and kept separate from all other excavation or borrow materials. All stockpiles shall be properly stabilized.

If the volume of on-site material is inadequate, additional off-site material to be utilized as Channel Bed Fill shall have a coloration, shape and gradation similar in appearance to the native channel bed material. Any stone or gravel materials shall be naturally rounded riverbed material or gravel and shall be uncut. If gradation requirements are not provided in the Plans, the Contractor shall have a sieve analysis performed on a sample of the existing streambed material. This sample shall be taken from a location either directly upstream or downstream from each site where the Channel Bed Fill is to be placed and shall be a sample of the streambed surface armoring material, not an augered sample. The new stone shall match as closely as possible to the  $D_{min}$ ,  $D_{50}$ ,  $D_{90}$ , and  $D_{max}$  of the taken sample. The sample size shall consist of a minimum of 200 pieces of the existing streambed surface armoring materials. The results of the sieve analysis and the proposed gradation and sources of additional off-site material shall be submitted to the Engineer for approval.

In areas to receive Channel Bed Fill, the voids of the proposed riprap shall be filled using Borrow Type B prior to the placement of any Channel Bed Fill. The voids shall be filled such that the tops of some individual riprap stones are still visible. Borrow Type B shall be paid under its respective item. Once complete, Channel Bed Fill shall be placed at the locations and dimensions as shown on the plans.

**Method of Measurement:**

The quantity of Special Borrow for Channel Bed Fill will be measured by cubic yards of material placed and accepted.

**Basis of Payment:**

The quantity of Channel Bed Fill will be paid for at the Contract unit price per cubic yard. Price and payment will constitute full compensation for salvaging, stockpiling, maintenance of any stockpiles, furnishing, hauling, and installing all materials; for all sample gathering, sieve analysis and submittals associated with use of off-site material; and for all labor, equipment and other incidentals necessary to complete the work. Excavation of all natural streambed material shall be paid under its respective item. Furnishing and placement of Borrow Type B shall be paid under its respective item.

12/7/04

**715500 - UNDERDRAIN OUTLET PIPE, 6"**  
**715504 - UNDERDRAIN OUTLET PIPE, 8"**

**Description:**

This work consists of furnishing and placing underdrain outlet pipe in accordance with the locations, notes and details shown on the Plans and as directed by the Engineer.

**Materials and Construction Methods:**

The materials and construction methods for underdrain outlet pipe shall conform to the applicable requirements of Section 715 of the Standard Specifications, except there shall be no requirements for filter fabric and Del. No. 8 stone around the pipe and the pipe shall not be perforated. The material for underdrain outlet pipe shall be the same as for perforated pipe underdrains.

The installed under drain outlet pipe shall be video inspected in accordance with Subsection 715.07 of the Standard Specifications.

**Method of Measurement:**

The quantity of underdrain outlet pipe will be measured from end to end in linear feet (linear meters) of pipe completed and accepted.

**Basis of Payment:**

The quantity of underdrain outlet pipe will be paid for at the Contract unit price per linear foot (linear meter) of the diameter as specified on the Plans. Price and payment will constitute full compensation for furnishing all materials, excavation and backfilling, connectors, bolts to block outlet opening to prevent small animals from entering, video inspection for all labor, tools, equipment and incidentals to complete the item.

10/29/01

**715502 - TEMPORARY DRAINAGE PIPE, 30"**  
**715503 - TEMPORARY DRAINAGE PIPE, 48"**  
**715505 - TEMPORARY DRAINAGE PIPE, 15"**  
**715506 - TEMPORARY DRAINAGE PIPE, 24"**  
**715507 - TEMPORARY DRAINAGE PIPE, 36"**  
**715508 - TEMPORARY DRAINAGE PIPE, 18"**  
**715510 - TEMPORARY DRAINAGE PIPE, 12"**  
**715515 - TEMPORARY DRAINAGE PIPE, 60"**

**Description:**

This work consists of furnishing, installing, and disposing of temporary drainage pipe and end sections in accordance with the locations and elevation shown on the Plans and as directed by the Engineer.

**Materials:**

Pipe, fittings, and end sections initially furnished under this section shall be as noted on the Plans. If material is not specified on the Plans, the Contractor may use either Corrugated Polyethylene Pipe meeting the requirements of AASHTO M 294 or reinforced concrete pipe meeting the requirements of Section 612 of the Standard Specifications, or corrugated metal pipe meeting the requirements of Sections 614 of the Standard Specifications and as noted on the Plans. End sections and fittings shall be the same material as the pipe.

The pipe provided shall have a connection systems with all necessary gaskets, sealers, clamps, etc. required to produce water tight joints.

**Construction Methods:**

Temporary pipe is to be placed in accordance with Standard Specification Section 208 except that in order to maintain drainage during embankment construction, it will be necessary to install the temporary pipe prior to placement of the fill.

The temporary pipes shall be installed with leak resistant joints. The Contractor shall be responsible for the repair of leaks and damage caused by such leaks.

Temporary pipe is to be backfilled utilizing suitable excavated material or material being used for construction of the embankment over the pipe.

Required compaction shall be 95% or more of the laboratory maximum density.

The Contractor shall be responsible for placing sufficient embankment over the temporary pipe prior to crossing the area with any substantial loads. Any pipe damaged due to excessive loading must be excavated, replaced and backfilled by the Contractor at his/her expense. In areas of multiple pipes, sufficient separation of the pipes shall be maintained in order that proper compaction around all pipes can be performed.

If pipes are not to be covered with fill, they shall be securely anchored to prevent movement under use.

In order to maintain stream flow at all times, it will be necessary to offset the temporary pipe location from the permanent pipe location. Necessary diversion of ditches to align the flow through the temporary pipe and then back through the permanent pipe shall also be performed under this item.

When pipe is no longer needed it shall be removed and the resulting trench shall be backfilled. Where under final roadway the backfill material shall conform to the requirements of Borrow Type C. When water is present Borrow Type B shall be used for backfill up to 12" (300 mm) above the elevation of the water.

**Method of Measurement:**

The quantity of temporary drainage pipe will be measured as the actual number of linear feet (linear meters) of pipe installed and accepted, measured end to end including any fittings, end sections, couplings or connecting bands which will not be measured or paid for separately.

**Basis of Payment:**

The quantity of temporary drainage pipe will be paid for at the Contract unit price per linear foot (linear meter). Price and payment will constitute full compensation for furnishing, hauling, and installing the pipe, fitting, and end sections, for all cribbing, shoring and sheeting, and for all materials including couplings or connecting bands, labor, equipment, tools, and incidentals necessary to complete the work. Also included in this item is the excavation, backfill, and backfilling necessary to install the pipe, remove the pipe, and fill the empty trench.

If pipes are not covered with fill, this item will include all cost for securely anchoring the pipes and all cost for complete removal of such anchoring system.

Following its removal, the temporary pipe, fittings, and end sections will be eligible for reuse at other location(s) of this Contract if approved by the Engineer and desired by the Contractor. The Engineer shall be the sole authority in determining the acceptability of the pipe, fittings, and end sections for reuse. If approved, any reuse of temporary pipe, fittings, and end sections will again be paid as if the pipe was new. All provisions outlined in this specification will apply to both new and reused pipes.

After final use of the pipes, fittings, and end sections, they shall become the Contractor's property and shall be removed from the project. However, the Contractor may use these pipes, fittings, and end sections for similar work on this job at different locations(s) or on different jobs if found to be in good condition as determined by the Engineer.

10/25/01

**720506 - RELOCATING PORTABLE P.C.C. SAFETY BARRIER**

**Description:**

This work consists of relocating the P.C.C. Safety Barrier at the job site to locations indicated on the Plans and/or as directed by the Engineer.

**Construction Methods:**

The relocations under this item shall be made once the initial placements of the P.C.C. Barriers are completed and accepted under the item(s) 720567 - Furnish and Maintain Portable P.C.C. Barrier.

The relocation(s) may be made for temporary storage at job site for later use, or relocation(s) required by the Plans and/or as directed by the Engineer at the construction sites. The vertical surfaces of the barriers to be exposed to the moving traffic, shall be painted with white latex paint prior to each relocation. Also, the barriers shall be painted every six-months after relocation if left at the same location and shall be painted before the winter shut-down in the Fall.

**Method of Measurement:**

The quantity of portable P.C.C. safety barrier relocated will be measure in linear feet (meters) of barrier relocated.

**Basis of Payment:**

The quantity of portable P.C.C. safety barrier relocated will be paid for at the Contract unit price per linear foot (meter). Price and payment will constitute full compensation for relocating the barriers, temporary storage at the job site, furnishing paint and painting, maintenance, for all labor, tools, equipment and necessary incidentals to complete the work.

01/21/01

**720512 - P.C.C. SAFETY BARRIER PERMANENT, DOUBLE FACE**  
**720529 - P.C.C. SAFETY BARRIER PERMANENT, SINGLE FACE**  
**720587 - P.C.C. SAFETY BARRIER PERMANENT, DOUBLE FACE, MODIFIED**  
**720651 - P.C.C. SAFETY BARRIER PERMANENT, DOUBLE FACE BIFURCATED TYPE 1**  
**720652 - P.C.C. SAFETY BARRIER PERMANENT, DOUBLE FACE BIFURCATED TYPE 2**  
**720654 - P.C.C. SAFETY BARRIER PERMANENT, SINGLE FACE, MODIFIED TYPE 1**  
**720655 - P.C.C. SAFETY BARRIER PERMANENT, SINGLE FACE, MODIFIED TYPE 2**  
**720656 - P.C.C. SAFETY BARRIER PERMANENT, SINGLE FACE, MODIFIED TYPE 3**  
**720657 - P.C.C. SAFETY BARRIER PERMANENT, SINGLE FACE, MODIFIED TYPE 4**  
**720658 - P.C.C. SAFETY BARRIER PERMANENT, SINGLE FACE, MODIFIED TYPE 5**

**Description:**

This work consists of furnishing all materials and constructing permanent portland cement concrete safety barrier in accordance with the locations, details, and notes shown on the Plans, and/or as directed by the Engineer.

**Materials:**

Material shall conform to the requirements listed on the Plans, and as noted herein. Portland cement concrete shall be 4500 psi (30 MPa) minimum and shall conform to the material requirements of Class A, Section 812, Portland Cement Concrete of the Standard Specifications.

Bar reinforcement shall be epoxy coated meeting the requirements of Section 604 Grade 60 (Grade 400).

Waterproofing membrane shall conform to the material requirements of Section 808 of the Standard Specifications.

**Construction Methods:**

Construction methods shall conform with the applicable subsections of Sections 602 and 603 of the Standard Specifications, and details shown on the Plans.

The Contractor shall have the option of constructing the permanent safety barriers by selecting Cast-In-Place, or Pre-Cast, or Slip-form methods. The Contractor shall submit his/her plans for the selected method to the Department's Materials and Research Section for approval. In case of selecting the Slip-form method, the Contractor shall be able to demonstrate his/her ability to successfully accomplish the item by his/her past involvement in doing such work. Slip-form plans shall show the sawing of 3" (75 mm) deep contraction joints every 10' - 20' (3 m - 6 m) as determined by the Engineer. The joints shall be sawed within 2-24 hours after placement of concrete depending upon the weather conditions.

**Method of Measurement:**

The quantity of permanent portland cement safety barrier will be measured by the linear foot (linear meter) along the toe of the barrier, installed in place and accepted.

**Basis of Payment:**

The quantity of portland cement safety barrier will be paid for at the Contract unit price per linear foot (linear meter) for each type of barrier. Price and payment will constitute full compensation for all material, formwork, sawing of joints, reinforcement bars, geotextile, backfill, drainage appurtenances, joint material, waterproofing membrane and concrete all complete in place and accepted, for all labor, equipment, tools and incidentals necessary to complete the work. Payment for this item includes excavation and the P.C.C. footer portion of the barrier included in this item.

4/6/11

**720517 - IMPACT ATTENUATOR, TYPE I**

**Description:**

\_\_\_\_ This work consists of furnishing and installing impact attenuator in accordance with the locations, notes and details on Plans, these Special Provisions, and as directed by the Engineer.

**Materials:**

The impact attenuator shall be a nongating device meeting the requirements of the NCHRP Report 350, Test Level 3. The configuration of the device shall be as specified (in published literature) by the manufacturer for the design speed indicated on the Plans. Dimensional requirements, if any, shall be as noted on the Plans.

The impact attenuator shall be designed and constructed so there is no solid debris on the roadway after either head-on or side angle impacts.

The impact attenuator shall be designed for quick and easy repair after an impact.

The impact attenuator must be approved by the Department prior to use. The Contractor shall submit the manufacturer's certification, literature and shop drawings for approval.

**Construction Methods:**

Installation of the impact attenuator shall be accomplished by experienced workmen in accordance with the manufacturer's recommendations. The Contractor shall provide written certification that the impact attenuator has been properly installed.

**Method of Measurement:**

The quantity of Impact Attenuator, Type 1 will be measured as the number installed and accepted.

**Basis of Payment:**

The quantity of impact attenuators will be paid for at the Contract unit price per each for "Impact Attenuator Type 1", which price and payment shall constitute full compensation for all materials and hardware required for furnishing and installing the impact attenuator complete in place and accepted, certificate of compliance from the manufacturer, shop drawing showing the details of the attenuator being attached to the existing object for approval, for excavation, foundation (if required), for all labor, equipment and incidentals necessary to complete the item.

11/14/01

**NOTE:**

When this item is completely installed, the Contractor may notify the Engineer and request acceptance. The Engineer will make an inspection of the installation and the Contractor shall correct any deficiencies. Once the corrective work is completed to the satisfaction of the Engineer, the installation will be accepted and the Contractor will be relieved from the responsibility for this item. If this item is damaged before the final acceptance of the project, and the damage is not the result of the Contractor's negligence, the Engineer will notify the Contractor to make repairs, and the Contractor will make repairs at the unit price bid (in the case of complete replacement or at a negotiated price (in the case of partial replacement or repair)). Damaged caused by the Contractor shall be repaired at no cost to the Department.

**720527 - PLASTIC DRUMS**

**Description:**

The item shall consist of furnishing, placing, relocating and maintaining plastic drums with reflective sheeting. Each drum weighted with sand filled base or weighted with other approved devices comprising an integral part of the drum shall be able to withstand 60 mph (100 km/h) winds, and conforming to the applicable requirements of the manual "Delaware Traffic Controls for Street and Highway Construction, Maintenance, Utility & Emergency Operations", (latest edition with all revisions made up to the Advertisement date). The device shall have at least an 18" (450 mm) diameter at the top and bottom and be at least 36" (900 mm) high. Drums damaged or stolen shall be replaced at the Contractor's expense. The drums shall be either new or refurbished to ensure required reflectivity as described herein; the Engineer may reject those plastic drums not suitable for the intended purpose. The warning light as applicable shall be installed on the top of the weighted drum.

**Reflective Sheeting for Plastic Drums**

Reflective sheeting shall consist of a retroreflective lens system having a smooth outer surface. When adhesive backing is used, the sheeting shall have a pre-coated adhesive on the backside protected by an easily removable liner.

**A. Color Requirements**

The colors specified shall be matched visually and shall be within the color tolerance limits shown on the appropriate Highway Color Tolerance Charts issued by the Federal Highway Administration utilizing the instruments thereon. Certification as to conformance with these requirements is acceptable.

**TABLE I  
Color Specification Limits and Reference Standards  
Type III Sheeting**

	Color Chromaticity Coordinates*								Reflectance Limits	
	(Corner Points)								Y	
	1		2		3		4		Min	Max
	X	Y	X	Y	X	Y	X	Y		
White**	.303	.287	.368	.353	.340	.380	.274	.316	27	--
Orange	.505	.360	.630	.371	.581	.418	.516	.394	14	30

Reference\*\*\*  
Standard  
(Munsell Papers)

White**	5.0PB 7/1
Orange	2.5 YR 5.5/1

\* The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 standard calorimetric system measured with standard illumination source C.

\*\* Silver White is an acceptable color designation.

\*\*\* Available from Munsell Color Company; 2441 Calvert Street, Baltimore, Maryland 21218.

**B. Reflective Intensity**

The reflective sheeting shall have minimum Specific Intensity per unit Area (SIA as shown in Table II expressed as "candelas per footcandle per foot" (Cd fx -1) ft. -2.) Measurement of SIA shall be conducted in accordance with the method detailed in section 718 of FP-79.

**TABLE II**  
**Minimum Specific Intensity**  
**Per Unit Area (SIA)**  
**(Candelas Per Footcandle Per Foot)**  
**A - Glass Bead Retroreflective**  
**Element Material**

Observation Angle	Entrance Angle	White	Red	Orange	Yellow
0.2	-4	250	45	100	170
0.2	+30	150	25	60	100
0.5	-4	95	15	30	62
0.5	+30	65	10	25	45

C. Specular Gloss

The reflective sheeting shall have an 85 degree specular gloss of less than 50 for III when tested in accordance with ASTM 523.

D. Color Processing

The sheeting shall permit cutting and color processing with compatible opaque process inks in accordance with the manufacturer's recommendations at temperature of 60 °F (16°C) to 100°F (38°C) and relative humidity (R.H.) at 20 to 80 percent.

E. Shrinkage

A 9" (225 mm) by 9" (225 mm) reflective sheeting specimen with liner shall be conditioned a minimum of 1 hour at 72°F (22°C) and 50 percent relative humidity. The liner shall be removed and the specimen placed on a flat surface with adhesive side up. Ten minutes after the liner is removed and again after 24 hours, the specimen shall be measured to determine the amount of dimensional change. The reflective sheeting shall not shrink in any dimension more than 1/32" (0.79 mm) to 10 minutes nor more than 1/10" (2.54 mm) to 24 hours.

F. Flexibility

The sheeting, with liner removed and conditioned for 24 hours at 0°C shall be sufficiently flexible to show no cracking when slowly bent, in one second's time, around 1/8" (3 mm) mandrel with adhesive contacting the mandrel. For ease of testing, it is recommended that talcum powder should be spread over the adhesive sticking to the mandrel.

G. Adhesive

The reflective sheeting shall include a pre-coated pressure sensitive adhesive backing, which may be applied without necessity of additional adhesive coats on either the reflective sheeting, or application surface.

The protective liner attached to the adhesive shall be removed by peeling without soaking in water, or other solvents without breaking, testing, or removing any adhesive from the backing. The protective liner shall be easily removed following accelerated storage for 4 hours at 160°F (71°C) under a weight of 2.5 lbs. per square inch (1758 kg/m<sup>2</sup>).

The adhesive backing of the reflective sheeting shall produce a bond to support a 1 3/4 pound (0.79 kg) weight for 5 minutes, without the bond peeling for a distance of more than 1" (25 mm) when applied to a smooth aluminum surface and tested as specified in Section 718, FP-79.

H. Impact Resistance

Reflective sheeting material, applied according to the manufacturer's recommendations to a cleaned, etched aluminum panel of alloy 6061-T6, 0.04" (1 mm) by 3.0" (75 mm) by 5.0" (125 mm) and conditioned for 24 hours at 32°F (0°C), shall show no cracking when the face of the panel is subjected

to an impact of 2 pounds (0.91 kg) weight with 5/8" (16 mm) rounded tip dropped from a 100" pound (11 N-m) setting on a Gardner Variable Impact Tester, IG-11120.

**Method of Measurement:**

Plastic drums shall be paid for Each/Day furnished and maintained. This includes relocation(s) of the drum as directed by the Engineer or as noted on the plans.

**Basis of Payment:**

The number of plastic drums, measured as provided above shall be paid for at the contract unit price bid Each/Day for "Plastic Drums", which price and payment shall constitute full compensation for furnishing and placing all materials, including plastic drums, reflective sheeting; for installation and all relocations, for maintenance, labor, tools, equipment, and incidentals required to complete the item.

01/17/01

**720532 - INSTALL PORTABLE IMPACT ATTENUATOR**  
**720534 - FURNISH PORTABLE IMPACT ATTENUATOR**  
**720539 - RELOCATE PORTABLE IMPACT ATTENUATOR**

**Description:**

Work under these items shall consist of furnishing, installing, maintaining, repairing, and relocating portable impact attenuators under the proper item(s) as required to protect the various construction work zones in accordance with these specifications and/or as directed by the engineer in the field.

**Materials:**

The impact attenuator shall be an energy-absorbing, non-gating, redirection device meeting the requirements of the NCHRP Report 350, Test Level 3. The configuration of the device shall be as specified (in published literature) by the manufacturer for the design speed indicated on the Plans. Dimensional requirements, if any, shall be as noted on the Plans.

No system that requires removal from site for repairs shall be accepted.

**Construction Methods:**

Installation of the attenuator system shall be accomplished by experienced workmen in accordance with the manufacturer's recommendations. The Contractor shall provide written certification that the impact attenuator has been properly installed. Such certification shall be to insure that the attenuator system device is crash-worthy according to the manufacturer's current specifications. Certification must be provided within 24 hours of the installation of the attenuator system.

Each attenuator system must be re-inspected and recertified after relocation.

The Contractor shall furnish (720534), install (720532) and relocate (720539) the attenuator system in project locations in accordance with these specifications and/or as directed by the Engineer in the field. Additionally, the Contractor shall furnish (720534) two complete replacement (stand-by) attenuator systems and store on site. If an installed attenuator is damaged, requiring replacement, the Contractor shall remove the damaged attenuator, install (720532) the replacement (stand-by) attenuator, and re-order a replacement (stand-by) attenuator system to be furnished to the project site (720534). If additional replacement (stand-by) attenuator systems are required on this contract, the procedure for payment outlined above will continue to be followed.

The attenuator system shall be repaired or replaced within 24 hours of the time when the Contractor is notified. After repair or replacement is completed as described above, re-inspection and recertification is required. The Contractor shall provide a 24-hour emergency contact, specifically for the repair or replacement of the attenuator system. If the system has not been repaired or replaced within 24 hours of notification, a \$1000 per hour penalty will be charged for each hour over 24 hours that the attenuator system goes unreplaced or unrepaired.

When no longer needed on the contract, any undamaged attenuator system(s) and the stand-by system shall become the property of the Contractor. Damaged attenuators will become the property of the Contractor.

**Basis of Payment:**

The payment for this item as required by the contract shall be made for the actual number of “Furnish Portable Impact Attenuator” furnished at the unit price bid per each, the actual number of “Install Portable Impact Attenuator” installed at the unit price bid per each, and the actual number of relocations performed under the item “Relocate Portable Impact Attenuator”, as required and approved by the Engineer at the unit price bid per each relocation. The prices under these items shall constitute full compensation for furnishing, installing, maintaining, relocating, delivery to the site, removal from the site, all labor, equipment, tools, and incidentals necessary to complete the work. When attenuators are damaged by the public and replaced with a stand-by attenuator by the contractor, the replacement will be paid for as one (1) installation.

In the case of partial replacement or repair, the Contractor will make repairs in accordance with the manufacturer’s recommendations and will be paid at the unit price listed on the repaired/replaced part(s) portion of the “Install Portable Impact Attenuator” and “Furnish Portable Impact Attenuator” forms. The Contractor shall list all major components of Portable Impact Attenuator that can be repaired/replaced independently, according to the manufacturer’s recommendations, and the total number of each component(s) that is necessary to comprise one (1) complete Portable Impact Attenuator. The Contractor shall submit a unit price per each component(s) multiplied by the number of each component shown in the form, and the sum shall equal the total cost of one installed Portable Impact Attenuator and one furnished Portable Impact Attenuator, respectively. Price and payment for attenuator repairs will constitute full compensation for furnishing and installing all materials, removing and disposing of damaged material, and for all labor, equipment, tools, and incidentals required to complete the work.

All maintenance of traffic costs associated with portable impact attenuator replacement or repairs shall be paid for under the unit price bid for the respective maintenance of traffic items. Attenuators damaged by the Contractor shall be repaired or replaced at the Contractor’s expense.

4/29/11

**720544 - REFLECTORS, WHITE, CONCRETE**  
**720545 - REFLECTORS, YELLOW, CONCRETE**

**Description:**

This work consists of furnishing and installing white and/or yellow reflectors on P.C.C. Safety Barrier or on concrete surfaces in accordance with the details and at the designated locations as shown on the Plans and/or as directed by the Engineer.

**Materials and Construction Methods:**

The reflector and related hardware shall be approved prior to its installation.

The reflector unit shall be installed to the P.C.C. Safety Barrier or to any other required concrete objects in accordance with the manufacturer's recommendations and/or notes on the Plans.

**Method of Measurement:**

The quantity of reflectors will be measured as the actual number of reflectors installed and accepted.

**Basis of Payment:**

The quantity of reflectors will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing the reflector, installing, labor, equipment, tools, and incidentals necessary to complete the work.

10/29/01

**720552 - REFLECTOR PANELS**

**Description:**

This work consists of furnishing and installing panels with retroreflective surfaces on P.C.C. safety barriers, as specified on the Plans in accordance with the Delaware Traffic Controls for Streets and Highway Construction, Maintenance, Utility and Emergency Operations (Latest edition with all revisions made up to the date of advertisement of this Contract) and as directed by the Engineer.

**Materials and Construction Methods:**

The retroreflective panels shall be 6 inches (150 mm) wide and 12 inches (300 mm) high with rounded corners (as per FHWA publication "Standard Highway Signs") and be double faced with durable retroreflective fluorescent orange sheeting facing traffic flow meeting the requirements of Delaware Traffic Control manual except the panels shall not indicate direction (no black corners). The panels shall be installed on the barrier at 50 feet (15 meter) intervals and at least 6 retroreflective panels shall be used at each location. The panels shall be bolted and not glued to the safety barriers. The Contractor shall keep the retroreflective panels clean, and all damaged panels shall be replaced at Contractor's expense. The retroreflective panels shall be relocated with the safety barriers and barrels as integral part of them at no extra payment for relocated retroreflective panels. The retroreflective panels shall become the property of the Contractor after the completion of the Contract.

**Method of Measurement:**

The quantity of reflector panels will be measured as the actual number installed and accepted.

**Basis of Payment:**

The quantity of reflector panels will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing panels and hardware, installation and removal after no longer required, for all labor, equipment, tools and necessary incidentals to complete the work.

01/24/01

**720567 - FURNISH AND MAINTAIN PORTABLE P.C.C. SAFETY BARRIER**

**Description:**

The item shall consist of furnishing and placing Portable P.C.C. Safety Barrier at the locations in accordance with the notes and details on the Plans and as directed by the Engineer. After the completion of the project, the safety barrier shall become the property of the Contractor and shall be removed from the project site.

**General Requirements:**

All barrier provided to satisfy this special provision shall be certified to be crashworthy in accordance with the National Cooperative Highway Research Program (NCHRP) Report 350 and the memorandum issued August 28, 1998 by the USDOT Federal Highway Administration **Information:** Crash Tested Work Zone Traffic Control Devices.

For new barrier, the Contractor shall submit to the Engineer the Federal Highway Administration NCHRP-350 acceptance letter prior to acceptance.

An exception to this requirement is barrier that:

- 1.) Was manufactured prior to October 1, 2002.
- 2.) Is constructed of Class A concrete (as defined in Section 812 of the Standard Specifications) and is adequately reinforced.
- 3.) Has a joint system that provides a positive connection between adjacent segments that can transfer tension and moment in a vertical plane across the joint [The Contractor must certify that the joint system provided has been tested and found acceptable under National Cooperative Highway Research Program (NCHRP) Report 230 test criteria].

For this barrier, the Contractor shall certify, in writing to the Engineer prior to installation, that his/her barrier meets the above three (3) conditions.

On each project, the Contractor shall use only one type of barrier. All sections of barrier shall be of equal length and use the same type connector.

For DelDOT administered projects the certification (for new barrier or barrier manufactured prior to October 1, 2002) shall be submitted to the Engineer prior to installation.

The barriers shall be placed on the construction site at the location(s) shown on the Contract Plans, and as directed by the Engineer. The vertical surface of the barriers to be exposed to the moving traffic, shall be painted with white latex paint prior to the initial installation. The barriers shall be painted every six months after the initial placement if left at the same location and shall also be painted before the Winter shut down in the Fall.

Workmen or equipment movements shall not be allowed to traverse between the barricaded areas and the travel lanes, except as approved by the Engineer. However, after obtaining the approval, adequate number of flaggers shall be provided to safeguard workmen and traffic, in advance of, and at the point where the barrier is opened.

Warning lights, reflectors, and other traffic protective devices shall be placed in accordance with the DE MUTCD (Delaware Manual on Uniform Traffic Control Devices) (latest edition with all revisions made up to the date of Advertisement of this project) and as directed by the Engineer. Payment for these traffic protective devices shall be made under the applicable bid items elsewhere of this Contract.

**Method of Measurement and Basis of Payment:**

The measurement of the item shall be made along the centerline of the barrier as the number of linear feet (meters) and payment shall be made at the Contract unit price per linear foot (meter) bid for the item "Furnish

and Maintain Portable P.C.C. Safety Barrier", which price and payment shall constitute full compensation for furnishing, placing, painting, and maintaining, for all labor, equipment, tools, and incidentals necessary to complete the work. Furnishing and Maintaining of Portable P.C.C. Barrier End Section, and/or Curved Sections if required and specified on the Plans, shall be treated as Item 720567 for measurement and payment and other requirements.

Payment for all subsequent relocations after initial placement performed under this item shall be made under the item 720506 - Relocating Portable P.C.C. Safety Barriers of this Contract.

5/14/02

**720585 - GUARDRAIL END TREATMENT ATTENUATOR, TYPE 1**  
**720586 - GUARDRAIL END TREATMENT ATTENUATOR, TYPE 2**  
**720588 - GUARDRAIL END TREATMENT ATTENUATOR, TYPE 3**

**Description:**

This work consists of furnishing and installing an impact attenuating guardrail end treatment in accordance with the locations, notes and details on the Plans, the Standard Construction Details, these Special Provisions, and as directed by the Engineer.

**Materials:**

The end treatment system shall meet the requirements of NCHRP Report No. 350 Test Level 3. The Guardrail End Treatment, Type 1 shall be designed for installation parallel to the roadway. The Guardrail End Treatment, Type 2 shall be designed for installation with the end flared back from the roadway. The Guardrail End Treatment, Type 3 shall be designed for installation where 2 runs of guardrail come together.

The entire end treatment shall be designed for quick and easy replacement after an impact.

Guardrail End Treatment Attenuator Type 1 shall have a minimum of 2 square feet (0.2 square meters) of yellow retroreflective material on the nose. Guardrail End Treatment Attenuator, Type 2 and Type 3 shall have a minimum of 3 square feet (0.3 square meters) of yellow retroreflective material on the nose.

The Contractor shall submit shop drawings, the manufacturer's certification, and the manufacturer's installation instructions to the Engineer. Installation cannot begin until these submissions have been approved by the Engineer.

**Construction Methods:**

The end treatment system shall be fabricated and installed in accordance with the manufacturer's recommendations and details shown on the Plans.

The end treatment system shall be installed so that there is no rigid object projecting more 4" (100 mm) above ground level in that portion of the attenuator impacted and broken away by an errant vehicle. It is the intent that the errant vehicle not be snagged by an embedded component of the end treatment attenuator.

The grading between the edge of pavement and the end treatment shall be 10:1 or flatter for the length of the end treatment.

Reflectorized washers are not to be used on attenuators unless specified and/or approved by the manufacturer.

The Guardrail End Treatment Attenuator, Type 1 shall be installed with steel tubes and soil plates for the first 4 (min.) wood post. As an alternate, the first 4 (min.) post may be hinged, breakaway steel post if the manufacturer's specifications permit.

Unless otherwise noted on the Plans, the Guardrail End Treatment Attenuator, Type 1 shall be installed with a 50:1 taper beginning 50' (15 m) from the end of the end treatment.

**Method of Measurement:**

The quantity of guardrail end treatment attenuators will be measured as the number of each type fabricated, installed and accepted.

**Note:** All guardrail end treatment attenuators will be considered as 50 feet (15 meters) long. The 50' (15 m) length will begin at the center of the nose post and extend back along the attenuator and guardrail to which it is attached. Any guardrail within the 50' (15 m) length will be considered as part of the guardrail end treatment attenuator and not be measured separately. Measurement for the guardrail will begin 50' (15 m) from the center of the nose post of the attenuator.

**Basis of Payment:**

The quantity of guardrail end treatment attenuators will be paid for at the Contract unit price per each type of guardrail end treatment attenuator. Price and payment will constitute full compensation for furnishing all materials, fabrication and installation and for all materials, labor, equipment, tools and incidentals required to complete the work.

**Note:** When this item is completely installed, the Contractor may notify the Engineer and request acceptance. The Engineer will make an inspection of the installation and the Contractor shall correct any deficiencies. Once the corrective work is completed to the satisfaction of the Engineer, the installation will be accepted and the Contractor will be relieved from the responsibility for this item. If this item is damaged before the final acceptance of the project, and the damage is not the result of the Contractor's negligence, the Engineer will notify the Contractor to make repairs, and the Contractor will make repairs at the unit price bid (in the case of complete replacement) or at a negotiated price (in the case of partial replacement or repair). Damage caused by the Contractor shall be repaired at no cost to the Department.

7/19/02

**720612 - IMPACT ATTENUATOR, SPECIAL****Description:**

This work consists of furnishing and installing impact attenuator in accordance with the locations, notes and details on Plans, these Special Provisions, and as directed by the Engineer.

**Materials:**

The impact attenuator shall be a non-gating, redirectional device meeting the requirements of the NCHRP Report 350, Test Level 3. The configuration of the device shall be as specified (in published literature) by the manufacturer for the design speed indicated on the Plans. Dimensional requirements, if any, shall be as noted on the Plans.

**Construction Methods:**

Installation of the impact attenuator shall be accomplished by experienced workmen in accordance with the manufacturer's recommendations. The Contractor shall provide written certification that the impact attenuator has been properly installed.

**Method of Measurement:**

The quantity of Impact Attenuator, Special will be measured as the number installed and accepted.

**Basis of Payment:**

The quantity of impact attenuators will be paid for at the Contract unit price per each for "Impact Attenuator, Special", which price and payment shall constitute full compensation for all materials and hardware required for furnishing and installing the impact attenuator complete in place and accepted, certificate of compliance from the manufacturer, shop drawing showing the details of the attenuator being attached to the existing object for approval, for excavation, foundation, for all labor, equipment and incidentals necessary to complete the item.

**NOTE:**

When this item is completely installed, the Contractor may notify the Engineer and request acceptance. The Engineer will make an inspection of the installation and the Contractor shall correct any deficiencies. Once the corrective work is completed to the satisfaction of the Engineer, the installation will be accepted and the Contractor will be relieved from the responsibility for this item. If this item is damaged before the final acceptance of the project, and the damage is not the result of the Contractor's negligence, the Engineer will notify the Contractor to make repairs, and the Contractor will make repairs at the unit price bid (in the case of complete replacement or at a negotiated price (in the case of partial replacement or repair)). Damaged caused by the Contractor shall be repaired at no cost to the Department.

3/3/11

**727520 - CONSTRUCTION SAFETY FENCE**

**Description:**

This work consists of furnishing all materials; erecting construction safety fence at location(s) as noted on the Plans or as directed, relocating if required and maintaining/repairing during the construction period. The construction safety fence shall be removed and disposed of after no longer required as determined by the Engineer.

**Materials and Construction Methods:**

The construction safety fence shall be 4' (1.2 m) high, high density polyethylene, U.V. stabilized, high visibility orange plastic with standard mesh opening size of approximately 1 1/2" (38 mm). The fence post shall be of sufficient length for 18" (450 mm) embedment in the ground and be oak wood, a minimum of 2" (50 mm) square or steel 1.25" x 1.00" (32 mm x 25 mm) T-Section. If the fence is to be installed on bituminous and/or concrete pavement, the Contractor shall use the kind of posts which can be anchored by placing sand beds at their base without damaging pavement. The post spacing shall be no more than 10' (3 meters) or as per the manufacturer's recommendation if a shorter spacing is specified. The ties for securing the fence to the post shall be 8" (200 mm) self-locking nylon safety ties. The fencing materials including the posts shall be approved by the Engineer prior to installation.

It shall be the responsibility of the Contractor to reposition/relocate the safety fence as necessary to perform construction activities. No payment shall be made for such repositioning/relocating and the cost shall be incidental to the item.

**Method of Measurement:**

The quantity of construction safety fence will be measured as the actual number of linear feet (meters) of safety fence furnished, installed and accepted.

**Basis of Payment:**

The quantity of construction safety fence will be paid for at the Contract unit price per linear foot (meter). Price and payment will constitute full compensation for furnishing, placing, maintaining, relocating and repositioning, cleaning the area, removal and disposal of the fence and related accessories, furnishing all labor, equipment, tools and all incidentals necessary to complete the work. Safety fencing stolen or damaged shall be replaced at the Contractor's expense.

1/17/01

- 735531 - SOIL RETENTION BLANKET MULCH, TYPE 1**
- 735532 - SOIL RETENTION BLANKET MULCH, TYPE 2**
- 735533 - SOIL RETENTION BLANKET MULCH, TYPE 3**
- 735534 - SOIL RETENTION BLANKET MULCH, TYPE 4**
- 735535 - SOIL RETENTION BLANKET MULCH, TYPE 5**
- 735536 - SOIL RETENTION BLANKET MULCH, TYPE 6**
- 735537 - SOIL RETENTION BLANKET MULCH, TYPE 7**

**Description:**

This work consists of furnishing, placing and anchoring soil retention blanket mulch over seeded areas in accordance with notes and details on the Plans, these specifications and direction of the Engineer.

**Materials:**

The blanket mulch shall be one of the pre-approved products listed in the Approved Product List (APL) at the time of bid, for the type(s) of mulch required on the Plans.

Pre-approval procedures and the current APL may be obtained by writing to the Stormwater Engineer, Delaware Department of Transportation, P. O. Box 778, Dover, DE 19903 or calling (302) 760-2177 or viewing DelDOT's web page at [www.deldot.net/business](http://www.deldot.net/business). The Contractor shall submit an 8" x 8" (200 mm x 200 mm) sample to the Stormwater Engineer to verify pre-approval. Also, the Contractor shall submit manufacturer's literature, including installation recommendations, to the Engineer.

The products on the APL have been used extensively on DelDOT projects with satisfactory results and/or have received satisfactory evaluations by the Texas Department of Transportation/Texas Transportation Institute (TxDOT/TTI).

Soil Retention Blanket Mulch, Types 1, 2, 3, 4 and 5, generally referred to as erosion control blankets (ECB), shall be composed entirely of 100% biodegradable material.

Soil Retention Blanket Mulch, Types 6 and 7, generally referred to as turf reinforcement mats (TRM), shall be composed of mostly non-degradable material.

In order for a product to be added to DelDOT's Approved Product List and be eligible for use in DelDOT's construction and maintenance works, the product must meet the above guidelines and receive a satisfactory evaluation by TxDOT/TTI. The Department will remove products from the APL when field performance is unsatisfactory.

**Types of Soil Retention Blanket Mulch Application**

- Type 1.** Sandy soils on slopes steeper than 3H:1V
- Type 2.** Sandy soils on slopes equal to or flatter than 3H:1V
- Type 3.** Top-soiled slopes steeper than 3H:1V
- Type 4.** Top-soiled slopes equal to or flatter than 3H:1V
- Type 5.** Top-soiled grass swale at maximum design shear stress less than or equal to 2 pounds per square foot (96 Pascals)
- Type 6.** Top-soiled grass swale at maximum design shear stress greater than 2 pounds per square foot (96 Pascals) and less than or equal to 6 pounds per square foot (287 Pascals)
- Type 7.** Top-soiled grass swale at maximum design shear stress greater than 6 pounds per square foot (287 Pascals) and less than or equal to 8 pounds per square foot (383 Pascals)

**Construction Methods.** The soil retention blanket mulch, shall be placed immediately after seeding operations have been completed or as approved by the Engineer, but in no case shall this period exceed 24 hours from the completion of the seeding operation. Prior to seeding and mulching, the area to be mulched shall be tracked, free of ruts, rocks or clods over 1 1/2 inches (40 millimeters) in maximum dimension and all sticks or other foreign materials which will prevent the close contact of the blanket with the soil. If as a result of rain, the prepared bed becomes crusted or eroded or if any eroded areas, ruts or depressions exist for any reason, the Contractor shall retrack and reseed the eroded areas.

Except for sprayed blanket mulch installation and anchorage of the soil retention blanket mulch shall be in accordance with notes and details in the Plans and the following DeIDOT Standard Construction Details:

Standard No. E-9 for rolled blankets under Types 1 through 5  
Standard No. E-25 for blankets under Types 6 and 7

Should the installation requirements of the manufacturer be more stringent than the above, the manufacturer's requirements shall govern.

Sprayed blanket mulches shall be applied as per the manufacturer's instructions and recommended rate. No application shall be permitted if rain is anticipated within 24 hours as determined by the Engineer.

**Method of Measurement:**

The quantity of soil retention blanket mulch will be measured in square yards (meters) of each type soil retention blanket mulch installed and accepted. Measurements for calculating the number of square yards (meters) will be made along the surface of the area covered. Overlaps of materials of any kind will not be measured.

**Basis of Payment:**

The quantity of soil retention blanket mulch will be paid for at the contract unit price per square yard (meter) per each type. Price and payment will constitute full compensation for furnishing and placing all materials; for all methods of anchorage and securement; for repairing any loose or raised pins or pegs or any loose, torn, or undermined fabric; and for all labor, equipment, tools, and incidentals required to complete the work.

01/24/01

**736500 - MOWING ROADSIDE**  
**736501 - MOWING MEDIAN**  
**736502 - MOWING**

**Description:**

This work consists of mowing roadside, median, and/or any designated areas to a height between approximately 4" (100 mm) and 6" (150 mm), unless otherwise indicated on the Plans, and in accordance with the locations, notes on the Plans and/or as directed by the Engineer.

**Equipment:**

Equipment used for mowing operations shall be mechanical, and shall be sufficiently equipped with safety devices to protect the operator, motorists, and pedestrians from moving hazards, and shall have prior approval of the Engineer. Hand mowing shall be performed on inaccessible areas at the direction of the Engineer.

**Method of Measurement:**

The quantity of mowing will be measured in linear feet (linear meters) of Mowing Roadside and/or Mowing Median, and in acres (hectares) for other designated areas.

Measurement for Mowing Roadside, shall be made along the approximate center line of the adjacent pavement for mowing areas between the right of way and pavement.

Measurement for Mowing Median shall be made along the approximate center line of the median area to be mowed.

No measurements shall be made for mowing traffic separation islands in intersections.

**Basis of Payment:**

The quantity of Mowing Roadside and/or Mowing Median, will be paid for at the Contract unit price per linear foot (linear meter) bid "Mowing Roadside" and/or "Mowing Median", and Contract unit price per acre (hectare) for "Mowing", as specifically applicable to this Contract. Price and payment shall constitute full compensation for all labor, tools, equipment, fuels, lubricants, safety devices, necessary traffic controls, location moves, and incidentals necessary for the performance of the work.

Mowing of traffic separation islands in intersections shall not be paid for separately, but are considered incidental to Mowing Roadside or Mowing Median.

For new construction contracts, there shall be no payment for the final clean up mowing as required in Subsection 104.13 of the Standard Specifications.

1/11/02

**737527 - INTERCHANGE TREE PLANTING**

**Description:**

This work shall include, but is not limited to, site preparation, and furnishing and installing shrubs and trees. All planting will be conducted by approved methods and shall be in accordance with the Contract Plans and Specifications and/or as directed by the Department. The area to be planted and paid for under this item shall include all designated planting areas on the Landscaping Plans.

**Materials:**

**General:** Any materials deemed not in compliance with the specifications by the Department shall not be utilized for this work. The Department reserves the right to reject, on or after delivery, any materials that do not meet the specifications. All rejected materials and equipment shall be removed from the work site by the end of the working day. Any equipment proposed for use by the Contractor for planting shall be subject to the approval of the Department.

**Trees and Shrubs:** All trees and shrubs shall be containerized and nursery-grown. Species and sizes have been designated in the Plant Schedule located on the SR1/I-95 Interchange Reforestation and Landscaping Plan Sheets, and no substitutions of products, tree or shrub types or sizes shall be made without the approval of the Department or an authorized representative. Requests for substitutions shall be made in writing and shall state the reason for the substitution, the suggested alternative and any change in cost. The names of the nurseries unable to supply the original specified trees and shrubs must be supplied with each request for substitutions. Dimensions of the container shall be appropriate to the size of the tree and shrub stock in accordance with standard nursery practices. Trees and shrubs shall be grown in containers long enough and under proper conditions so that new roots shall develop throughout the full volume of the soil in the container. All trees and shrubs shall be over-wintered stock, and shall be in a dormant state at the time of planting.

**Soil Mixture:** Planting soil mixture shall consist of one third peat moss or peat humus and two thirds native surface soil from the planting hole location. Soil mixing shall be confined to the planting hole and immediate surrounding area. Soil shall not be mixed while in a muddy or frozen condition. The soil mixture shall be free of hard clods, weeds, roots, sticks, toxic substances or any other extraneous material.

**Peat Moss and Peat Humus:** Peat moss and/or peat humus shall make up one third of the planting soil mix.

**(a) Peat Moss:** Peat moss shall be from sphagnum peat bogs. All peat moss shall be shredded, not dusty, and free of twigs, stones, hard lumps, roots, or any other undesirable materials. All peat moss must be moistened before using, but not watered to a saturated or puddle, unworkable condition. Peat moss shall show an acid reaction of 3.5 to 5.5 pH. The Contractor shall provide written certification from the manufacturer that the peat moss was obtained from sphagnum peat bogs.

**(b) Peat Humus:** Peat humus shall be a natural peat or peat humus from fresh water saturated areas, consisting of sedge, sphagnum, or reed peat and be of such physical condition that it passes through a 12.5 mm sieve. The humus shall be free from sticks, stones, roots, and other objectionable materials. Samples taken at the source of supply shall have the following analysis:

Acidity Range – 4.0 to 7.5 pH

Minimum Water Absorbing Ability – 200% by weight on oven-dry basis

Minimum Organic Content – 60% when dried at 105 C

**Fertilizer:** Fertilizer for all trees and shrubs shall be a time-release fertilizer of 100% resin-coated pill containing a minimum 19% total nitrogen, 6% available phosphoric acid, and 12% soluble potash. Fertilizer shall have a control release for nitrogen, potassium and phosphorous of 3 to 4 months at an average soil temperature of 70 degrees Fahrenheit. Fertilizer application shall be 60 grams for each shrub and tree.

Fertilizer shall be furnished in new, sealed and properly labeled packages or containers. Fertilizer shall conform to all applicable state and federal regulations. The Department may require the Contractor to furnish an affidavit from the vendor or a testing laboratory with the available nutrient information contained in the

fertilizer at no charge to the Department.

**Genetic Origin and Tree/Shrub Hardiness:** The source of all trees and shrubs shall be within the coastal or central portions of New York, New Jersey, Delaware, Maryland or Virginia and within Hardiness Zones 6 or 7. Nursery trees and shrubs grown outside of these geographic and hardiness boundaries are subject to approval by the Department. The genetic stock shall be chosen to provide typical form for the species. The contractor shall provide the Department with the source and genetic origin of the trees and shrubs.

**Mulch:** Mulch shall be chopped pine bark, shredded hardwood bark, wood chips, or similar material approved by the Department. All mulching materials will be visually inspected by the Department prior to delivery at the planting site and shall conform to the following requirements. Mulch shall only be applied around trees and shrubs planted in the area designated as Reforestation Area on the Reforestation and Landscaping Plans.

Chopped pine bark shall be freshly prepared so as not to be decomposed or in any condition that may shorten its lifetime as effective mulch. It shall be free of stones, sticks, weed seeds, pieces of wood, or bark that measure 4 inches in their longest dimension and shall not contain any toxic or foreign materials. The mulch shall contain no more than 50% of material passing through a  $\frac{3}{4}$  inch sieve. Shredded hardwood bark shall be from a deciduous hardwood source and be mechanically ground to a maximum size of 6 inches. In addition, the bark shall be relatively free of bark fines dust and shall exclude all foreign and toxic substances. Wood chips must be stockpiled for at least one year prior to placement as certified by the supplier and verified by the Department and shall not contain leaves, twigs, wood shavings, sawdust, or any foreign or toxic substances. One of the above mulches will be selected and approved for use throughout the entire project, and written certification for the above listed requirements of the mulch shall be submitted to the Department by the Contractor.

**Nomenclature:** Trees and shrubs shall conform to the nomenclature of "Standard Plant Names" as accepted by the American Standard for Nursery Stock, latest edition, published by the American Association of Nurserymen (AAN). Names of varieties not included shall conform to names accepted in the nursery trade and their use must be approved by the Department.

**Quality:** All trees and shrubs shall be true to type and nomenclature and typical of their species, variety, sizes and grading, and shall conform to those listed in the American Association of Nurserymen's "USA Standards for Nursery Stock". The Department shall receive a list of the suppliers of all trees and shrubs and a tag from each tree and shrub species at the time of delivery. All trees and shrubs shall be healthy and vigorous with numerous viable buds and a well-developed stem and root system that are not bound. Trees and shrubs shall be without stem damage or broken branches and shall have no significant disease or evidence of deleterious insect infestation that could adversely affect the survival or performance of the trees and shrubs. Any tree or shrub may be inspected for viability and specification adherence by the Department. Materials that represent undersized trees and shrubs or materials not conforming to the specifications may be rejected at the time of delivery, installation, or acceptance without any compensation.

**Submittals:** Within thirty days of the award of the contract, the successful bidder shall forward in writing to the Department, a complete list of sources for the proposed trees and shrubs including their genetic origins. Send submittals to Materials and Research, Delaware Department of Transportation, P.O. Box 778, Dover, Delaware, 19903. The Department will review these submitted materials and if deficient for any reason, additional information shall be provided by the Contractor. Problems associated with obtaining specified trees and shrubs shall be outlined in writing and forwarded to the Department. A list of vendors contacted shall also be included. The Contractor should be aware that more than one vendor may be required to obtain all the necessary trees and shrubs. Suggestions concerning appropriate substitutions may be included with this correspondence; however, only the Department may approve such substitutions. Within thirty days of the notice to proceed, two copies of a confirmed purchase order listing the quantity, species ordered, and delivery date shall be forwarded to the Department.

**Water:** All water for watering trees and shrubs shall conform to the requirements of Section 803.

**Construction Methods:**

**General:** Trees and shrubs shall be protected from desiccating winds and sun as well as maintained in a cool and moist environment during transport, on-site handling and all other phases of this work. Trees and shrubs not properly transported, packed or handled may be rejected without compensation and shall be removed from

the site by the end of each workday. Trees and shrubs shall be watered with freshwater and kept moist until installed.

The Contractor shall examine the area of planting to assure the area is properly prepared for planting. This includes the removal of any debris which appears on the site at the time of planting. The Department shall be notified in writing of any condition detrimental to the proper and timely completion of the work. The Contractor shall identify areas that may be problematic for planting and consult with the Department to determine corrective action. In such a case, planting work shall not proceed until either the condition is corrected or a waiver is granted by the Department.

**Tree and Shrub Inspection:** The Contractor shall be responsible for certificates that may be required by federal, state, or other authorities to accompany shipments of trees and shrubs. The successful bidder shall furnish the names and addresses of all plant nurseries intended as sources of trees and shrubs. The Department reserves the right to inspect all trees and shrubs at the nursery. This inspection will not in any way eliminate the right of rejection at the site. Inspection prior to transporting nursery material shall not be considered final approval.

The Department shall be notified at least 72 hours prior to the delivery of trees and shrubs to the project site. On-site inspections of the trees and shrubs, including root systems, may be made by the Department or the representative of the Department. Any tree or shrub delivered to the site that is damaged, desiccated, contains a dried root system or dried rootstock, or does not meet material specifications will not be accepted. The Department reserves the right to reject all stock found to be unsatisfactory. No payment will be made for any unsatisfactory materials or materials not accepted by the Department.

**Planting Schedule:** All trees and shrubs shall be planted during the time period March 1 through May 1 as designated by SR 1/1-95 Interchange Reforestation and Landscaping Plans. If trees and shrubs are not installed by May 1 an extended establishment period may be required. The Contractor shall submit to the Department a draft Estimated Planting Schedule no later than January 15th, subject to approval by the Department. The Contractor shall adhere to this schedule unless directed otherwise by the Department.

**Tree and Shrub Transport:** All transport/shipping/handling methods and materials shall be performed according to best nursery and horticultural practices. If directed by the Department, a description of the transport materials, packing procedures and shipping methods shall be provided. Transit time from the nursery to the construction site or designated delivery point shall be direct and shall not exceed 24 hours for all trees and shrubs. Trees and shrubs shall be scheduled for shipping so that the trees and shrubs arrive at the construction site or designated delivery location no earlier than 72 hours prior to their scheduled planting date.

**Tree and Shrub Handling:** If the trees and shrubs are not installed on the day of delivery, they shall be stored in a shaded location, kept from freezing, kept moist, cool, and out of the wind and sun.

**Tree and Shrub Watering:** All trees and shrubs shall be watered with freshwater daily until installation.

**Tree and Shrub Installation Period:** The Contractor shall complete the plantings within 72 hours of delivery of any portion of the trees and shrubs. The period of on-site storage may be extended if the Contractor can demonstrate to the Department's satisfaction, the ability to store the materials on site without damaging the viability of the trees and shrubs. During this period, it is the sole responsibility of the Contractor to ensure that the trees and shrubs are kept saturated and are not desiccated or subjected to stress.

**Planting Methods:** No planting shall occur until there is approval of plant material and site conditions by the Department.

**Containerized Tree and Shrub Stock:** The following planting methodology shall be used:

1. The soil surface shall be opened with a tile spade, hoe, or other appropriate hand or power tool. An auger may be used to develop the planting hole.
2. The planting hole shall be approximately 1.5 times the width and 1.5 times the depth of the root-mass and shall be wide enough to allow easy tree and shrub placement at the specified depth while limiting the formation of air pockets beneath and surrounding the planting hole.
3. Prior to placement of the tree or shrub in the planting hole, 60 grams of 19-6-12, 3- to 4-

- month-release granular fertilizer shall be placed in the bottom of the planting hole.
4. Trees and shrubs shall be placed in the planting hole with the root system oriented downward to a depth such that the top of the rootball is level with the surrounding soil surface.
  5. Backfill the hole with soil mixture containing one third peat moss or peat humus and two-thirds native soil. Hand compact the soil as the hole is backfilled to eliminate air pockets.
  6. Once the tree or shrub planting hole is closed, firm foot pressure shall be applied in several positions immediately adjacent to the plantings to ensure good soil, tree and shrub contact, and to remove any remaining air pockets and voids.
  7. If a soil depression is formed above or immediately adjacent to the planting location, soil shall be sloughed from the surrounding area and firmly tamped into the depression leaving the planting area at the same elevation as the surrounding soil.
  8. Apply a 2" thick circle of mulch in a 24" diameter circle in planting areas.

***Tree and Shrub Establishment:*** The tree and shrub establishment period for all planting shall begin immediately after all planting and replacements, as specified under Planting Methods, are complete and acceptable to the Department. The tree and shrub establishment period consists of one full growing season during which time the Contractor shall be responsible for all work necessary to keep the trees and shrubs in a live and healthy condition. If the Contractor completes all planting, as specified under the Planting Methods and Planting Schedule, by May 1, the semi-final inspection will be held on or about October 1 of that year. In the event the Contractor does not complete all planting by May 1, the semi-final inspection will be held on or about October 1 of the following year. All replacement trees or shrubs determined to be necessary at the semi-final inspection must then be approved at the replacement tree and shrub source by October 15. At this time, the Department will direct the Contractor to replace those trees and shrubs determined to be dead or unhealthy by December 1. The Contractor shall notify the Department in writing that all replacement planting has been accomplished. The Department will conduct a final inspection within 15 days after such notification to determine the acceptability of the replacements. If all replacements are at this time determined satisfactory by the Department, the Contractor will be relieved of all further responsibility for care and replacement.

All saucer limits of individual plants shall be kept free of weeds and grass during the life of the Contract. The Contractor may use a pre- or post-emergent herbicide to control such grass and weeds and shall be totally responsible for the proper use and placement of any such herbicide. As requested in writing by the Department, the Contractor shall be responsible to weed within all saucer limits of individual trees and shrubs, beginning ten calendar days after the date of notification. The Contractor shall prune and apply insecticides or fungicides as required. Repair tree and shrub saucer washouts when and as specified by the Department.

Any trees or shrubs that settle below or rise above the desired finished grades shall be reset at the proper grades. All replacements shall be trees or shrubs of the same kind, size, and quality as originally specified in the Contract, and they shall be furnished, planted, mulched, and watered as specified herein for new trees and shrubs.

If any dead or unhealthy trees or shrubs are discovered, they shall be removed and replaced within ten calendar days after the date of written notification.

If, upon written request, the Contractor fails to proceed within seven calendar days with the above requirements, the Department may arrange for and proceed with adequate labor, equipment, and material to perform the work requested.

The Contractor shall be responsible for all damage incurred to trees and shrubs as a result of fire, theft, vehicular damage, or acts of vandalism.

The Contractor shall water all trees and shrubs as required to sustain them in a healthy condition.

**Method of Measurement:**

The quantity of interchange tree planting will not be measured, but will be paid for at the contract lump sum price bid for "Interchange Tree Planting."

**Basis of Payment:**

The payment for this item will be made at the Contract Lump Sum bid for the item 737527 "Interchange Tree Planting." Price and payment will constitute full compensation for planting, furnishing, and placement of all materials including trees and shrubs, fertilizer, and mulch. Price and payment includes the care of the trees and shrubs until completion and acceptance of all planting; reforestation work; replacement planting; cleanup or repairs to trees and shrubs; acts of vandalism; and/or herbivory damage. The Contract Lump Sum includes all labor, equipment, tools, and incidentals required to complete the work.

The Contractor shall fill-in the price and the cost (unit price multiplied by proposed quantity) for each species and size listed on the Breakout Sheet. The unit price shall be equal to an installed price and include all incidental items required for proper installation of the material. The Contract Lump Sum price bid shall be the sum of the total cost for all species and sizes listed. The completed Breakout Sheet shall be attached to the bid proposal. Failure to submit the Breakout Sheet with the bid proposal will result in the bid proposal being declared non-responsive and will be rejected. The Department reserves the right to delete from the Contract the furnishing and installing of one or more species and/or sizes listed and the right to add or subtract from the quantity of each species and size listed. The Lump Sum will be adjusted in accordance with the Contractor's unit prices as required above. There will be no extra compensation to the Contractor if such additions and/or deletions are made. Payment for the planting as described above may be processed if, in the opinion of the representative of the Department, all work required described herein is satisfactorily completed. No partial payment will be made for any living tree or shrub unless planted in accordance with these specifications. No additional payment will be made for the furnishing of trees and shrubs larger than specified.

9/16/10

**743501 - WARNING LIGHTS, TYPE B**  
**743504 - WARNING SIGNS**  
**743507 - TEMPORARY BARRICADES, TYPE III**  
**743524 - TEMPORARY BARRICADES, TYPE III**  
**743525 - TEMPORARY WARNING SIGNS**

**Description:**

This work consists of furnishing, installing and maintaining these temporary traffic control devices in accordance with the contract documents and with the latest edition of the manual titled "Delaware Manual on Uniform Traffic Control Devices (MUTCD)," hereafter referred to as the "Delaware MUTCD", including all revisions as of the date of the advertisement of this Contract and as directed by the Engineer.

As required under the section entitled "Certification" temporary traffic control devices shall be crashworthy in accordance with the National Cooperative Highway Research Program (NCHRP) Report 350, the memorandum issued August 28, 1998 by The USDOT Federal Highway Administration, and/or in accordance with the latest edition of the Manual for Assessing Safety Hardware (MASH), published by the American Association of State Highway and Transportation Officials (AASHTO). In case of conflict between the Delaware MUTCD and the requirements of NCHRP Report 350 and/or MASH, the requirements of NCHRP Report 350 and/or MASH shall govern.

**Materials and Construction Methods:**

Materials and construction of all signs and barricades shall meet all requirements including retroreflectorization of the Delaware MUTCD.

Unless specified on the Plans, all temporary traffic control devices shall be either new or restored to a satisfactory condition. All reconditioned and/or restored temporary traffic control devices must be approved by the Engineer before their use. Bases of warning signs, when required, shall be weighted with sandbags to resist overturning.

Lane closures necessary for the installation of barricades and the placement of other temporary traffic control devices shall be in accordance with the requirements of the Delaware MUTCD. Type III barricades shall have a minimum width of 4' and shall be placed in accordance with the applicable sections of the Delaware MUTCD. Type B warning lights with yellow lenses shall be placed above all diversion barricades as shown on the plans or as directed by the Engineer. Type B warning lights with red lenses shall be placed above all closure barricades as shown on the plans or as directed by the Engineer. Type B warning lights shall not be used for any other purpose except as described above.

Temporary traffic protection devices shall be suitably maintained at all times. Such maintenance shall include washing sign faces, replacing deficient batteries and lights, aligning lights properly, replacing retroreflective materials, relocating barriers, and any other maintenance of traffic protection devices deemed necessary by the Engineer to maintain traffic in a safe and effective manner.

Warning signs and temporary warning signs shall be retroreflective and shall have rounded corners as per FHWA publication "Standard Highway Signs". Warning signs shall be installed in accordance with the applicable sections of the Delaware MUTCD.

For purposes of measurement and payment the following definitions for signs shall apply:

Warning Signs (Item 743504) are those signs that are generally permanently installed at the beginning of a sustained construction phase (i.e., a construction phase exceeding 24 hours) and/or at the beginning of the project and shall remain in place for the duration of the sustained phase and/or project.

Temporary Warning Signs (Item 743525) are those signs erected for a particular operation or phases of the project that do not exceed 24 hours and may remain in place just during working hours such as "Flagger Ahead" signs.

Any permanent warning signs used on the project shall be securely mounted on break away supports such that the supports are installed in the ground per the sign post manufacturers recommendations. Permanent warning signs shall not be mounted on portable sign stands except in the following situations:

- Any signs that are placed on a concrete island in the median of a divided highway may be mounted on portable sign stands with proper ballasting material in order to avoid drilling through the concrete to ground mount the sign.
- If a documented utility conflict exists and field adjustments to the sign location cannot be made, the sign may be mounted on a portable sign stand with proper ballasting material. Documentation of the utility conflict shall be provided to the Engineer.

All holes or trenches within paved roadways or sidewalks which could not be practically backfilled and paved prior to restoring the area to traffic, shall be covered by protective covers consisting of temporary steel plates, furnished, installed and secured in place by the Contractor at no extra cost to the Department.

All temporary traffic control work and related items shall either be performed entirely by the Contractor's own organization or totally subcontracted. Maintenance of the equipment shall not be subject to this requirement.

**Certification:**

Temporary traffic control devices used on all highways open to the public in this State shall conform to the Delaware MUTCD. All devices shall be crashworthy in accordance with the National Cooperative Highway Research Program (NCHRP) Report 350, the memorandum issued August 28, 1998 by The USDOT Federal Highway Administration, and/or in accordance with the latest edition of the Manual for Assessing Safety Hardware (MASH), published by the American Association of State Highway and Transportation Officials (AASHTO).

The Contractor shall submit certification for temporary traffic control devices used specifically on this project at or prior to the pre-construction meeting.

Certification of compliance with NCHRP report 350 and/or MASH is required for the following categories of temporary traffic control devices:

Category I contains small and lightweight channelizing and delineating devices, which includes cones, tubular markers, flexible delineator posts and drums, all without any accessories or attachments.

Category II includes temporary traffic control devices that are not expected to produce significant vehicular velocity changes to impacting vehicles. These devices, which shall weigh 45 kg (100 lbs.) or less, include Type III barricades, portable sign supports with signs, and intrusion alarms. Also included are drums, cones, and vertical panels with accessories or attachments.

For Category I devices, the manufacturer or Contractor may self-certify that the devices meet the NCHRP-350 and/or MASH criteria. The Contractor shall supply the Federal Highway Administration 2000, that have not been crash tested in accordance with NCHRP that falls under Category II and III devices.

**Method of Measurement:**

Temporary Barricades, Type III (743507) erected by the Contractor shall be measured in unit of L.F./Day furnished and used as required and approved by the Engineer.

Temporary Barricades, Type III (743524) erected by the Contractor shall be measured per Each furnished and used for the duration of the Contract and approved by the Engineer. This payment shall include installation, maintenance, replacement, cleaning and removal. No separate compensation shall be made for shifting the barricades to different locations(s) required after initial installation.

Warning Lights, Type B will be measured in units of Each/Day furnished and used, and approved by the Engineer.

Warning Signs shall be furnished and erected by the Contractor and measurement shall be made per Each for the duration of the sustained phase and/or project. Temporary Warning Signs shall be measured in unit

of Each/Day furnished and erected.

**Basis of Payment:**

The number of temporary barricades measured as described above, shall be paid for at the Contract unit price bid per Each barricade for the item "Temporary Barricades, Type III" which prices and payments shall be full compensation for providing certification, furnishing, placing, maintaining, and relocating the barricades as required, all labor, equipment, tools, and all incidentals necessary to complete the work. Barricades stolen or damaged shall be replaced at the Contractor's expense.

The number of each type of warning lights measured as described above shall be paid for at the Contract unit price bid per Each/Day for the item, "Warning Lights, Type B" as required by the Contract, which prices and payments shall be full compensation for providing certification, furnishing, placing, maintaining and relocating the lights, all labor, equipment, tools, and all incidentals necessary to complete the work. Warning lights stolen or damaged shall be replaced at the Contractor's expense.

The number of Warning Signs, measured as described above, shall be paid for at the Contract unit price bid per Each for the item, "Warning Signs", and the Contract unit price bid per Each/Day for "Temporary Warning Signs" which prices and payments shall be full compensation for providing certification, furnishing, placing, maintaining, and relocating warning signs, and any temporary sign supports, hardware, materials and all labor, equipment, tools, and incidentals necessary to complete the work. Signs stolen or damaged shall be replaced at the Contractor's expense.

Payment for traffic control devices shall be based on the Contractor's daily certification, on a Department's form, that the number of temporary traffic control devices are fully operational (i.e., lights working, signs in good legible condition and in their proper position).

9/16/10

**743512 - FURNISH AND MAINTAIN TRUCK-MOUNTED ATTENUATOR, TYPE I**  
**743537 - FURNISH AND MAINTAIN TRUCK-MOUNTED ATTENUATOR, TYPE II**

**Description:**

The item shall consist of furnishing, positioning, and maintaining truck mounted attenuator(s) (TMA), Type I and/or Type II at the project site(s) as required and specified on the Plans and as directed by the Engineer.

The Contractor shall be responsible for keeping the TMA in effective crashworthy condition for which it is designed throughout the life of the contract. Should the TMA be damaged at any time throughout the life of the project, repairs and/or replacement, if necessary, shall be the responsibility of the Contractor with cost to be incidental to this pay item.

The Contractor shall supply the manufacturer's roll ahead distances information of the TMA to be used. This information along with NCHRP Report certification shall be given to the inspection staff at least 7 calendar days prior to arrival of the unit at the project site and a copy shall be kept in the truck at all times. No payment for the TMA will be made if the information is not supplied.

At the completion of its usage, the TMA with the service truck shall remain the property of the Contractor and shall be removed from the site as part of this item.

**Materials and Construction Methods:**

The Truck Mounted Attenuator, Type I shall meet the requirements of NCHRP Report 350 Test Level 2. The TMA, Type I is to be used on highways with prior to construction posted speed up to and including 45 mph (70 km/h).

The Truck Mounted Attenuator, Type II shall meet the requirements of NCHRP Report 350 Test Level 3. The TMA, Type II is to be used on highways with prior to construction posted speed greater than 45 mph (70 km/h). The TMA Type II shall be used for the Delaware Turnpike and Interstate Mainline regardless of the construction zone posted speed.

The entire height and width of the TMA end shall be covered with 6" (150 mm) diagonal, inverted "V" stripes of retroreflective material placed 6" (150 mm) apart. A large rotating amber beacon or strobe light shall be mounted on the TMA vehicle in such a manner as to be clearly visible for a distance of not less than 500' (150 m) in all directions from the vehicle. The TMA vehicle shall also be equipped with a Type C arrow panel, complete with W1-6 arrow sign.

The TMA shall be attached to the back of a truck in accordance with the manufacturer's recommendations. The weight of the truck shall also be in accordance with the manufacturer's recommendations. The truck upon which the TMA is mounted must be in good operating condition. The truck must have a valid registration, registration number plate, current inspection documentation, weight verification, and proof of insurance.

The Contractor shall make arrangements with his supplier to have replacement components for the TMA readily available for immediate repair.

**Basis of Payment:**

The payment for furnishing and maintaining the truck mounted attenuator shall be made for at the contract unit price per Each-Day bid for "743512 - Furnish and Maintain Truck Mounted Attenuator, Type I" and/or "743537 - Furnish and Maintain Truck Mounted Attenuator, Type II", which price and payment shall constitute full compensation for furnishing and maintaining the unit, including the truck with Type C Arrow Panel, W1-6 sign, and the driver, the necessary repairs or replacement of the unit during its need on the job after damage, removal when no longer required, roll ahead distance information and for all labor, tools, equipment and necessary incidentals to complete the job.

Payment will only be made for those TMA units in place on the roadway and protecting active construction operations. No payment will be made for TMA units available or in storage but not in use.

2/28/09

**744500 - CONDUIT JUNCTION WELL, TYPE 6, 17" x 30" PRECAST POLYMER CONCRETE**  
**744506 - CONDUIT JUNCTION WELL, TYPE 7, 36" x 60" PRECAST POLYMER CONCRETE**  
**744507 - CONDUIT JUNCTION WELL, TYPE 8, 30" x 48" PRECAST POLYMER CONCRETE**  
**744509 - CONDUIT JUNCTION WELL, TYPE 10, 24" x 36" PRECAST POLYMER CONCRETE**  
**744520 - CONDUIT JUNCTION WELL, TYPE 1, 20" x 20" PRECAST CONCRETE**  
**744523 - CONDUIT JUNCTION WELL, TYPE 4, 20" x 42 1/2" PRECAST CONCRETE**  
**744524 - CONDUIT JUNCTION WELL, TYPE 5, 24" x 16" PRECAST CONCRETE**

**Description:**

This work consists of supplying, constructing and installing conduit junction wells. Types 1, 4 and 5 are precast concrete and Types 6, 7, 8 and 10 are precast polymer concrete. Sizes shown for precast concrete junction wells represent inside dimensions, while those listed for precast polymer concrete junction wells are outer dimensions.

**Materials:**

Concrete shall conform to Section 812, Class B of the Standard Specifications.

Castings shall conform to Section 708.05 of the Standard Specifications.

Frames and lids shall be in accordance with Sections 708 and 744 of the Standard Specifications. Provide suitable grounding lugs on all cast iron frames and covers.

Types 6, 7, 8 and 10 are precast polymer concrete stackable boxes with no base.

Ground rods shall be 3/4 - inch in diameter by 10 feet long and shall be constructed of copper clad steel. Connections in junction wells shall be by suitable bolted ground connections.

#6 Bare Copper Wire

Precast polymer concrete is reinforced by heavy-weave fiberglass with a compressive strength of 9,000-15,000 psi (62 - 103 MPa), impact energy of 30-72 ft. lbs. (40 - 98 N-m) and a tensile strength of 800-1,100 psi (5.6 - 7.6 MPa). Precast polymer concrete should be tested according to the requirements of ASTM Method D-543, Section 7, Procedure 1 for chemical resistance.

All precast polymer concrete covers shall be the heavy-duty type with a design load of 15,000 lbs. (6.8 tonnes) over a 10" (255 mm) square. The coefficient of friction should be greater than 0.5. The precast polymer concrete cover logo shall bear the inscription "DelDOT" (Types 6, 8, and 10) or "DelDOT TRAFFIC FIBER OPTICS" (Type 7).

**Construction Methods:**

The conduit junction well shall conform to the dimensions shown on the Standard Construction Details, in these specifications, or on the manufacturer's specifications and shall be built so as to ensure that the cast iron frame and lid or polymer concrete box and cover are set level with the surrounding surface when constructed within pavement, sidewalks, etc., and set above grade and graded to drain away from the junction well when constructed in unpaved areas. More than one conduit may extend into the well and shall conform to the dimensions shown on the Standard Construction Details or these specifications. A stone base shall be built for all types of junction wells.

Electrical circuits shall be bonded and grounded in each junction well with metallic parts (cast iron lids, etc.). One ground rod shall be installed inside each conduit junction well, with the top of the ground rod exposed at the bottom of the junction well. Using the appropriate ground rod clamps, connect #6 ground wire to the ground rod. Extend #6 ground wire to grounding lugs on the cast iron frame and cover. Sufficient slack shall be left in ground wire to provide acceptable access to the junction well when the cover is removed. Connect equipment grounding wire to conduit bushings and ground rod inside the manhole.

**Method of Measurement:**

The quantity of junction wells shall be the actual number of conduit junction wells by type, which are supplied, constructed, complete in place, and accepted, including frames, lids and ground rods or precast polymer concrete covers, and stone base. Frames and lids or precast polymer concrete covers must be installed prior to acceptance of this item.

Payment for all conduits extending into the junction well shall be included in the items for conduit installation.

The length of ALL conduits within a junction well shall conform to the Standard Construction Details or as directed by Engineer. Payment for cutting existing conduit as directed by Engineer, where a junction well is replaced with a larger type of junction well is included in the bid price. The removal and replacement of cables within the conduits to be shortened shall be handled under other items of this contract.

**Basis of Payment:**

Payment for conduit junction wells as measured above shall be made at the Contract unit price per each junction well of the type indicated, completely installed and constructed, including excavation and backfilling. Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

4/6/11

**744505 - ADJUST OR REPAIR EXISTING CONDUIT JUNCTION WELL**

**Description:**

This work consists of adjusting or repairing existing conduit junction wells, including furnishing all materials, in accordance with this specification, notes and details on the Plans, the Standard Construction Details, and as directed by the Engineer.

**Materials:**

Portland cement concrete shall conform to the requirements of Section 812, Class B.

Mortar shall conform to the requirements of Section 611.

Brick shall conform to the requirements of Section 611.

Concrete block shall conform to the requirements of Section 819.

**Construction Methods:**

Repair of conduit junction wells includes repairing/patching the masonry walls and replacing damaged or missing frames and lids or precast polymer concrete covers.

Adjusting involves raising the elevation of the frame and lid to match the grade of the surrounding area.

**Method of Measurement:**

The quantity of conduit junction wells adjusted or repaired will be measured as the actual number of conduit junction wells adjusted or repaired and accepted. If a new frame and lid or precast polymer concrete cover is needed, it will be supplied under a separate item.

**Basis of Payment:**

The quantity of conduit junction wells will be paid for at the Contract unit price per each junction well. Price and payment will constitute full compensation for excavating, backfilling, compacting and disposing of excess materials, for furnishing and placing all materials and for all labor equipment, tools and incidentals required to complete the work.

02/20/03

**744525 - REMOVAL OF EXISTING JUNCTION WELL**

**Description:**

This work consists of removing a Type 1, Type 2, Type 3, Type 4, Type 5, Type 6, Type 7, Type 8, or Type 10 conduit junction well presently in place and returning it to the North District Maintenance Shop, 39 E. Regal Blvd., Newark, DE.

**Construction Methods:**

The conduit junction well shall be removed in a manner as to not damage the junction well, frame and lid, or precast polymer concrete cover. The conduits that enter into the junction well shall be abandoned and capped off or connected together as directed by the Engineer. Removal of cables that enter into the well and any conduit used to tie into existing conduits, shall be paid under a separate item.

The areas left open after removal of the junction well shall be backfilled with Type C borrow or suitable fill material as directed by the Engineer. The fill shall be tamped in 6 inch (150 mm) lifts, graded, top soil placed (6 inch (150 mm) minimum) seeded and mulched.

**Method of Measurement:**

The quantity of junction wells to be measured under this item shall be the actual number of junction wells removed and returned to the North District Maintenance Shop, 39 E. Regal Blvd., Newark, DE. Excavation around junction well to remove it and the backfilling of the area where junction well was removed are to be included in this price.

Backfill material will be incidental if required and as directed by the Engineer.

Any extra conduit used to reconnect the conduits that entered the well are to be paid for under another item of this contract.

**Basis of Payment:**

The number of junction wells removed, as determined above, shall be paid for at the Contract unit price bid per each. Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

8/20/10

**744529 – P.C.C. BARRIER, JUNCTION WELL**

**Description:**

This work consists of furnishing junction wells (located in P.C.C. Barrier sections) of the sizes and types shown on the plans.

**Materials and Construction Methods:**

Junction boxes (or pull boxes) shall be rated Nema 4X. The cover shall be of the same material as the box, fastened with stainless steel screws, and rain-tight.

Furnish grounding lugs that are UL listed and approved for copper wire. Use stainless steel for both inside and outside mechanical connections to the junction box.

Conduit knockouts shall be made in the junction box by an approved method. Each conduit entrance shall accommodate the nominal outside diameter of the conduit specified on the plans. All conduits are to be secured to the junction box using washers, locknuts, and bushings. A drain pipe with outlet to free air shall be installed in the junction box as detailed on the plans.

**Method of Measurement:**

The quantity of P.C.C. Barrier, Junction Well will be measured as the actual number of junction boxes of the size specified furnished and accepted under the terms of this Contract.

**Basis of Payment:**

The quantity of P.C.C. Barrier, Junction Well will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for all materials, including box, cover, gasket, drain pipes, cover screws, grounding lugs, necessary fittings and hardware, and all incidentals to the satisfaction of the Engineer.

Installation of P.C.C. Barrier, Junction Well will be incidental to the pertinent concrete or barrier wall item.

9/7/06

745520 - SUPPLY OF 4" SCHEDULE 40 HDPE CONDUIT  
745521 - SUPPLY OF 4" SDR-13.5 HDPE CONDUIT  
745522 - SUPPLY OF 3" SCHEDULE 80 PVC CONDUIT  
745523 - SUPPLY OF 4" SCHEDULE 40 PVC CONDUIT  
745524 - SUPPLY OF 4" SCHEDULE 80 PVC CONDUIT  
745525 - SUPPLY OF 4" GALVANIZED STEEL CONDUIT  
745526 - SUPPLY OF 3" GALVANIZED STEEL CONDUIT  
745527 - SUPPLY OF 2 1/2" GALVANIZED STEEL CONDUIT  
745528 - SUPPLY OF 2" GALVANIZED STEEL CONDUIT  
745529 - SUPPLY OF 1 1/2" GALVANIZED STEEL CONDUIT  
745530 - SUPPLY OF 1" GALVANIZED STEEL CONDUIT  
745531 - SUPPLY OF 3/4" GALVANIZED STEEL CONDUIT  
745532 - SUPPLY OF 3" SCHEDULE 40 PVC CONDUIT  
745533 - SUPPLY OF 2 1/2" SCHEDULE 40 PVC CONDUIT  
745534 - SUPPLY OF 2" SCHEDULE 40 PVC CONDUIT  
745535 - SUPPLY OF 1 1/2" SCHEDULE 40 PVC CONDUIT  
745536 - SUPPLY OF 3/4" ALUMINUM RIGID CONDUIT  
745537 - SUPPLY OF 3/4" FLEXIBLE METALLIC-LIQUIDTIGHT CONDUIT  
745538 - SUPPLY OF 1 1/2" FLEXIBLE METALLIC-LIQUIDTIGHT CONDUIT  
745739 - SUPPLY OF 2" NONMETALLIC POLE RISER SHIELD  
745540 - SUPPLY OF 3" NONMETALLIC POLE RISER SHIELD  
745541 - SUPPLY OF 4" NONMETALLIC POLE RISER SHIELD

**Description:**

This work consists of supplying a conduit or shield, of the type required and as specified in the contract documents or as directed by the Engineer.

**Materials:**

All conduits shall be UL listed and nonmetallic pole risers shall be Rural Utility Service (RUS) listed.

4" (100 mm) high density polyethylene (HDPE) schedule 40, or SDR-13.5 smooth wall conduit with permanently pre-lubricated lining, meeting ASTM D247, ASTM D3035 and NEMA TC7 specifications.

4" (100 mm) through 1-1/2" (38 mm) schedule 40 or 4" (100 mm) through 3" (75 mm) schedule 80 rigid polyvinyl chloride (PVC) conduit, meeting Commercial Standard CS-272-65 (PVC), ASTM D-1785 and U.C. Standard 651 specifications.

4" (100 mm) through 3/4" (19 mm) rigid galvanized steel conduit meeting National Electric Code 2002, Article 344.

3/4" (19 mm) aluminum rigid conduit meeting National Electric Code 2002, Article 344

3/4" (19 mm) and 1-1/2" (38 mm) liquidtight flexible metallic conduit meeting National Electric Code 2002, Article 350.

2" (50 mm), 3" (75 mm), and 4" (100 mm) nonmetallic pole riser shield with belled ends meeting NEMA TC-19 specifications.

In addition to any normal markings provided by the manufacturer, HDPE and PVC conduit shall have the following longitudinally printed on it in white letters: "DelDOT Traffic Fiber Optic Cable."

**Method of Measurement:**

The quantity of conduit or shield will be measured as the number of linear feet (meters) of conduit or shield supplied and accepted. The length of liquidtight flexible metallic conduit shall be measured including all fittings; no additional request for payment will be accepted based upon liquidtight fittings of 90-degrees, 45-degrees, straight, or swivel.

The length of any conduit that is reduced or divided (with a junction box or conduit body) shall be measured as part of the larger conduit. The nonmetallic pole riser shield length shall include any adapter required.

**Basis of Payment:**

The quantity of linear feet of conduit or shield will be paid for at the Contract unit price per linear foot (meter). Price and payment shall include full compensation for all materials and labor, and incidentals necessary to complete the item.

01/15/03

- 745542 - INSTALLATION OF CONDUIT UNDER EXISTING PAVEMENT - DIRECTIONAL BORE**
- 745543 - INSTALLATION OF CONDUIT UNDER EXISTING PAVEMENT - OPEN CUT**
- 745544 - INSTALLATION OF CONDUIT IN UNPAVED TRENCH**
- 745545 - INSTALLATION OF CONDUIT ON WOOD POLE**
- 745546 - INSTALLATION OF CONDUIT ON STRUCTURE**
- 745547 - INSTALLATION OF ADDITIONAL CONDUITS IN TRENCH OR OPEN CUT PAVEMENT**
- 745548 - INSTALLATION OF ADDITIONAL CONDUITS IN DIRECTIONAL BORE**

**Description:**

This work consists of installing trade sized rigid galvanized, PVC or HDPE conduit with all necessary fittings, under existing pavement either by directional bore or open cut, in unpaved trench, on wood pole, or on structure other than bridge or overpass. Installation of additional conduit in trench or open cut pavement or in a directional bore shall also be covered under this item.

The structure can be sign structure, tower, building or other type of structure. Installation of conduit on a bridge, highway and railroad overpass is not included in this payment item, and shall be covered under other items of these specifications.

The Contractor shall be responsible for correcting any existing conduit which is disturbed during installation.

**Materials:**

- Weatherhead for galvanized or PVC conduit.
- Insulated grounding bushing with knockouts.
- Condulets for conduit sizes.
- Anchors.
- One hole conduit hangers: Steel City Series 6H or 6H-B or approved equal.
- End caps.
- LONG sweep sections for conduit sizes.

**Construction Methods:**

The Department has the right to reject any installation method proposed for a given work site. PVC shall not be installed under existing pavement unless it is on a continuous roll or with the Engineer's written approval.

Conduit installed underground shall be installed in a straight line between terminal points. In straight runs, junction well spacing shall be no more than 900 feet (275 m) for fiber optic conduit or no more than 300 feet (90 m) for copper conduit, or as directed by the Engineer. If bends are required during installation, they must be sweeping bends. The Engineer will be consulted before any bends are installed to ensure that the proper arc is provided.

Conduit shall have a minimum cover as measured from the finished grade of 24 inches (600 mm) and a maximum cover of 48 inches (1.2 m).

The opening shall be filled half way with the cover material, and tamped down firmly before filling in the remainder of the opening. Additional lifts shall be used as required to install the warning tape at the specified depth. All cover material shall be free of rocks, debris, vegetation or other deleterious material that may damage the conduit. An underground utility warning tape shall be installed as specified in this section and the remainder of the fill shall be added, tamping down the top layer.

Conduit not terminated to a base or in a junction well shall be terminated 2 feet (600 mm) beyond the edge of the pavement unless otherwise directed by the Engineer, and properly capped. Tape is NOT an approved method. Conduit shall not extend more than 3 inches (75 mm) inside a junction well. See Standard Construction Details for typical methods of termination.

All underground conduits shall be marked in the ground with a warning tape. The marking tape shall be buried directly above the conduit run that it identifies, at a depth of approximately 12 inches (300 mm) below final grade. The tape identifying ALL conduits shall be at least 6 inches (150 mm) wide, and have a minimum thickness of 3 mils and 500 percent elongation.

The color of the warning tape identifying fiber optic cable should be bright orange (preferably AULCC orange), and shall read "WARNING - OPTICAL CABLE" or other wording approved by the Engineer that conveys the same message. The color of the tape identifying all other cables shall be bright red, and shall read "WARNING—BURIED ELECTRIC BELOW" or other wording approved by the Engineer that conveys the same message.

Using conduit tools, rigid metallic conduit shall be cut, reamed, and threaded. The thread length shall be as necessary to ensure that the sections of conduits when screwed into a coupling and tightened correctly will butt together and the joint will be watertight.

A three-piece threaded union, as approved by the Engineer, shall be used to join two threaded lengths of conduit in the case where a standard coupling will not work. A threaded union shall not be used in a conduit run that is to be driven. **At no time is a threadless coupling or a split-bolt coupling to be used for direct buried conduit.**

All lengths of HDPE conduit shall be connected with irreversible fusion couplings. Mechanical and removable couplings will not be accepted.

All lengths of PVC conduit shall be connected by one conduit end fitting inside the flared end of the other conduit section. If this is not possible, then a coupling may be used. Regardless of how connection is made, all joints shall be sealed with the appropriate epoxy to ensure that the two conduit pieces bond to one another to form a solid waterproof link.

Using conduit tools, the conduit shall be cut and prepared. If approved by the Engineer, a coupler module may be used where conduit segments do not align properly to allow the flared end of one conduit segment to mate with the normal end of the other segment.

Sealed end caps (with knockouts if empty) shall be placed on the ends of all conduits by after compressed air has been used to clear all foreign matter.

If not already pre-installed by the manufacturer, a polyester or polypropylene pulling rope or tape (fish wire) with a minimum rated strength of 1250 pounds (5560 N) shall be installed in each conduit for future use. In instances where the Contractor installs the cable, the fish wire may be eliminated.

#### Installation Of Conduit Under Existing Pavement - Directional Bore:

Directional bore shall be used for installation of conduits under existing pavement with a conduit diameter not less than 1-1/2" (38 mm). The size of a bore shall not exceed the outside diameter of the conduit by more than 1 inch (25 mm). If it does, cement grout shall be pumped into the void.

#### Installation Of Conduit Under Existing Pavement - Open Cut:

Installation by cutting a slot in the existing pavement with masonry saw shall be used for conduits not less than 1-1/2" (38 mm) diameter. The Engineer must first approve all open cutting of roadways. The minimum size of open cut for a paved roadway shall be 18 inches (450 mm). The Contractor shall be responsible for the removal of all cut pavement and the replacement and correction of any damaged pavement once the conduit(s) are installed.

#### Installation Of Conduit In Unpaved Trench:

Trenching or other approved method shall be used for installation of conduit in unpaved trench or under new pavement. Backfill in conduit trenches shall be compacted thoroughly as it is being placed. At the discretion of the Engineer, sod, that must be removed for the placement of conduit, shall either be removed by the use of an approved sod cutter and then replaced or 6 inches (150 mm) of topsoil shall be placed and the surface seeded in accordance with Section 734001 - Seeding. In areas where new pavement is to be placed or in areas where total reconstruction is taking place, sodding or seeding may not be required by the

Engineer.

Installation Of Conduit On Wood Pole:

Conduit installed on wood pole shall be installed in a straight vertical line. The conduit shall be attached to the wood pole with 2 hole straps spaced not more than 36 inches (1 m) apart with the top-most strap being 12 inches (300 mm) from the weatherhead and the lower-most being 12 inches (300 mm) from the conduit. A weatherhead matching the diameter of the conduit shall be installed on the upper end of the conduit. A conduit of the same size as the conduit being installed, but not smaller than 2 inches (50 mm) shall be placed 48 inches (1.2 m) above finished grade. Install two, 2 hole straps of the proper size, evenly spaced below the conduit. Nonmetallic pole risers (U-guard) shall be installed on wood poles to allow interduct to be connected directly to messenger cable. The underground conduit shall be as close to the base of the pole as possible. If the nonmetallic pole riser is not the same size as the conduit, an adapter shall be used at no additional cost to the Department. The nonmetallic pole riser shall be attached to the wood pole with 1/4" (6 mm) x 1-1/2" (38 mm) galvanized lag bolts with washers. Lag bolts will be used every 36 inches (1 m) on BOTH sides of the nonmetallic pole riser, and in the top most and bottom most set of slots.

Installation Of Conduit On Structure:

Conduit installed on structure shall consist of drilling anchors into concrete, brick, stone, steel or wood and mounting the conduit with the proper clamps or hangers. The conduit shall be attached to the structure by use of one-hole conduit hangers and approved anchors not more than 36 inches (1 m) apart. Any 90-degree turns in the conduit run shall be accomplished by placing the proper size and type sweeping bends for the application needed.

Installation Of Additional Conduit In Trench Or Open Cut Pavement:

In the case of slotted or trenched installations, the Contractor shall install additional conduits at the same time as the initial installation. The Engineer shall indicate the quantity of conduits to be installed during a build. Additional conduits may be stacked one on top of the other, side by side or in a matrix. The orientation shall be at the Contractor's discretion, but conduits shall not twist around one another or be allowed to deviate from straight line paths except in the case of bend installations. Conduits installed at the same time in the same trench or slot shall remain oriented the same in relation to one another throughout the conduit run.

Installation Of Additional Conduits In Directional Bore:

In the case of a directional bore that more than one conduit shall be installed, the Contractor shall, at the same time as the initial installation, install one (1) or more additional conduits. The Engineer shall indicate the quantity of conduits to be installed during a build. The additional conduits may be stacked one on top of the other, side by side or in a matrix. The orientation shall be at the Contractors discretion, but conduits shall not twist around one another or be allowed to deviate from straight line paths except in the case of a gentle bend. Conduits installed at the same time, in the same bore shall remain oriented in the same relation to one another throughout the conduit run.

**Method of Measurement:**

The quantity of conduit installed as specified, shall be measured as the number of linear feet (meters) of conduit installed as specified, complete in place, and accepted.

The length of conduit installed under existing pavement by a directional bore shall be measured along the path of the bore from the point that cannot be trenched to the point that trenching can resume. The length of conduit installed by cutting a slot in the existing pavement, in unpaved trench or under new pavement, on wood pole, or on structure shall be measured along the conduit.

**Basis of Payment:**

The quantity of conduit will be paid for at the Contract unit price per linear foot (meter). Price and payment shall include full compensation for all materials and labor, topsoil and seed if needed, and incidentals necessary to complete the item.

01/15/03

**745549 - INSTALLATION OF BRIDGE-MOUNTED CONDUIT FROM WORK AREA ABOVE  
BRIDGE DECK**  
**745550 - INSTALLATION OF BRIDGE-MOUNTED CONDUIT FROM WORK AREA BELOW  
BRIDGE DECK**

**Description:**

This work consists of installing rigid galvanized steel, Schedule 80 PVC, or SDR-13.5 HDPE conduit on bridge or overpass structures. Certain bridges require access to cross members or other parts of the bridge substructure from work sites on the bridge deck via the use of a snooper or similar technique in order to make conduit attachments. Other bridges can be accessed from below the bridge deck via bucket trucks from a roadway or by other means.

**Materials:**

Structural Steel A36 (Hot dipped galvanized).  
Expansion Anchors (Stainless Steel).  
U-Bolts (Stainless Steel).  
Expansion Couplings.

**Construction Methods:**

Installation of conduit on bridge or overpass structures shall consist of drilling anchors into concrete, brick, stone, steel or wood and mounting the conduit with the proper clamps or hangers.

Expansion anchors shall be installed in strict conformance with manufacturer recommendations. Anchors shall not be installed within 1 foot (300 mm) of the edge of a deck joint. Any damage to the galvanized coating shall be repaired. Expansion joints shall be installed in the conduits at all expansion joints in the bridge or overpass.

Use of a snooper must be approved in advance by the Engineer in order for the Contractor to be paid at the rate appropriate for its use.

**Method of Measurement:**

The quantity of conduit will be measured as the number of linear feet (meters) of conduit attached to a bridge or overpass structure measured along the conduit, complete in place and accepted.

**Basis of Payment:**

The quantity of linear feet of conduit attached to a bridge or overpass structure will be paid for at the Contract unit price per linear foot (meter). Price and payment will constitute full compensation for all materials, labor, equipment, tools, and incidentals required to complete the work.

01/15/03

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**THIS PAGE IS LEFT BLANK FOR SEQUENCING PURPOSES.**

- 746511 - CABLES, 1/#4 AWG
- 746512 - CABLES, 1/#6 AWG
- 746513 - CABLES, 1/#8 AWG
- 746514 - CABLES, 1/#10 AWG
- 746515 - INSULATED GROUND CABLE, 1/#6
- 746527 - CABLES, 1/#2 AWG
- 746543 - CABLES, 1/#9 AWG
- 746546 - CABLES, 1/#12 AWG
- 746564 - INSULATED GROUND CABLE, 1/#4
- 746565 - CABLES, 1/#3/0 AWG
- 746566 - CABLES, 1/#1 AWG
- 746567 - CABLES, 1/#1/0 AWG
- 746577 - INSULATED GROUND CABLE, 1/#8
- 746598 - INSULATED GROUND CABLE, 1/#2
- 746605 - INSULATED GROUND CABLE, 1/#10
- 746622 - CABLES, 1/#4/0 AWG
- 746658 - INSULATED GROUND CABLE, 1/#1/0
- 746690 - INSULATED GROUND CABLE 1/#12
- 746817 - CABLES, 1/#2/0 AWG

**Description:**

This work consists of furnishing all materials and installing cables of the size(s) required by the Contract in accordance with the notes and details shown on the Plans and/or as directed by the Engineer.

**Materials and Construction Methods:**

All wire(s) to be used in this contract shall be manufactured in conformance with the National Electrical Code, insulated for 600 volts, and be of the type USE and/or RHW.

The Contractor shall provide adequate equipment satisfactory to the Engineer for installation of wire; and shall pull all wires through conduits in a manner which will not overstress, or stretch any wire, and shall use precautions so as not to score, cut, twist or damage the insulation and/or the jacket. In pulling the wire into conduits, where the strain on the wires is likely to be excessive, the Contractor shall use soapstone powder as a lubricant. Without exception, all wires in junction or fuse boxes, transformer bases, and service panels shall be provided with a sufficient slack; and shall be arranged in a neat and orderly manner. After wires have been installed, and pending permanent connection or splicing, the end of each wire shall be carefully sealed using rubber tape, and painted with a sealing type of waterproof compound. All wiring shall be finished to give a neat and orderly appearance. Wires in meter cabinets shall be neatly arranged and laced with cable ties. Wires shall be supported on cable rack assemblies in all junction boxes and junction box foundations.

Where two or more wires are to occupy the same conduit, they shall be drawn in together and kept parallel to each other by means of a pulling head. Phase legs shall be arranged circumferentially and in sequence around the neutral wires.

Splices in junction wells shall be barrel (unless specified otherwise in the Plans) type, mechanically secured by means of a standard tinned copper pressure type connector. Splices shall then be wrapped with half-lapped layers of insulating tape installed in opposite directions. Several layers of half-lapped jacket tape shall be applied over the insulating tape. Two coats of waterproofing sealant shall be applied over the completed splice.

The insulating tape shall be of the self-bonding type and shall be 3M Company, Inc., Cat. No. 130C, 2228; or Plymouth Rubber, Cat. No. 2212; or Permacel, Cat. No. 253, P280; or approved equal.

The jacket tape shall be of the waterproof type and shall be 3M Company, Inc., Cat. No. 33; or Plymouth Rubber, Cat. No. 3117; or Permacel, Cat. No. P29; or approved equal.

**Method of Measurement:**

The quantity of cables will be measured as the number of linear feet (linear meters) of each size along the longitudinal axis of each cable installed and accepted.

**Basis of Payment:**

The quantity of cables will be paid for at the Contract price per linear foot (linear meter). Price and payment will constitute full compensation for furnishing and installing the cables in conduits, junction boxes, or lighting standard bases, connecting, splicing, rodding conduits with mandrel and wire brush, and all materials, labor, equipment and incidentals necessary to complete the work.

No separate payment will be made for furnishing and installing the connector kits with #10 AWG wiring of the type as indicated on the plan for the lighting standards as shall be included in the items for lighting standards.

8/28/01

**746517 - ALUMINUM LIGHTING STANDARD WITH SINGLE DAVIT ARM, 30' POLE**  
**746518 - ALUMINUM LIGHTING STANDARD WITH SINGLE DAVIT ARM, 35' POLE**  
**746519 - ALUMINUM LIGHTING STANDARD WITH SINGLE DAVIT ARM, 40' POLE**  
**746520 - ALUMINUM LIGHTING STANDARD WITH DOUBLE DAVIT ARM, 30' POLE**  
**746521 - ALUMINUM LIGHTING STANDARD WITH DOUBLE DAVIT ARM, 35' POLE**  
**746522 - ALUMINUM LIGHTING STANDARD WITH DOUBLE DAVIT ARM, 40' POLE**  
**746618 - ALUMINUM LIGHTING STANDARD WITH SINGLE DAVIT ARM, 45' POLE**

**Description:**

The work consists of furnishing and installing Aluminum Lighting Standard with Single Davit Arm and/or Aluminum Lighting Standard Pole with Double Davit Arms, breakaway transformer base or anchor base, anchor bolts, luminaires, in accordance with the details on the Plans, and/or as directed by the Engineer to make a functional street lighting system. The foundation will be provided under other items in the contract.

**Materials and Construction Methods:**

All materials shall be of the best quality and free from all defects. No materials shall be installed until approved by the Engineer. Any material not specifically covered in these specifications shall be in accordance with accepted standards and as directed by the Engineer. Any materials deemed unsatisfactory by the Engineer, shall be replaced by the Contractor.

Lighting standards shall meet or exceed the requirements of the 2009 edition of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals." Computations, signed and sealed by a professional engineer licensed in the State of Delaware, confirming conformance with AASHTO Specifications, with the year of the edition specified, shall be submitted to the Delaware Department of Transportation.

All electrical materials shall conform to the requirements of the National Electrical Code of the national Fire Protection Association, and shall conform to all local and special laws and/or ordinances governing such installations. Where these requirements do not govern, and where not otherwise specified, electrical materials shall conform to the Standardization Rules of the Institute of Electrical and Electronic Engineers.

Shop drawings and catalog cuts for all electrical and related materials shall be submitted by the Contractor for approval.

The anchor bolts are to be supplied by the Contractor. The anchor bolts will be installed using a template, and set so that luminaire arm is perpendicular to the roadway.

Anchor bolts, nuts, couplings, washers, and cap screws shall be of carbon steel conforming to the requirements of AASHTO M 314, and hot-dip galvanized in accordance with AASHTO M 232/M 232M.

New aluminum lighting standards shall consist of a tapered aluminum shaft having a base welded to the lower end. The pole shaft, pole extensions, and davit arms shall each be spun from one piece of seamless tubing, the strut and arm plates shall be extruded, all of which conform to the requirements of ASTM B221 aluminum alloy 6063-T6. The shaft shall have no circumferential welds, except at the lower end joining the shaft to the base and shall conform to the dimensions listed in the chart below. The shaft shall contain an internal vibration dampening device positioned approximately 2/3 the height of the pole. The top of the lighting standard shaft shall be drilled for two lockbolts to secure the davit bracket to the lighting standard shaft. If the pole is not placed on a transformer base, it will have one 4" x 8" handhole which after

pole is set should face the roadway such that the maintainer can access it from the shoulder.

Bracket arms shall be of the davit type. The davit arm shall be designed to slip over the top of the lighting standard shaft for a distance of at least 12" (300 mm). The luminaire end of the davit arm shall be fitted with a 2" (50 mm) NPS aluminum pipe not less than 6" (150 mm) long. The height of the lighting standards will be determined by the Contractor to provide a nominal mounting height as shown on the Plans. The length of the davit arm will be as shown on the Plans or 12' (3.6 m) if not specified elsewhere. Davit arm less than 10' (3.0 m) long shall not be used without written permission from the Chief Traffic Engineer.

Each lighting standard shall be provided with a permanent tag that shall be 2" x 4" and fabricated from clear, anodized 1/16" thick aluminum. The edge shall be smooth and corners rounded and the tag shall be curved to fit the light standard shaft. Tags shall be secured to shafts by means of four (4) 1/8" diameter 18-8 stainless steel round head drive screws of self-tapping screws. The embossed identifying letters and/or numerals shall be not less than 3/4" high with stroke width of not less than 3/16". Identifying letters and/or numerals shall be as designated on the Plans.

Transformer Base: Transformer bases, when required, shall conform to the 2009 edition of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaire and Traffic Signals".

Before any work, begins the Contractor shall submit documents showing that the breakaway device meets the current AASHTO Breakaway Design.

For breakaway installations, the standard shall electrically disconnect from the supply wire at the foundation when knocked down by an errant vehicle or from some other cause.

Luminaire: Provide an HPS, roadway luminaire, with photo cell receptacle and shorting cap, multi-voltage ballast, light distribution pattern as specified on the plans, connector kit, and 1.25"-2" slipfitter.

Each luminaire shall include an HPS lamp of the wattage specified on the plans.

The luminaire shall have a die cast aluminum housing with an optical assembly and a removable door. The door shall have integral hinges for hands-free installation, relamping, and maintenance. Hinges shall be made from non-corrodible material.

The luminaire shall have a cutoff optical assembly that includes an aluminum reflector with a heat/impact-resistant tempered sag glass lens or acrylic or polycarbonate resin clear globe. Luminaires with flat lenses shall not be considered acceptable. The refractor door shall be tightly sealed with an appropriate gasket to make a dust-tight optical system. The latch for the refractor door shall be of sufficient size to enable easy handling and constructed of rust resistant materials. The latch shall produce an audible click when it is properly locked.

In order to provide for normal exchange of air between the inside and outside of the optical system, a ventilating channel shall be provided. The channel shall contain a charcoal filter which will prevent the entrance of flying insects and other small animal life forms, as well as provide a cleaning action on the air to remove smoke and dust particles.

The luminaire shall be of the multi-voltage ballast regulator type. The ballast shall be capable of maintaining the wattage of the HPS lamp throughout the life of the lamp. The ballast and the photoelectric control shall be suitable for operating the units of the wattage specified.

All major electrical components, including ballast, shall be mounted on the removable mounting door and connected to the fixture electrically through a quick disconnect plug. The luminaire shall employ

solderless push-on type connectors for all wiring connections to facilitate the replacement of any component.

The luminaire shall be completely wired so that it shall require only the connection of the power supply cables to a terminal block for energizing the entire fixture.

The luminaire shall be equipped with a porcelain, corrosion resistant socket. The socket shall be easily adjustable to provide different light distributions; such adjustments shall be accomplished through adjusting not more than two screws within the optical assembly. The socket in this installation shall be preset to provide a distribution pattern as indicated on the Plans or type III distribution pattern if not indicated.

The luminaire shall have a 2 bolt slipfitter suitable for mounting on a 1.25"–2" mounting arm. A birdguard shall be provided with each luminaire. The luminaire shall be designed with a leveling pad and capable of being adjusted +/- 3 degrees for proper leveling.

The luminaire shall have a NEMA-approved decal attached to the housing, which shall be readily visible from the ground. The decal shall be yellow (to indicate HPS lamp) and shall indicate the lamp wattage.

All electrical materials shall conform to the applicable requirements of the National Electrical Code (NEC) of the National Fire Protection Association.

The luminaire shall be UL Listed.

The Contractor shall furnish and install identification decals on the luminaire housing that can be seen visually from the road. Lamp decals shall indicate the lamp wattage and type via standard identifying numbers and background color. For example, "25" on a yellow sticker indicates a 250 watt high pressure sodium lamp.

No luminaire shall be installed until the lamp socket position has been inspected and approved by the Engineer. All luminaires shall be adjusted up or down on the slipfitter to provide maximum light on the roadway to be lighted. The connections between the luminaire and service cable shall be made with a connector kit using #10 AWG single wire. Installation of the connector kit shall be in accordance with the manufacturer's recommendations.

Installations of Lighting Standards: Lighting Standards shall be installed and located in accordance with the Plans, to provide continuously aligned lighting.

The bracket arms shall be set perpendicular to the edge of the roadway unless otherwise ordered or specified. If necessary aluminum shims may be used to plumb the pole.

#### **Method of Measurement:**

The quantity of aluminum lighting standards with single or double davit arms of the size(s) specified will be measured as the actual number installed and accepted.

#### **Basis of Payment:**

The quantity of aluminum lighting standards with single or double davit arms will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing all materials including labor, equipment, hardware, anchor bolts, washers, shims and nuts for the foundations, excavation and backfilling, supply and installation of the transformer base or anchor base, supply and installation of poles and davit arm(s), and supply and installation of the luminaires. This price will also include all miscellaneous hardware, connector kits, and wiring from the supply cables to the luminaire(s), labor, tools, equipment, and

incidentals necessary to complete the work.

4/6/11

**746537 - RELOCATING EXISTING LIGHT STANDARDS****Description:**

This work consists of removing, storing, and installing existing light standard(s) at location(s) shown on the Plans and as directed by the Engineer.

**Materials and Construction Methods:**

Any material required and furnished under this item, shall be in accordance with the notes on the Plans.

The light standard shall be carefully removed from the existing location to avoid any damage. Should any damage occur to the light assembly, and in the opinion of the Engineer adequate precaution was not exercised by the Contractor during the relocation operation, the Contractor shall at his/her expense replace damaged component in kind or equivalent to the satisfaction of the Engineer.

The Contractor shall contact the manufacturer of the existing light pole and/or transformer base to determine the appropriate anchor bolt size. This will require supplying the manufacturer with existing pole information, dimensions and design criteria. Anchor bolts shall be hot dipped galvanized and meet the requirements of AAHSTO M 314. Anchor bolts shall have a minimum yield strength of 55,000 PSI. Once the manufacturer has determined the anchor bolt size, detailed drawings and design information shall be supplied to the Engineer for approval prior to installation. Design shall be in accordance with the 2009 edition of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals".

Final acceptance of the light standard shall be made only after its satisfactory operation as determined by the Engineer.

**Method of Measurement:**

The quantity of light standards relocated will be measured as the actual number of light standards relocated and accepted.

**Basis of Payment:**

The quantity of light standards relocated will be paid at the Contract for unit price per each. Price and payment will constitute full compensation for removing, storing and installing the entire light standard unit, including but not limited to, pole, luminaire, transformer base, furnishing and installing new anchor bolts, installing new fuse if required by the Engineer, labor, tools, equipments, and all incidentals to complete the work.

4/6/11

**746552 - FURNISH AND MAINTAIN TEMPORARY LIGHTING**

**Description:**

This work consists of furnishing, installing, operating, moving and removing temporary roadway lighting. The existing lighting will be impacted during various phases of construction. The temporary lighting shall be used to supplement the existing lighting to illuminate the travel way during these phases of construction. At such time the ultimate lighting system is in place in this area, the temporary lighting can be removed. The temporary lighting assemblies shall become the property of the Contractor after the completion of the project.

**Materials and Operation Requirements:**

The Contractor shall coordinate the Temporary Lighting Design with the phases of the Maintenance of Traffic Design.

The Contractor may elect to use portable light assemblies, fixed poles, or portable poles. The lighting systems may be powered by a generator or an electrical feed from the local utility company. If the Contractor elects to use a feed from the local utility he shall submit an Application for Electric Service and coordinate the Electric Service with the local utility company. The Contractor shall meet the Electric Service requirements of the local utility company. If the Contractor elects to use a feed from the local utility company he may use overhead triplex temporary wiring between the light poles.

At least sixty days prior to the installation of the Temporary Lighting the Contractor shall submit a Temporary Lighting Design drawing to DeIDOT for their review and approval. The Temporary Lighting Design drawing shall include the following:

1. Layout drawings showing locations of temporary lighting equipment, including both spacing and placement.
2. Description of lighting equipment to be used.
3. Description of electrical power source.
4. Specific technical details including catalog cuts on all lighting fixtures to be provided, including power rating and photometric charts.
5. Details of any hoods, louvers, shields or other means to control glare.
6. Lighting calculations confirming that the illumination requirements will be met by the layout plan.

The layout drawings shall be on sheet size approved by the Engineer and at an appropriate scale to adequately describe the work. Layout drawings must be submitted and approved for all Phased of Construction.

Temporary Lighting design shall be 0.8 average maintained footcandles with an average / minimum uniformity ratio of 4 to 1 and a veiling luminance ration of 0.4 ( $L_{vax}/L_{avg}$ ).

It is the Department's intent to provide a continuously operating light assembly unit whenever the unit is in service. Should an operation problem be reported to the Contractor at any time during use of the unit, the Contractor shall have 30 minutes after receipt of notification to rectify the problem to the Engineer's satisfaction. Failure of the Contractor to make this effort may result in deduction of payment for the day the unit is not satisfactorily operating. To this end, the Contractor shall designate an on-site representative, other than the Project Superintendent, who shall be the Department's contact person on all issues related to the light assemblies. The Contractor shall also designate a Manufacturer's Representative to be on call for technical assistance or as otherwise necessary.

**Method of Measurement:**

The quantity of temporary lighting assemblies will not be measured.

**Basis of Payment:**

Payment for this item will be made a the lump sum price bid for the item "Furnish and Maintain Temporary Lighting," which price and payment will constitute full compensation for wire, conduit, service installations, meter installations, meter applications, monthly bills, furnishing fuel, installation, relocation, maintaining light assemblies, cost for any movement and set up to another location, final removal from project and for all labor, materials, equipment and tools required to complete the work.

9/16/10

**746592 - REPLACE/ADAPT EXISTING TRANSFORMER BASES****Description:**

This item shall consist of adapting or replacing the existing light pole transformer bases so that they meeting current standards for breakaway poles.

**Material & Construction Methods:**

The Contractor shall contact the manufacturer of the existing light pole to determine the best method of adapting the transformer bases to be breakaway bases. This will require supplying the manufacturer with existing foundation information and dimensions. Once the manufacturer has determined a method of adapting the bases, detailed drawings and information shall be supplied to the Engineer for approval prior to any installation. It shall show that the breakaway device meets current AASHTO Breakaway Design.

If the existing foundation bolts protrude more than 5 inches above the existing ground, the area around the foundation shall be filled at the direction of the Engineer so that the bolts protrude no more than 5 inches above the finished grade.

All electrical materials shall conform to the requirements of the National Electrical Code of the National Fire Protection Association, and shall conform to all local and special laws and/or ordinances governing such installations. Where these requirements do not govern, and where not otherwise specified, electrical materials shall conform to the Standardization Rules of the Institute of Electrical and Electronic Engineers (IEEE).

Anchor bolts, nuts, couplings, washings, and cap screws shall be of carbon steel conforming to the requirements of AASHTO M 314, and hot-dip galvanized. Anchor bolts shall have a minimum yield strength of 55,000 PSI.

Each transformer base shall be provided with a new foundation as specified on the Plans. The foundation payment will be made under Item 602774. Cost for removal of the existing foundation shall be included under item 746830.

**Method of Measurement:**

The number of light pole transformer bases to be adapted/replaced shall be the number of poles adapted as called for on the Plans for which the work has been completed according to these specifications.

**Basis of Payment:**

The number of light pole bases adapted as measured above, shall be paid for at the contract unit price bid per Each for "Replace/Adapt Existing Light Pole Transformer Base," which price and payment shall be full compensation for all materials, removing and resetting the light pole/replacing the transformer base, rewiring, grading around the foundation base, disposal of surplus materials, furnishing and installing all materials and for all labor, tools and incidentals necessary to complete the work.

4/7/11

**746594 - LUMINAIRE (HPS) 250 WATT**

**Description:**

This work consists of furnishing and installing 250 watt high pressure sodium fixtures on poles, in accordance with these specifications and as shown on the Plans.

**Materials:**

The complete luminaire shall have a Type III IES distribution with Cutoff Optics and shall be a 250 watt high pressure sodium type powered from a nominal 240 or 277 volt, 60 hertz source. The luminaire shall have a heavy-duty die-cast aluminum housing with an electrocoat gray finish and a hinged and removable door assembly with a heat/impact resistant glass prismatic lens. The luminaire shall be provided with internal two-inch slipfitter mounting and photocell control. The ballast shall be a multi-tap (120/208/240/277 volt) auto-regulating type, capable of starting and operating the lamp down to temperatures of 78°F (-28°C). The optical assembly shall be sealed with a perimeter gasket and activated charcoal filter.

**Method of Measurement:**

The quantity of 250 watt (HPS) luminaires will be measured as the actual number of luminaires provided complete in place and accepted.

**Basis of Payment:**

The quantity of 250 watt (HPS) luminaires will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing all materials, and for all labor, tools, equipment, and incidentals necessary to complete the item installation.

9/16/10

**746596 - JUNCTION BOX ON STRUCTURE**

**Description:**

The item shall consist of furnishing and installing Junction Box(es) as detailed on the Plans and specified herein.

**Materials and Construction Methods:**

Unless noted otherwise on the Plans, the junction box shall be 12" x 12" x 6", cast iron and hot-dipped galvanized. Units shall be surface-mounted to structure and held in place by four stainless steel drop-in anchors and bolts. A flat neoprene gasket shall be cemented to cover. The unit shall be U.L. listed and NEMA 4.

**Method of Measurement:**

The number of junction boxes to be measured under this item shall be the actual number of installed junction boxes in accordance with these specifications.

**Basis of Payment:**

The number of junction boxes, as determined above, shall be paid for at the contract unit price bid per Each for Item 746596, Junction Boxes on Structure, which price and payment shall constitute full compensation for furnishing and installing of the box, and other related hardware, for all labor, tools, equipment and necessary incidentals to complete the work.

**746620 - RELOCATION OF EXISTING LIGHTING TOWER****Description:**

This work item shall consist of relocation of 100' lighting towers being affected by the proposed work under this contract as indicated on the plans, in accordance with the notes, as described in these Special Provisions and as directed by the Engineer.

**Materials:**

See Plan sheets.

**Construction Methods:**

The work under this item shall consist of removing lighting towers complete with tapered shafts, base plate, and associated materials, control enclosure, and secondary wiring; installing them on new concrete foundations with new anchor bolts; making all required connections; and, grounding and bonding all at the locations indicated on the Plans or as directed by the Engineer.

The existing luminaires shall be removed and replaced with new luminaires. This work is included in other items in the contract.

The high mast tower lighting control cabinets shall be relocated near the new high mast tower location and installed on supports equal to the existing installation.

Removal of the complete existing lighting tower as above defined shall be executed in a careful manner, to the satisfaction of the Engineer, to obtain the lighting tower in the best possible condition for reinstallation.

Prior to the removal of the lighting tower and before and after installation of the lighting tower, all welded and bolted connections shall be checked for soundness by a qualified inspection personnel approved by the Engineer. All inspection and testing shall be performed by a firm or agent employing certified inspection personnel and using up-to-date equipment and approved by the Department. All inspection and testing shall be performed in the presence of the Department's representative. The apparent low bidder shall submit to DeDOT, within ten (10) calendar days after the bid opening, the name, address and telephone number of the firm or agent selected to perform visual inspection of the bolted connections and to perform visual inspection and non-destructive testing of the welds.

Any defects discovered during the inspection of bolted and welded connections prior to the removal of the existing tower shall be repaired prior to the relocation of the tower and this work will be paid for at a price to be agreed upon in writing by the Contractor and Engineer before such work begins in accordance with Section 109 of the Delaware Standard Specifications.

Any damage to the lighting tower caused by the Contractor during the removal and reinstallation operation, shall be replaced by equivalent new materials or repaired to the satisfaction of the Engineer at the expense of the Contractor.

All repair work, prior to or after relocation of the tower, shall be performed by a firm or agent employing qualified personnel and using up-to-date equipment and approved by the Department. All repair work shall be completed to the satisfaction of the Engineer.

**Basis of Payment:**

Payment for relocating existing lighting tower (exclusive of foundation) will be made for the actual number of such existing lighting towers removed and reinstalled in place, completed and accepted, at the price each bid for the item 746620 - RELOCATION OF EXISTING LIGHTING TOWER, which price and payment shall constitute full compensation for disconnecting, removing and reinstalling the lighting tower assembly complete with the control enclosure and wiring within the lighting tower shaft; furnishing and installing new anchor bolts, galvanizing, making all required connections; providing new grounding and bonding as needed; all materials, labor, equipment, tools and incidentals necessary to complete the work.

Payment for all labor, materials, equipment and incidentals necessary to inspect all welded and bolted connections as specified above shall be included in the item 746620-Relocation of Existing Lighting Tower.

Payment for all labor, materials, equipment and incidentals necessary to repair any defects discovered during the inspection of bolted and welded connections prior to the removal of the lighting tower shall be paid for at a price to be agreed upon in writing by the Contractor and Engineer before such work begins in accordance with Section 109 of the Delaware Standard Specifications.

No additional payment will be made for any repairs of damage caused by the Contractor during the removal and reinstallation of the existing light tower.

Payment for removal of the existing luminaires shall be made under Item 746816 – Removal of Luminaire. Payment for providing and installing new luminaires shall be made under Item 746563 – Luminaires (HPS), 1000 Watts. Payment for modifying electrical cables and controls for 277/480V operation shall be made under Item 746579 – Electrical Modifications to Existing Towers.

4/7/11

**746621 - LIGHTING TOWERS AND INSTALLATION****Description:**

This item shall consist of furnishing all materials and erection of 120' lighting towers complete with but not necessarily limited to: tapered pipe shaft; base plate; anchor bolts; handhole; luminaire mountings; luminaires; circuit breaker; terminal board; all cables and wires; cable grip; all fastening clamps and hardware; identification tags; grounding; and all necessary connections at locations indicated, in accordance with the notes and details shown on the plans, as described in these Special Provisions and as directed by the Engineer.

**Submittals:**

Complete photometric, assembly, and electrical data shall be provided for each type luminaire proposed. The data shall include candlepower distribution and isofootcandle graphs, assembly drawings with replacement part numbers, and electrical schematic with ballast input, output voltage, amperage, and wattage ratings.

Complete construction details for the structural items shall be submitted to the Delaware Department of Transportation. The details shall be substantiated with design calculations signed and sealed by a professional engineer licensed in the State of Delaware.

All shop drawings shall show clearly the nature, dimensions and location of all welds, bolt sizes, open holes, painting and other details.

**Materials:**

All structural metalwork and the erection thereof for the lighting towers shall conform to the Section 605 of the Standard Specifications except as modified below:

High Mast Lighting Towers shall be designed for mounting a head frame and lowering device assemblies. Design shall be in accordance with the 2009 edition of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals".

Provide a reinforced access door opening in the base of the pole shaft that secures with a cover. Furnish a cover made with stainless steel hinges that bolts shut with stainless steel hex bolts and is weather tight. Fit the cover with a stainless steel padlock hasp and install a department-approved padlock.

The shaft shall be made from the best grade, hot rolled, basic open hearth steel conforming to the requirements of the Society of Automotive Engineers Specification S.A.E. 1015. It shall be formed, welded and longitudinally cold rolled under sufficient pressure to flatten the weld, form a round tapered tube and improve the physical characteristics of the metal to ensure a guaranteed minimum yield strength of 50,000 psi. The shaft sections shall taper uniformly from top to bottom and shall assemble by telescoping over the next lower section with a firm tapered fit. The telescoping field joints shall not be welded. Assembly of the telescoping sections into one shaft shall be accomplished in accordance with the manufacturer's recommendations.

All sections of pipe shafts necessary for the lighting towers shall be furnished by the Contractor.

Ends of pipe sections shall be furnished with ends cut square.

Slip sleeve splices in pipe shafts will be permitted only where shown on the Plans. All base plate connections shall be made in the shop. Electrodes shall conform to the requirements of A.S.T.M. Specification A233. E-70 Series low-hydrogen electrodes shall be used for all welds involving tower shaft; all other electrodes for the tower metalwork shall be E-60 Series low hydrogen electrodes.

A true end cut shall be provided at the ends of the pipe sections to be welded, in order that the required root opening may be maintained.

All welding, including radiographing, shall conform to the current requirements of the ANSI/AASHTO/AWS

D1-5 Bridge Welding Code. Pipe shaft welds shall be made by the manual shielded metal-arc welding process.

All base plate connections shall be radiographed at the expense of the Contractor.

Steel shapes, plates and bars shall conform to the requirements of A.S.T.M. Specifications A709 Grade 50 unless otherwise noted.

Unfinished bolts and nuts shall conform to the requirements of A.S.T.M. Specification A307.

C. Stainless steel bolts, nuts and washers shall conform to the requirements of A.S.T.M. Specification A153, Class C.

High-strength bolts, nuts and hardened washers shall conform to the requirements of A.S.T.M. Specification A325 Type I.

Anchor bolts shall be hot dipped galvanized and meet the requirements of AASHTO M 314. Anchor bolts shall have a minimum yield strength of 55,000 PSI.

Gaskets for handholes shall be neoprene rubber conforming to the requirements of A.S.T.M. Specification D752.

All metal parts, except the tower shafts including base plates and stiffener plates, stainless steel and non-ferrous metals, shall be hot-dip galvanized after fabrication in accordance with A.S.T.M. Specification A123.

Metals or hardware on which the galvanizing has been damaged shall be replaced with new materials having properly galvanized surfaces except that subject to the approval of the Engineer, minor damage to galvanized surfaces may be repaired by field galvanizing with the application of a paste composed of approved zinc powder and flux mixed with a minimum amount of water. The places to be coated shall be thoroughly cleaned before the paste is applied. The surface to be coated shall first be heated with a torch to a sufficient temperature so that all metallic in the paste are melted when applied to the heated surface. Extreme care shall be taken to see that the surrounding galvanized surfaces are not damaged by the torch. The flux in the paste will cause a black substance to appear on the surface of the coated parts and this black substance shall be removed by wiping off with waste or by the quick application of cold water. A sufficient number of coats shall be applied to such damaged areas to ensure that a thickness of at least equivalent to two ounces of zinc per square foot has been attained.

All erection work shall be subject to the inspection of the Engineer, or his representative, who shall be given all facilities required for a thorough inspection of the workmanship. Material and workmanship not previously inspected will be inspected after its delivery to the site of the work.

The proper execution of the high-strength bolting operation shall be checked by applying an approved manual torque wrench to a minimum of 5 per cent and a maximum of 10 per cent of the bolts. The torque shall at least equal the equivalent torque for required minimum bolt tension (based on non-lubricated bolts and nuts). If the bolts are not sufficiently tight, additional bolts shall be checked and tightened with a torque wrench, as directed by the Engineer. No loose or imperfect bolts will be allowed to remain in any part of the work.

#### Handholes:

Openings for handholes shall be reinforced to maintain the design strength of the pole. The handhole shall have a weatherproof gasket made of neoprene or silicone rubber. The gasket shall be formed for a forced fit around the handhole or be attached by mechanical means. The door hinges shall be the same type steel as the poles. The hinge pins and other securing hardware shall be stainless steel and tamperproof. The door shall be fabricated to allow for a padlock. The hasp used for padlocking shall be fabricated from stainless steel.

#### Lowering Device:

Each high mount light standard shall have a device to lower the luminaires from the operating position at the top of the standard to a service position approximately 3 ft. above the base of the standard. The device shall include a

head-frame, luminaire ring, and winch assembly. The device shall be designed for the number of luminaires as shown on the plans.

#### Head Frame Assembly:

Attach, to the top of each high mast pole, a head frame assembly designed to support the luminaire ring with its required number of luminaires, in addition to the cable pulleys and mechanisms. Mount pulleys and mechanisms on the head-frame assembly and cover them with a protective, non-corrosive housing. Make necessary cable openings as small as practical to prevent birdlife entry. Provide a housing that can be easily removed from the head-frame assembly for service of pulleys and other mechanisms.

Provide a 24 inch, nickel-tip copper lightning rod on each pole, extending not less than 20 inches above the head-frame cover and located on or near the pole centerline. Ground the lightning rod to a suitable lug at the pole top, using No. 1/0 AWG braided copper, adapters, cable connectors and a grounding lug furnished by the lightning rod manufacturer. Mount the lightning rod with brass or bronze hardware.

Fabricate pulleys of either cast steel with a nylon bushing or aluminum with a bronze bushing, both with a stainless-steel shaft, Type 304, and both equipped with guards to prevent the cable from jumping off the pulley.

Furnish a head frame that provides three-point suspension and positive centering and engagement between the mating parts of the head frame and the luminaire ring assembly. Hot-dip galvanize the head from, after fabrication, per ASTM-A123, or completely zinc-electroplate with an additional 5 mil minimum thickness of approved zinc-rich paint or an epoxy powder coating.

#### Luminaire Ring:

The luminaire ring shall be constructed from steel, hot-dip galvanized after fabrication per ASTM-A123. It shall be pre-wired and include a weatherproof junction box and test receptacle for ground level testing of luminaires. If a special cable is required for ground level testing, one cable shall be supplied with each portable power unit. The ring shall include the appropriate number of 2 inch steel luminaire mounting tenons installed. The luminaire ring shall have spring loaded iris arms or spring loaded rollers to keep the ring concentric around the pole during raising and lowering. Springs and spring mounting hardware shall be stainless steel.

The luminaire ring shall be supported by means of hoist and lifting cables, manufactured from stainless steel aircraft cables of seven strands with 19 wires per strand with a minimum breaking strength of 3,900 lbs. A terminator shall be provided for joining the hoist cable and 3 suspension cables.

#### Latching Mechanism:

Each pole shall be provided with a latching mechanism that shall secure the suspension cables and minimize the stress on the winch cable and winch. The latching mechanism shall be completely accessible through the access door in the pole base. Additionally, a safety chain shall be provided capable of supporting the full weight of the luminaires and lowering equipment in the event of a failure of the latching mechanism.

#### Winch Assembly:

Provide a self-locking, permanently lubricated, worm gear winch assembly, enclosed within the pole mast, capable of raising and lowering the entire luminaire ring when driven by a portable power unit. The winch assembly shall consist of a winch drum and gearbox mounted in the pole and an external power unit. The winch assembly shall include a failsafe brake system to prevent freewheeling of the winch drum. The winch drum shall automatically reverse the lay of the hoist cable and not allow uneven build-up or tangling.

#### Portable External Power Unit:

The portable external power unit shall consist of a heavy duty reversible drill motor, torque limiter, transformer, and remote switch. The torque limiter shall cause drive slipping at a predetermined torque load to prevent damage to the system. The unit shall operate from a remote switch, with sufficient cable length to allow the operator to stand a

minimum of 15 ft. from the base of the pole during lowering and raising operations. Provide sufficient length of cable and mating plug to directly utilize the power supply. Equip the power unit to attach to the winch drive shaft and the pole so that the unit is completely self-supporting.

The power unit shall raise or lower the luminaires at a rate of not less than 10 feet per minute. As part of the power unit, a transformer shall be provided to convert from the operating voltage of the luminaires to 240 volts for the portable power unit. The transformer shall have a 10 foot long, 3/C, 600 volt, heavy duty portable cable with plug to match the drive unit receptacle in the base of the lighting mast and a grounded weatherproof receptacle on the load side to supply the power unit motor. All outlets shall be easily accessible from the access door.

The complete unit shall be supplied in a durable metal storage case with all equipment and instructions for operation. The case shall have a continuous hinge on the lid and sturdy carrying handles. One portable power unit and case shall be provided for the completed project.

#### Electrical Equipment:

Terminal boards shall be rated 30 amperes, 600 volts, fabricated from non-tracking materials and equipped with covers.

Plugs and receptacles shall be heavy duty, weather resistant, rated 20 amperes, 240-volts AC, grounded type. Receptacles shall have weatherproof cap and mating plug.

Electrical power cord shall be Type SO, extra flexible, rated for 600 volts. Power cord shall be 4 conductor #8 AWG. Provide UL listed, watertight cord connectors.

Junction boxes shall be galvanized cast iron with hubs and hinged covers.

#### Luminaires:

The reflector with its aluminum cover shall be firmly attached to a cast ring. This ring shall have keyhole slots in its upper surface such that the reflector/refractor assembly may be readily attached to or detached from the luminaire bracket entry and lamp support assembly without completely removing the support bolts.

Each luminaire shall contain an integral auto-regulator type ballast connected for 277V input +/-10% and a power factor more than 90%. The luminaire ballast shall be enclosed within an aluminum housing which integrally attached to the luminaire bracket entry and lamp support assembly. It shall be readily removable without removing the luminaire from the bracket arm.

The luminaire shall be attached to the bracket arm by means of a bracket entry and lamp support assembly. The assembly shall include a side entry slipfitter designed for a 2 inch pipe with provision for 3 degrees adjustment for leveling the luminaire. An enclosed terminal block shall be included such that all electrical connections shall be protected from exposure to weather.

All electrical connections shall be made waterproof or be made inside a weather resistant enclosure. All luminaires shall have the ANSI/IES light distribution as indicated on the plans. Each luminaire shall be labeled with a permanent label that states the type of lamp, voltage input, power input, power factor, ballast type, socket position, ANSI/IES light distribution and any other catalog information to allow for a replacement to be readily ordered.

#### **Construction Methods:**

The loading, transporting and unloading of all parts shall be conducted to avoid injury and deformation of the metal. Areas damaged in transport or erection shall be repaired to the satisfaction of the Engineer. During the erection process, all materials shall be handled carefully and shall be stored on platform, skids, or other supports to keep parts off of the ground. The steel shall be kept free and clean from all foreign materials, particularly grease, oil, concrete, chock marks and dirt that may effect the natural oxidation of the steel. All structures shall be treated with care given to any product such that the finished surface remains as prepared in the fabrication shop. Any foreign matter that gets on the surface after galvanizing shall be removed as soon as possible and the soiled areas shall be returned to the

conditions as listed above.

The Contractor shall submit erection plans and procedures to the Engineer for approval prior to installation of the High Mast Lighting Structure on location. Structures shall be installed with all internal wiring, attachments, and hoist cable assemblies in place and erected in accordance with the manufacturer's recommendations. Structures shall be erected plumb. Plumb shall be checked using two transits set 90 degrees apart. Plumbing shall not be done in full sun to avoid deflection from radiant heat. Tolerance for plumb shall be 3 inches per 100 feet. Nuts shall be tightened to secure the structure in place.

#### Luminaires:

All high mount luminaire shall be lamped just prior to testing the system. The date of installation shall be marked with the code on the base of each lamp.

Each luminaire shall be leveled and secured in all directions. Careful attention should be given to luminaire aiming. The wiring for each luminaire shall be securely terminated and shall include an equipment grounding conductor to bond the housing to the supply cord grounding conductor.

#### Operation:

The operation of the lowering device shall be demonstrated by the Contractor by raising and lowering the ring with luminaires a minimum of five (5) times for each high mast. The raise and lower demonstration shall include latching and unlatching at the top and connection of test cables at the bottom. Twisting of the cables, failure of the ring to latch or unlatch, unlevelness of the ring, or hang-up of guide arms will be sufficient reason for the Engineer not to accept the lowering device.

#### **Method of Measurement and Basis of Payment:**

Payment for lighting tower installations will be made for the actual number of lighting towers, exclusive of foundations, installed in place, completed and accepted, at the Contract unit price each bid for the item 746621 - Lighting Tower and Installation, which price and payment shall constitute full compensation for furnishing all materials, fabricating and erecting the tower complete with tapered pipe shafts, base plates, luminaire head assembly and lowering mechanism, portable external power equipment, luminaires, all other structural metal work, handholes, anchor bolts, galvanizing; welding, furnishing and installing all required electrical materials and equipment, all fittings, internal wiring, cable grip for vertical riser cables, hardware, identification tags, and lighting luminaire aiming data chart; grounding and bonding; all necessary connections; performing all prescribed structural and electrical tests and furnishing required certificates therefore; all materials, labor, equipment, tools and incidentals necessary to complete the work.

4/6/11

**746653 - ELECTRICAL TESTING**

**Description:**

This work consists of furnishing all materials, equipment, tools, and labor necessary to perform electrical testing in accordance with these special provisions, notes and details on the plans, and as directed by the Engineer.

When this item is required to test a highway lighting system constructed as part of the Contract, the item shall also include a one year warranty of the highway lighting system. The highway lighting system is understood to include all items of work performed under this Contract to provide lighting of roadways.

**Construction Methods:**

Ground Resistance Testing

The ground resistance shall be measured with a three-terminal, fall-of-potential, direct-reading, battery-powered earth tester with a 0.50 to 500 ohm scale or digital read-out. The 25 ohm reading shall be approximately at mid scale.

The test shall be performed according to the manufacturer's instructions and OSHA requirements. The test shall be performed when the soil is dry. The Contractor shall not add any chemical or salt solutions to any portion of the grounding system. All grounding rods and foundation grounds to be tested shall be installed a minimum of ten days prior to testing unless otherwise determined by the Engineer in the field.

Two auxiliary copper clad ground rods shall be driven into the ground at a minimum distance of 3 feet (one meter). The lateral spacing for each test rod shall be given in writing on the test report form and the spacing shall be approved by the Engineer.

Each ground rod or foundation ground shall be isolated with the bond wires disconnected when the test is being performed. The resistance to ground shall be 25 ohms or less.

Unless noted otherwise on the plans, there shall be two ground resistance tests performed under this item of work.

System Testing

Insulation from ground and roadway lighting circuits shall be tested as follows:

- (1) Insulation from Ground. All underground circuits shall be tested for resistance to ground with a megger both before and after the conduit and wiring have been buried and all ground rods have been installed and connected. No circuit shall measure less than 10 megohms to ground. Circuits that fail will be inspected, repaired, and retested.
- (2) Roadway Lighting Circuits. The Contractor shall connect field wiring to the load center terminals. The entire lighting system shall be energized for ten consecutive days for ten hours each day at the time directed by the Engineer prior to initial acceptance. Failures occurring during this test period shall be corrected. The Contractor shall repair or replace any equipment, components, or system that fails during this test. A retest shall be performed on the repaired portion at the Engineer's direction.

All tests shall be performed in the presence of the Engineer, and test results shall be written, dated, and given to the Engineer for approval.

**Highway Lighting System Warranty:**

The Contractor shall secure the manufacturer's warranties and/or guarantees on electrical and/or mechanical equipment. These warranties and/or guarantees shall be submitted to the Department upon final acceptance of the completed highway lighting system. In addition to the manufacturer's warranties and/or guarantees, the Contractor shall warrant to the Department the complete, installed highway lighting system to be free of defects, as hereafter defined, for one calendar year beginning at the initial acceptance of the highway

lighting system by the Department. The initial acceptance of the highway lighting system will occur upon the satisfactory correction of all deficiencies noted in the lighting system during the final inspection of the project.

The highway lighting system will be considered defective if any of the following conditions are discovered by visual inspection or by inspection with testing equipment within the warranty period:

1. Defective lamps or ballasts.
2. Failure to operate, in whole or in part.
3. Power wire grounding less than ten mega-ohms.
4. Shifts in pole/foundation alignment.
5. Short circuits or open circuits anywhere within the system.
6. Deterioration of finishes, plating, or paint not normal and customary in the environment in which the equipment is installed.
7. Settlement of trench backfill.
8. Defective fuses.
9. Defective or improperly installed splices.

These conditions listed shall not be considered all inclusive.

The highway lighting system is comprised of all Contract items for lighting, including but not limited to conduits, junction wells, cables, load centers, transformers, cabinet pads, pole bases, poles, high mast poles, light standards with and without davit arms, luminaires, service installations, and reworked/relocated existing lighting facilities.

There will be initial and periodic highway lighting system performance inspections after the Contractor has completed all the work. The initial inspection, to be conducted during the final construction inspection, will be to determine if the initial performance requirements are met. Periodic reviews will be conducted at monthly intervals through the warranty period to determine the sustained ability of the highway lighting system to meet the stated performance requirements.

The Department review team will be responsible for evaluating the highway lighting system within the project limits for both day and night acceptability considering all the possible defects listed above. If the highway lighting system is considered defective because of abnormal operation or deterioration (as listed above), the Department will require repair or replacement of the defective portion at its sole option.

All defective areas, which may include all highway lighting systems and components within the project limits, identified by the Department during initial or periodic inspections shall be repaired by the Contractor in accordance with this Section. All highway lighting system repair shall begin immediately following the notice to the Contractor of the lighting system defect unless weather limitations prevent the corrective work. The Department shall be given notification before the Contractor begins corrective work and shall be allowed full inspection of all operations and provided safe access to the areas being repaired.

If at any time during the warranty period, the highway lighting system or any portion thereof is rendered defective as a result of other than a manufacturing design or construction defect, the Department will repair, replace or revise said system at its sole option. The Contractor will not be held responsible for the cost to correct failures due to design defects in the highway lighting system.

**Method of Measurement:**

The quantity of electrical testing will not be measured.

**Basis of Payment:**

The quantity of testing will be paid for at the Contract lump sum price. Price and payment will constitute full compensation for furnishing all testing equipment, including ground rods; performing the tests; preparing the reports; and for all labor, equipment, tools, and incidentals required to complete the work. For highway lighting systems, price and payment will also constitute full compensation for providing the warranties.

**746716 - ELECTRIC SERVICE ON PEDESTAL**  
**746717 - ELECTRIC SERVICE ON PEDESTAL WITH SERVICE RISER**

**Description:**

This work consists of the installation of an electrical service, aerial or underground, on a pedestal board or on a pedestal board with service riser.

**Materials:**

Meter pan (Supplied by Contractor - utility company approved)  
 3/4" (19 mm) "LB" conduit  
 3/4" (19 mm) and 2" (50 mm) two hole pipe straps  
 3/4" (19 mm) weatherhead  
 2" (50 mm) galvanized conduit (5 feet (1.5 m) ±)  
 3/4" (19 mm) aluminum conduit (20 to 40 feet (6 to 12 m) ±)  
 2" (50 mm) "C" conduit, with cover and gasket  
 2" (50 mm) to 3/4" (19 mm) reducer  
 2" (50 mm) conduit ground clamp  
 3/4" (19 mm) and 2" (50 mm) offset nipples  
 60 amp fuse disconnect with 30 amp fuse  
 #8TW or THWN stranded copper wire (50 to 100 feet (15 to 30 m) ±):  
     - black and/or red for power  
     - white for neutral  
 #4 split bolt connector  
 #8/2 UF with ground  
 #8/3 UF with ground  
 #6 bare copper wire  
 3/4" (19 mm) Ground rod  
 3/4" (19 mm) Ground rod clamp  
 Copper covered staples  
 Service wedge clamp  
 Pressed steel channel clevis  
 Insulator  
 2" x 12" x 8' (50 mm x 300 mm x 2.4 m) pressure treated pine board, or sized as needed for required equipment  
 Anti-oxidant joint compound  
 Line Side Isolating Switch (per Delmarva Power Requirements for 3 phase electrical services)

All electrical materials shall conform to the requirements of the National Electric Code of the National Fire Protection Association, to all local and special laws, and/or to ordinances governing such installation. When these requirements do not govern, and where not otherwise specified, electrical materials shall conform to the Standardization Rules of the Institute of Electrical and Electronic Engineers. Shop drawings and catalog cuts for all electrical and related materials shall be submitted by the Contractor for approval.

**Construction Methods:****Electric Service on Pedestal without Service Riser:**

All work shall comply with NEC and NESC standards and comply with utility company minimum requirements.

All conduits and hardware connections shall be tightened with the appropriate wrenches or tools.

The meter pan shall be wired for 240 V single phase on the line side, unless otherwise noted on the Plans.

All service wires shall be #8 stranded copper.

All connections made within a meter pan shall include an anti-oxidant joint compound.

Install a 2" x 10" x 8' (50 mm x 250 mm x 2.4 m) pressure treated board with 3 feet (0.9 m) of the board placed in the ground at the service location as directed by the Engineer.

Install an appropriate length of 2" (50 mm) galvanized conduit (threaded and reamed on both ends) on the end of the 90-degree sweeps (installed by others or under other items in this contract) at the base of the pedestal board so that the conduit will be 3 feet (0.9 m) above the finished grade of the area.

Install the 2" (50 mm) "C" conduit on the top of the 2" (50 mm) galvanized conduit.

Place the meter pan 4 to 6 inches (100 to 150 mm) above the conduit and install a 2" (50 mm) chase or close nipple between them using approved methods. Place the meter pan on the pedestal to allow room for the line side conduit and connection (installed under other items in this contract) to be made.

Install #8/2 UF cable from the meter pan to the signal cabinet or the load location. The #8/2 UF cable and its installation shall be paid separately under other items in this contract.

The white wire shall be connected to the white wire of the #8/2 UF cable by the use of split bolt connector. The insulation should be removed from the ends of the wire to expose only 3/4" (19 mm) of stranded wire. The connection shall be completely taped. The bare copper wire from the #8/2 UF shall be attached to the "LB" conduit with a ground screw or clamp. The bare copper wire shall not enter the meter pan.

The black wire shall have a fused disconnect installed as per the manufacturer's installation instructions. Place all wires inside the conduit and install the cover(s) with gasket(s).

Install the ground rod under the conduit, driving rod within 6" (150 mm) of final grade. Using the appropriate ground rod clamps, attach enough #6 bare copper to reach and be connected to the 2" (50 mm) conduit ground clamp, to within 6" (150 mm) of the ground rod. Staple the #6 ground wire to the pedestal leaving enough slack to drive ground rod flush with final grade. Staples shall be placed every 6" (150 mm) and the #6 bare copper will be placed in a neat manner.

#### Electric Service on Pedestal with Service Riser:

Install the pedestal as described above. The pedestal will be installed within 10 feet (3 m) of the utility company's wood pole. If the distance from the pedestal to the utility company's wood pole exceeds 10 feet (3 m), the additional work and material will be covered under other items of this contract. Install a length of 2" (50 mm) galvanized conduit under the meter pan, so that the conduit will have 2 feet (0.6 m) of cover after a 2" (50 mm) galvanized elbow is installed. Connect the required length of 2" (50 mm) conduit to the elbow and install a second 2" (50 mm) galvanized elbow so that it is in direct contact with the utility company's wood pole. Install a 2" x 3' (50 mm x 0.9 m) nipple to the elbow. Reduce the 2" (50 mm) conduit to 3/4" (19 mm) with an approved reducing bushing. Install 30 feet (9 m) of 3/4" (19 mm) aluminum conduit above the conduit reducer, securing it to the wood pole within 12" (300 mm) of the conduit reducer and then at intervals not exceeding 3 feet (0.9 m). On the top of the 3/4" (19 mm) aluminum conduit install a 3/4" (19 mm) weatherhead, and secure the conduit to the wood pole within 12" (300 mm) of the weatherhead.

Install 3 (three) # 8 THHN stranded conductors {1 red, 1 black and 1 white} from the line side of the meter pan to the weatherhead, leaving 5 feet (1.5 m) coiled and taped outside for connection by others. Connect the other end inside the meter pan using an anti-oxidation.

For three phase services, install line side isolating switch (disconnecting means) with a visible break on the metered service pedestal next to the meter. Equipment and installation shall meet Delmarva Power requirements. Proper number and size of cables and conduit shall be provided for three phase service installations.

#### **Method of Measurement:**

The quantity of electrical services will be measured as the number of services installed in accordance with these specifications, complete in place, and accepted.

**Basis of Payment:**

The quantity of electrical services will be paid for at the Contract unit price per each. Price and payment shall include full compensation for installing the service, all utility permits, all materials and for all labor, tools, equipment, and incidentals necessary to complete the item.

4/29/11

**746774 - SUPPLY AND INSTALLATION OF LOOP DETECTOR WIRE**

**Description:**

This work consists of sawing a cut in existing pavement, furnishing and installing loop detector wire in the saw cut and sealing the saw cut with an approved sealer, in accordance with the Standard Details, the details in these specifications, or as directed by the Engineer.

**Materials:**

The loop detector wire shall be a shielded four-conductor controlled capacitance cable with conductors twisted 6 turns per foot and enclosed in an aluminized polyester shield within a polyethylene jacket, rated to 600 volts. The interior of the cable is filled with a water blocking material. The four conductors are AWG # 18 stranded copper with color-coded polypropylene insulation. Color rotation is black, red, white, and green. The loop detector wire shall have an UV stable high-density polyethylene outer cover that is chemical resistant and waterproof with a wall thickness of 0.032 inches (0.8 mm). The cable shall have a temperature tolerance range of -65 to +176 degrees Fahrenheit (-54 to +80 degrees Celsius). Outside diameter of the cable is 0.25 inches (6 mm).

Flexible embedding sealer shall be a cold poured, resilient type epoxy joint sealer, Bondo P-606 or Duracote - D115 for concrete or asphalt pavement or E-Poxy Industry 36-1 for concrete or E-Poxy Industry 11-1 for asphalt pavement, or approved equal.

A sealer accelerant or retarder may be added at the discretion of the Contractor.

3/8" (10 mm) closed cell foam backer rod

**Construction Methods:**

The saw cut shall be 1/4" (6 mm) wide and 3" (76 mm) deep. It shall be cut in the directions and sizes specified on the Standard Details or as directed by the Engineer. Contractor shall remove sharp edges in the saw cut and round the corners.

The saw cut shall be blown out with compressed air to remove all dust, water and particles of loose material.

A 3/8" (10 mm) backer rod will be placed into the bottom of the saw cut. The loop detector wire will then be installed using blunt tools so as to prevent damage to the polyethylene outer cover. One end of a loop detector wire shall be tagged to indicate start ("S"). All loop detector wires shall be laid in saw cuts in a clockwise rotation beginning with "S". The Engineer may require a High Voltage Ground Test with a 500 VDC megger after the loop detector installation is complete and prior to sealing saw cuts. If the resistance to ground is less than 100 megohms, this work will be rejected. Loop detectors also should be checked for continuity between the four conductors with an ohm-meter. If there is any resistance between colors or there is an open flow from color to color, this work will be rejected.

A sealer and sealer accelerant or retarder (if necessary) shall be applied in accordance with the manufacturer's directions and protected from traffic until it has set. A minimum of 1 inch of sealer shall be installed on top of the loop detector wire.

Two loop detector wires shall be installed in a saw cut from the loop to the edge of the road. These two wires shall then extend from the end of the saw cut to a junction well (see Standard Details). Wires shall be parallel and taped every 12" (305 mm) to 18" (457 mm) from the end of the saw cut to a junction well. A conduit may need to be installed between the end of the saw cut and junction well as directed by the Engineer. In this case the loop detector wire shall be installed in the conduit.

The loop detector wire shall be continuous and without splices from the junction well, through the saw cuts and conduit (if any).

**Method of Measurement:**

The quantity of loop detector wire to be measured under this item shall be the number of linear feet (meters) of saw cut in which loop detector wire is installed, sealed, tested, and accepted.

The additional loop detector wire needed beyond the saw cut to reach the junction well and sealer accelerant or retarder shall be incidental to this item and there shall be no separate measurement or payment. Any required conduit will be paid under a separate item.

Supply and installation of the conduit from the end of the saw cut to the junction well shall be covered under other items of this Contract. Installation of the loop detector wire in this conduit shall be incidental to this item and there shall be no separate measurement or payment.

Splicing of the loop detector wire to a lead-in cable in a junction well shall not be covered under this item and shall be paid separately under another item of this Contract.

**Basis of Payment:**

The quantity of detector wire supplied and installed will be paid for at the Contract unit price per linear foot (meter) of sawcut. Price and payment shall constitute full compensation for furnishing and placing all materials including loop detector wire, backer rod, sealer, labor, equipment, tools, and incidentals necessary to complete this item.

5/7/10

**746787 - REMOVAL OF CABLE FROM CONDUIT OR STEEL POLE**

**Description:**

This work consists of removing electrical wire and/or cable from existing conduits or steel poles. All electrical wire and/or cable may be removed, or one or more wires or cables may remain.

**Construction Methods:**

Hand pulling methods are required for conduit sizes of 1-1/2" (38 mm) or less and are preferred for all sizes.

Prior written approval by the engineer is required for the use of any power assisted method of pulling wire or cable from conduit. A short piece of material that will part if the strain exceeds the amount specified below shall be used between the pulling grip and the pulling medium, unless industry standards require less:

- 600 lbs. (2.7 kN ) for non-connectorized outdoor fiber optic cable,
- 150 lbs. (670 N) for all pulls up through 12 pair communications cable, and
- 300 lbs. (1.3 kN) for all larger cables

Any and all electrical wire or cable pulled from any conduit without the use of an acceptable pulling grip, kellems or equal, and without the use of a strain release element or by using methods which may have or did result in pulling forces in excess of those set forth herein or prescribed by industry standards are hereby declared damaged and shall be replaced by the contractor.

For removal from steel pole, only hand pulling methods are permitted. The weatherhead cover shall be removed first using proper tools. The wire or cable shall be removed by hand and the weatherhead cover replaced properly.

The electrical wire or the number of electrical or communications cable(s) to be pulled from each conduit or steel pole will be as shown on the plans or as directed by the Engineer.

The removal of wire or cables from existing conduit or steel pole shall be accomplished by pulling the wire or cables through the conduit or steel pole.

The number of electrical wires or cables pulled from a conduit may exceed one; the entire set to be pulled shall be considered one cable even if the wires or cables are pulled one at a time.

**Method of Measurement:**

The quantity of electrical wire or cable shall be measured as the number of linear feet (meters) of electrical wire or cable removed by pulling through a conduit or a steel pole in accordance with these specifications and returned to the Department at the North District Maintenance Shop, 39 E. Regal Blvd., Newark, DE. If more than one wire is to be pulled, the entire set to be pulled shall be considered one cable, even if pulled one at a time. Old electrical wire or cable being used as a fish wire to pull in new wire or cable shall not be paid as removal of cable or wire from conduits or poles.

**Basis of Payment:**

The quantity of electrical wire or cable removed will be paid for at the Contract unit price per linear foot (meter). Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

8/23/10

**746811 - INSTALLATION OR REMOVAL OF LIGHTING POLE W/ MAST ARM**

**Description:**

This work consists of assembling and installing complete highway lighting pole and single or twin mast arms on a pole base presently in place.

This item also includes the removal and return of a lighting pole with mast arm and all parts to the Department at the North District Maintenance Shop, 39 E. Regal Blvd, Newark, DE.

For the purposes of this item, single and twin mast arms shall be considered the same.

**Materials:**

The Department will supply the street lighting pole with mast arms.

**Construction Methods:**

Installation Methods:

The pole and mast arms shall be assembled, lifted by a suitable hoisting device as approved by the Engineer, set in place, plumbed, and secured to the pole base. The Contractor shall insure that the hoisting device is rated for the weight and reach necessary. The pole shall be connected to the ground rod. The service cable, if available, shall be placed in the pole base.

Removal Methods:

The service cable shall be disconnected and the wires to the luminaire shall be removed. The ground wire shall be disconnected and the pole and mast arms shall be lifted down by a suitable hoisting device. The pole bases shall be cleaned and protected to prevent danger to pedestrians and/or workers.

**Method of Measurement:**

The quantity of street lighting poles with mast arm will be measured as the number of lighting poles with mast arm installed in accordance with these specifications, complete, in place, tested, and accepted or removed, disassembled, and returned to the Department at the North District Maintenance Shop.

**Basis of Payment:**

The quantity of street lighting poles with mast arm will be paid for at the Contract unit price per each. For the purposes of this item, single and twin mast arms shall be considered the same. No additional payment shall be made for twin mast arm installations or removals. Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

8/23/10

**746815 - INSTALLATION OF LUMINAIRE**  
**746816 - REMOVAL OF LUMINAIRE**

**Description:**

This work consists of assembling and installing a complete highway lighting unit on a pole or mast arm presently in place and connecting it to an existing service cable or removing an existing luminaire and returning it to the Department at the North District Maintenance Shop, 39 E. Regal Blvd., Newark, DE.

**Materials:**

Installation:

The Department will supply the complete luminaire .

The Contractor will supply:

Connector Kits  
#8 THWN wire  
Split bolt connectors  
Electrical tape

**Construction Methods:**

**Installation Methods:**

The luminaire shall be transported to the site, assembled, and wired and attached to the mast arm or pole by use of hardware approved by the Engineer. The unit shall be attached to the existing service cable and tested. On wood poles, if the service cable is not available, a 5 foot (1.5 m) tail shall be left at the pole end of the mast arm. On metal poles, the electrical connections and grounding of pole will be made in the base. If the service cable is not available, a 5 foot (1.5 m) tail shall be left in the pole base.

Each luminaire installed under this item shall be separately connected to the service cable at the pole on wood poles and in the pole base on metal poles.

**Removal Methods:**

The luminaire shall be removed from the pole or mast arm after the wires have been disconnected. The wires shall be taped and secured so that they remain available for installation of a luminaire.

The luminaire and all hardware shall be returned to the Department at the North District Maintenance Shop.

**Method of Measurement:**

The quantity of luminaires measured under this item shall be the number of luminaries installed in accordance with these specifications, complete, in place, tested, and accepted or removed, wires secured for future use, and all materials returned to the Department at the North District Maintenance Shop.

**Basis of Payment:**

The quantity of luminaries shall be paid for at the Contract unit price per each. Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

9/8/10

**746830 - REMOVAL OF CONCRETE POLE BASES AND CABINET FOUNDATIONS**

**Description:**

This work consists of the removal of concrete pole bases and concrete cabinet foundations.

**Materials:**

Equipment as required to remove concrete pole bases and concrete cabinet foundations. Material as necessary to match the area surrounding the removed or graded masonry.

**Construction Methods:**

The masonry shall be removed to a depth of six inches below final grade or six inches below proposed pavement box in new pavement sections.

Backfill remaining hole with material that matches the surrounding area in accordance with the appropriate items.

**Method of Measurement:**

The quantity of concrete will be measured as the number of cubic yards (cubic meters) of concrete removed including anchor bolts, reinforcing bars, conduits and any other hardware within the concrete.

Concrete or other materials moved or removed which is not a part of the item being removed, shall not be measured for the purpose of payment under this item.

**Basis of Payment:**

The quantity of concrete will be paid for at the unit price per cubic yard (cubic meter). Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

9/16/10

**746843 - POLE BASE TYPE 1**  
**746844 - POLE BASE TYPE 2**  
**746845 - POLE BASE TYPE 2A**  
**746846 - POLE BASE TYPE 2B**  
**746847 - POLE BASE TYPE 3**  
**746848 - POLE BASE TYPE 3A**  
**746849 - POLE BASE TYPE 3B**  
**746850 - POLE BASE TYPE 4**  
**746851 - POLE BASE TYPE 5**  
**746852 - POLE BASE TYPE 6**

**Description:**

This work consists of constructing and furnishing round or square pole bases Types 1, 2, 2A, 2B, 3, 3A, 3B, 4, 5, and 6 for poles in accordance with the Standard Construction Details and at locations as directed by the Engineer.

**Materials:**

The concrete for pole bases shall conform to Section 812, Class B.

Bar reinforcement shall meet the requirements of Section 603 Grade 60.

Ground rods shall be copper clad, approved by the Underwriter's Laboratory and be supplied with approved clamps for connecting the grounding conductor to the rod.

Conduit for sweeps shall meet the requirements for galvanized rigid steel conduit in Section 745.

Anchor bolts will be supplied by the same entity that supplies the poles. This is the case for all poles types, with the exception of Type 4. For Type 4, drop-ins are used for breakaway and the Contractor will supply the anchor bolts for Type 4. The anchor bolts and nuts for Types 5 and 6 shall not be hot-dipped galvanized and these anchor bolts and nuts shall meet the requirements of AASHTO M 314. Anchor bolts shall have a minimum yield strength of 55,000 psi (380,000 kPa).

**Construction Methods:**

The bases shall conform to the dimensions as indicated on the Standard Construction Details. A ground rod shall be installed as shown. A minimum of 8 feet (2.5 m) of the ground rod must be driven into undisturbed soil.

If a utility or a right-of-way conflict is found when a Type 2 or Type 3 base is specified in the Plans, an alternate base of equivalent strength may be used as directed by the Engineer. A Type 2 base has two equivalents, namely Types 2A and 2B. A Type 3 base has two equivalents, namely Types 3A and 3B.

Though the contract calls for the use of a round pole base, the Contractor may use a square base at its discretion.

The end of the conduit sweeps in the ground shall be extended outside the concrete and any forms or sheeting by 12 inches (300 mm) and capped or connected to the existing conduit. If the conduit is to be capped underground for future use, it must be sealed with a galvanized threaded conduit plug. Tape is NOT an approved conduit plug. The location of the conduits shall be marked on the base with arrows drawn in the wet concrete within 6 inches (150 mm) of the outer edge.

Excavation for the pole bases may not exceed the dimension of the foundation by more than 12 inches (300 mm) in any one direction. If a form is used in the excavation more than 18 inches (450 mm) below the ground surface, it is necessary that the area between the form and excavation be filled and tamped on all sides in layers not to exceed 6 inches (150 mm).

Where a pole base is to be placed in existing concrete pavement such as a sidewalk, the concrete shall be saw cut in a square pattern or removed to the nearest joint. In other pavement material, a round hole may be

cut using an appropriate tool. Any damage to the existing pavement shall be repaired at the Contractor's expense and shall meet the approval of the Engineer. Any removal or replacement of any type of pavement under this item shall be an incidental cost to this item.

The bases shall be edged and have a broom finish.

Where water or highly unstable material is encountered during the excavation for the pole base, pole base sheeting may be required and the following steps shall apply:

1. The condition exists in the upper half of the excavation. Stop all work until the Bridge Design Section reviews the condition.
2. The condition exists below the upper half of the excavation:
  - a. For a proposed Type 4 Base, increase the depth to 4 feet (1.2 m).
  - b. For a proposed Type 5 Base, substitute a Type 1 Base.
  - c. For a proposed Type 1, 2, or 3 Pole Base, substitute a Type 3A Pole Base for all but a Type 3B Pole Base. The depth of the base shall be as determined in (e) below, or 9 feet (2.7 m), whichever is greater.
  - d. For a proposed Type 6 Pole Base, substitute a Type 2 Pole base and increase the depth in accordance with (e) below.
  - e. Determine the depth of the base, which would be in the unsatisfactory area. Multiply that depth by 0.7 and add the result to the original required depth of the base to obtain the final depth of the base. The reinforcing bars shall be extended using the required pattern to match the final depth in accordance with the requirements of Section 603.07 of the Standard Specifications.

**Method of Measurement:**

The quantity of pole bases will be measured as the actual number of bases constructed, complete in place and accepted. Excavation and backfilling around the base and the two conduit sweeps in the base are included in this item.

Any increase in the vertical dimension required herein shall be paid for separately under another item of this contract.

Payment for any additional sweeps shall be paid for separately under the appropriate conduit items. The Contractor's use of square base rather than a specified round base shall not result in any additional cost to the Department.

**Basis of Payment:**

The quantity of pole bases will be paid for at the Contract unit price for each pole base type. If an alternate pole base type is selected by the Engineer, payment will be the Contract unit price for the alternate selected. Price and payment will constitute full compensation for furnishing and placing all materials; for a minimum of two conduit sweeps extending into the base; for excavating, backfilling and compacting around the base; for repairs to damaged existing pavement; for removal or replacement of pavement; and for all labor, equipment, tools, and incidentals required to complete the work.

01/15/03

**746876 – UNDERPASS LIGHT FIXTURE**

**Description:**

This work consists of furnishing and installing wall mounted luminaires with electrical circuitry for underpass lighting at locations shown on the plans. Work includes, but is not limited to, furnishing and installing underpass luminaire with lamp, ballast and mounting hardware.

**Materials and Construction Methods:**

Luminaires shall be listed as Suitable for Wet Locations according to UL Standard No. 1572 with sealed and filtered optical assemblies. Use high power factor ballasts that are completely pre-wired integral units for reliable starting and operating of high pressure sodium lamps at -40°F ambient temperature. Lamp sockets shall have a heavy-duty mogul base with split shell tempered brass lamp grips and a free-floating, spring-laded center contact. Use the luminaire type, wattage, voltage and IES illumination distribution pattern as shown on the plans.

Luminaire housing shall be cast aluminum, painted with premium quality gray or dark bronze paint. Use the same color luminaires throughout the project. Provide a prewired ballast and terminal board assembly and cast aluminum single-hinged door with glass refractor. Provide factory installed mounting holes in the back and conduit entrances in the sides and top. Provide a formed aluminum reflector and socket assembly with a chemically bonded lightweight non-breakable glass finish, which is removable with only a screwdriver.

Contractor shall mark the month and year the lamp is installed on the lamp base dating system with a sharp instrument.

The Contractor shall furnish and install identification decals on the luminaire housing that can be seen visually from the road. Lamp decals shall indicate the lamp wattage and type via standard identifying numbers and background color. For example, “7” on a yellow sticker indicates a 70 watt high pressure sodium lamp.

All underpass luminaires and lamps shall be furnished and installed as specified in the contract documents and in accordance with manufacturer’s recommendations. Clamps and attachment hardware shall be galvanized or stainless steel.

After installation has been completed and prior to performance test, refractors and reflectors shall be cleaned with a product approved for use by the manufacturer.

**Method of Measurement:**

The quantity of underpass light fixtures will be measured as the actual number of underpass light fixtures (with lamps) furnished, installed, operational and accepted.

**Basis of Payment:**

The quantity of underpass light fixtures shall be paid at the Contract unit price per each light fixture furnished and installed. Price and payment will constitute full compensation for furnishing all materials, including mounting hardware and supply cables, and supply and installation of luminaires and lamps. The price will also include all labor, tools, equipment, testing and incidentals to complete the work.

8/20/10

**747504 - INSTALLATION OR REMOVAL OF POLE OR POST MOUNTED CABINET**  
**747505 - INSTALLATION OR REMOVAL OF BASE OR PAD MOUNTED CABINET**

**Description:**

This work consists of transporting and bolting down, and sealing a field equipment cabinet as specified in the plans or as directed by the Engineer. This work shall include all necessary hardware and electrical connections.

This item also includes removing an existing cabinet including the connections to the cabinet and delivery of the cabinet to the Department at the North District Maintenance Shop, 39 East Regal Blvd, Newark, DE.

**Materials:**

The Department will supply the Cabinet.

The Contractor shall supply:

Silicone sealant with a guaranteed life span of 25 years or better.

Items necessary to protect the foundation during removal activities.

**Construction Methods:**

**Installation:**

Cabinet shall be obtained from the Department, transported to the work site, placed on the cabinet base, and bolted down. All cabinet mounting bolts will be coated with an anti-seize compound before installation. Just prior to bolting down the cabinet, a bead of silicone sealant shall be placed under the cabinet on three sides. The side to remain unsealed shall be the side with the lowest elevation. This provides for drainage from within the cabinet. A bead of sealant shall be placed around the outside of the cabinet on the same three sides once the cabinet is bolted down. The condition of the cabinet will be the same after it is bolted in place as it was at the Department.

**Removal:**

The cabinet shall be unbolted, removed, and placed upright on a truck and delivered to the Department at the North District Maintenance Shop, 39 East Regal Blvd, Newark, DE.. The cabinet anchor bolts shall be reinserted and tightened into the foundation. All conduits will be properly capped to prevent foreign matter from falling into the conduits. Tape is NOT an approved method of capping conduits. The foundation, if not immediately reused, shall be adjusted or marked as necessary to prevent injury to pedestrians.

**Method of Measurement:**

The quantity of cabinets will be measured as the number of cabinets installed in accordance with these specifications, complete, and accepted or removed and delivered to the Department at the North District Maintenance Shop, 39 East Regal Blvd, Newark, DE.

**Basis of Payment:**

The quantity of cabinets will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

9/16/10

**747506 - CABINET BASE**

**Description:**

This work consists of installing a Cabinet Base.

**Materials:**

Class B Concrete  
2 - 3/4" (19 mm) x 10' (3 m) sectional copperclad steel ground rods  
6 - 5/8" (16 mm) Hilti Drop-in Anchors or approved equal  
6 - 5/8" (16 mm) x 1-1/2" (38 mm) galvanized hex bolts  
2 - 3/4" (19 mm) acorn type ground clamps  
2 - 2" (50 mm) x 24" (610 mm) PVC conduit lengths

**Construction Methods:**

The base shall conform to the dimensions as indicated in the cabinet base detail on the Standard Construction Details. Conduits entering the base must enter only in the designated area. A minimum distance of 1 inch shall be maintained between conduits and a minimum distance of 2 inches (50 mm) between conduits and the ground rods.

A minimum of 8 foot (2.5 m) of the ground rods must be driven into undisturbed soil through the 2 inch (50 mm) PVC sleeve. The PVC sleeve shall be driven into the ground so that the top of the sleeve will be flush with the concrete when the base is poured.

**Method of Measurement:**

The quantity of cabinet bases will be measured as the number of bases constructed in accordance with these specifications, complete in place, and accepted.

Payment for all conduits extending into the cabinet base shall be included in the items for installation of conduit.

**Basis of Payment:**

The quantity of cabinet bases will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

01/15/03

**747509 - LIGHTING CONTROL CENTER – 200A**

**Description:**

This work consists of furnishing and installing load center cabinet with concrete pad and all necessary conduits, underground facilities, equipment, and wiring as indicated on the Plans or as directed by the Engineer.

**Materials:**

The concrete shall conform to Section 812, Class B of the Standard Specifications.

Galvanized steel conduits and fittings shall be as specified under Section 745 of the Standard Specifications.

Meter Pan for 277/480 volt, three phase, four wire service meeting the requirements of the utility company.

Ground Rod shall be sectional, copper-clad ¾" diameter by 10 feet long.

Service wire between the disconnect and the meter pan and between meter pan and the utility company shall be sized for 200 amp service (minimum) and meet utility company requirements.

Provide 3" rigid galvanized steel conduit from meter pan to nearest utility facility as indicated on plan or directed by the Engineer. Conduit will include mounting to utility pole and weather head. Installation is to meet utility company requirements.

**Cabinet**

The service cabinets and doors shall have a minimum size of 36" wide by 48" tall by 15" deep.

The cabinets and doors shall be constructed from 5052-H32 sheet aluminum alloy with a thickness of 0.125". External welds shall be made by using Heliarc welding method, internal weld, may be made by the wire welding method. All welds shall be neatly formed and free of cracks, flow holes and otherwise irregularities.

The outside surface of the cabinet shall have a smooth uniform, natural aluminum finish. The cabinets shall have a sloped top to prevent accumulation of water on its top surface.

The enclosure door frame shall be double flanged out on all four sides. These flanges increase strength of opening and keep dust and liquids from dropping into enclosure when door is opened. The cabinet door shall be hinged on the right side when facing the cabinet and shall be a minimum 80% of the front surface area. The door shall be gasketed to satisfy requirements of NEMA 4X enclosure.

The door shall have a heavy gauge continuous hinge with ¼" diameter stainless steel hinge pin. Hinge shall be secured with 1/4-20 stainless steel carriage bolts and stainless steel nylock nuts.

Cabinets shall be provided with a 5052-H32 aluminum alloy metal back panel of 0.125" minimum thickness. All mounting hardware shall be furnished. All internal hardware shall be either stainless steel or cadmium pressed steel Type II, Class I.

Cabinets finish shall be natural aluminum mill finish for Federal Specification QQA-250/8.

**Main Disconnect**

Provide a 200 AT/AF, 3 pole, molded-case circuit breaker. The circuit breaker shall be service entrance rated. It shall be rated for 277/480 volt three phase, four-wire operation. It shall have a minimum 22,000 RMS symmetrical ampere short circuit current rating. The circuit breaker shall be UL listed and comply with NEMA Standards and Federal Specification W-C-375B.

The main disconnect shall be separately enclosed external to the service cabinet. The main disconnect

Enclosure shall be NEMA 3R rated.

#### Panelboard

Panelboards shall be rated for 277/480 volt, three phase, four-wire operation. The panel board shall be UL listed and have a minimum of 200 amp rated main busses and main lugs only. It shall have a minimum of 30 spaces for branch circuit breakers. It shall have a minimum 22,000 RMS symmetrical ampere short circuit current rating. It shall conform to Federal Specification W-P-115C, Type 1, Class 1.

A solidly bonded equipment ground bar and neutral bar shall be provided.

The panel board shall be mounted within its own enclosure. It shall be of dead front construction and be rated NEMA Type 1. Finish shall be gray baked enamel.

#### Branch Circuit Breakers

Provide circuit breakers of quantity and current rating as required by the plans for proper circuiting and provide two spare breakers of like current rating as the other lighting circuit breakers. Circuit breakers shall be UL listed and comply with NEMA Standards and Federal Specification W-C-375B. Circuit breakers shall be rated for 10 KAIC

#### Lighting Contactor, Photocell and Override Control

Provide a central lighting contactor. Lighting contactor shall be two or three pole as required for the given service type. Contacts shall be rated for 200 amps at the given service voltage. Coil shall be rated for 277 volts.

Provide a remote photoelectric light control (photocell) mounted at the top the lighting cabinet as shown on the plans. Photocell shall be a cadmium-sulphide type with fail-safe in the "on" position. It shall be enclosed in a weatherproof housing, not susceptible to distortion, discoloration, cracking or crazing. It shall include pole mounting hardware and be a plug-in, locking type for mounting in a receptacle meeting UL Specification 773. It shall be rated of 1800 VA for ballast type loads and used to energize a contactor. It shall be designed to operate at 277 volts and at -20 degrees F ambient temperature. It shall have a turn-off time delay to prevent false turn-off due to lightning, stray lighting or flashing lights.

Provide 277 volt-rated DPST toggle switch for manual override of photocell control.

#### **Construction Methods:**

Service conduit shall be installed in accordance with DelDOT standard specification and utility company requirements.

The concrete pad shall be a cast-in-place monolithic slab, with sides formed to a minimum 30" depth below the final ground surface. Concrete shall not be poured until the forming, position of conduits and grounding facilities are approved by the Engineer. Appropriate provisions shall be used to support conduit, grounding facilities and anchor bolts during concrete pouring and curing. All conduits shall be provided with temporary pipe caps during the placement of concrete. A minimum distance of 1" shall be maintained between conduits. Install 2" conduit to serve as a sleeve for the ground rod. The pad will include all conduits within the pad, grounding bushings on conduits coming out of top of pad, and anchor bolts as shown on the contract drawings, or as directed by the Engineer.

Forms shall not be removed from the concrete pad until twenty-four (24) hours after the concrete has been poured and the pad is to be kept moist for a period of seven (7) days after pouring. The concrete surface shall be level and have a broom finish.

All excavation material shall be stockpiled on the site until backfilling has been completed. Backfill may be placed after the first 24 hours and is to be accomplished in 6" layers, with each lift mechanically tamped. All excess material is to be removed and used elsewhere on the project as approved by the Engineer.

Cabinets shall be installed on the concrete pad using the method of attachment as noted on the Plan details, or as directed by the Engineer.

Electrical equipment shall be installed as indicated on the plans.

**Method of Measurement:**

The quantity of load centers be measured as the actual number of load centers furnished and installed, including cabinets, all equipment, conduit, wiring, concrete pad, and incidentals, complete in place, operational and accepted.

**Basis of Payment:**

The quantity of load centers will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing and installing all materials for load center and concrete pad installation, excavation and backfilling for the service conduit and pad or footing, and for all labor, equipment, tools and incidentals necessary to complete the item.

9/16/10

**748502 - RAISED/RECESSED PAVEMENT MARKER**

**Description:**

This work consists of furnishing and installing raised/recessed pavement markers in accordance with the Plans and these specifications.

**Materials:**

The cast iron housing shall meet the requirements of ASTM A 536-84, Grade 72-45-84.

The reflectors shall meet the requirements of ASTM D 4383-03.

For installation on interstates, freeways, and principal arterials, the pavement marker shall have red reflectorized material on the back side (the side not facing the direction of traffic).

Epoxy shall meet the requirements of AASHTO M237, Type IV.

The followings models have been tested and approved by the Department and shall be used:

1. (Ennis Paint) Stimsonite - Avery Dennison Model 101LPCR Snow Plowable Marker.
2. Ray-O-Lite Model 300 Snow Plowable Marker with Model 2004 Reflector.
3. Or Approved Equal.

**Construction Methods:**

Pavement shall be saw cut to match the bottom contour of the marker housing using a saw and blade suitable for the pavement material being sawed. The depth of the cut slot must allow the housing to be set in epoxy, with leveling lugs resting on the pavement surface, so that the front edge of marker is at or below the surface of the pavement. Excessive saw cuts must be repaired to the satisfaction of the Engineer. When cutting is complete, the slot shall be cleaned as recommended by the manufacturer of the epoxy material. The epoxy and pavement marker will be installed in the prepared contour slot in the pavement per the manufacturer's recommendations.

After installation, the Striping and Markings Section shall be notified for inspection and approval of acceptance of the raised pavement markers.

**Method of Measurement:**

The quantity of raised/recessed pavement markers will be measured as the actual number installed and accepted.

**Basis of Payment:**

The quantity of raised/recessed pavement markers will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing all materials, installation, saw-cutting, cleaning, disposal of discarded materials, for all labor, tools, equipment, all necessary incidentals associated with the item to complete the work.

03/13/08

- 748506 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, WHITE/YELLOW, 4"
- 748507 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, WHITE/YELLOW, 6"
- 748508 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, WHITE/YELLOW, 8"
- 748509 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, WHITE/YELLOW, 12"
- 748510 - PERMANENT PAVEMENT STRIPING, SYMBOL/LEGEND, EPOXY RESIN PAINT
  - 748535 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 4"
  - 748536 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 6"
  - 748537 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 8"
  - 748538 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 10"
  - 748539 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 12"
  - 748540 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 16"
  - 748557 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 3"

**Description:**

This work consists of furnishing and applying white or yellow, epoxy reflectorized pavement markings or black epoxy contrast pavement markings at the locations and in accordance with the patterns indicated on the Plans, or as directed by the Engineer, and in accordance with these specifications.

The white/yellow epoxy marking material shall be hot-applied by spray methods onto bituminous and/or Portland cement concrete pavement surfaces as required by the Plans. Following an application of double drop glass beads of two sizes and upon curing, the resultant epoxy marking shall be an adherent reflectorized stripe of the specified thickness and width that is capable of resisting deformation by traffic. All marking materials shall be certified lead free and free of cadmium, mercury, hexvalent chromium, and other toxic heavy metals.

The black epoxy marking shall be a two-component, hot-spray applied epoxy resin pavement marking material to be used for pavement marking on Portland cement concrete pavement surfaces. Following an aggregate drop, and upon curing, it shall produce an adherent stripe of specified thickness and width capable of resisting wear from traffic. Black contrast pavement markings will be required on all Portland cement concrete pavements.

**Materials Requirements:**

A. White and Yellow Reflectorized Epoxy

1. Epoxy Composition Requirements:

The epoxy resin composition shall be specifically formulated for use as a pavement marking material and for hot-spray application at elevated temperatures. The type and amounts of epoxy resins and curing agents shall be at the option of the manufacturer, providing the other composition and physical requirements of this specification are met.

The epoxy marking material shall be a two-component (Part A and Part B), 100% solids type system formulated and designed to provide a simple volumetric mixing ratio (e.g. two volumes of Part A to one volume of Part B).

Component A of both white and yellow shall conform to the following requirements:

<b>% BY WEIGHT</b>		
	<b>WHITE:</b>	<b>YELLOW:</b>
Pigments	Titanium Dioxide - 18% Min. (ASTM D476, Type II)	Organic Yellow - 6%-10%
Epoxy Resin	75% Min., 82% Max.	70% Min., 77% Max.

The entire pigment composition shall consist of either titanium dioxide and/or organic yellow pigment. No extender pigments are permitted. The white pigment upon analysis, shall contain a minimum of 16.5% TiO<sub>2</sub> (100% purity).

Epoxy Content-WPE (Component A) - The epoxy content of the epoxy resin will be tested in accordance with ASTM D1652 and calculated as the weight per epoxy equivalent (WPE) for both white and yellow. The epoxy content will be determined on a pigment free basis. The epoxy content (WPE) shall meet a target value provided by the manufacturer and approved by the Department's Material and Research Section (from now on will be addressed as Department). A  $\pm 50$  tolerance will be applied to the target value to establish the acceptance range.

Amine Value (Component B) - The amine value of the curing agent shall be tested in accordance with ASTM D2074-66 to determine its total amine value. The total amine value shall meet a target value provided by the manufacturer and approved by the Department. A  $\pm 50$  tolerance will be applied to the target value to establish the acceptance range.

Toxicity - Upon heating to application temperature, the material shall not exude fumes which are toxic or injurious to persons or property.

Viscosity - Formulations of each component shall be such that the viscosity of both components shall coincide (within 10%) at a recommended spray application.

## 2. Physical Properties of Mixed Composition:

Unless otherwise noted, all samples are to be prepared and tested at an ambient temperature of  $73 \pm 5^\circ\text{F}$ . ( $23 \pm 3^\circ\text{C}$ ).

- a. Color. The white epoxy composition when applied at a minimum wet film thickness of  $20 \pm 1$  mils ( $500 \mu\text{m}$ ) as applicable and allowed to dry, shall plot within the boundaries described by the four corner points listed in Tables 1 and 2 of ASTM D 6628-01 when measured in accordance with the test methods prescribed in Section 7 of ASTM D 6628-01.

The yellow epoxy composition when applied at a minimum wet film thickness of  $20 \pm 1$  mils ( $500 \mu\text{m}$ ) as applicable and allowed to dry, shall plot within the boundaries described by the four corner points listed in Tables 1 and 2 of ASTM D 6628-01 when measured in accordance with the test methods prescribed in Section 7 of ASTM D 6628-01.

- b. Directional Reflectance. The white epoxy composition (without glass spheres) shall have a daylight directional reflectance of not less than 84% relative to a magnesium oxide standard when tested in accordance with Method 6121 of Federal Test Method Standard No. 141.

The yellow epoxy composition (without glass spheres) shall have a daylight directional reflectance of not less than 55% relative to a magnesium oxide standard when tested in accordance with Method 6121 of Federal Test Method Standard No. 141.

- c. Drying Time (Laboratory). The epoxy composition, when mixed in the proper ratio and applied at a  $20 \pm 1$  mils ( $500 \mu\text{m}$ ) minimum wet film thickness, and immediately dressed with large reflective glass spheres (Federal Spec. Type 4) at a rate of 12 lb/gal (1.4 kg/l) of epoxy pavement marking materials, immediately followed by a second drop of AASHTO M-247 Type 1 glass spheres applied at a rate of 12 lb/gal (1.4 kg/L) of epoxy pavement marking material, shall exhibit a no-track condition in 15 minutes or less (ASTM D711). A Bird Applicator or any other doctor blade shall be used to produce a uniform film thickness.

- d. Drying Time (Field). When installed at a minimum wet film thickness of  $20 \pm 1$  mils ( $500$  or  $625 \mu\text{m}$ ) and reflectorized with glass spheres, the

maximum drying times shall correspond to these temperatures:

80°F (27°C)	10 minutes
70°F (21°C)	10 minutes
60°F (16°C)	15 minutes
50°F (10°C)	25 minutes
40°F (4°C)	45 minutes
35°F (2°C)	60 minutes

The composition shall dry to "no-tracking" in approximately 10 minutes, and after thirty (30) minutes shall show no damaging effect from traffic. Dry to "no-tracking" shall be considered as the condition where no visual deposition of the epoxy marking to the pavement surface is observed when viewed from a distance of 100 feet (30 meters), after a passenger car is passed over the line. Regardless of the temperature at the time of installation, the installation contractor shall be responsible for protection of the markings material until dry to a non-tracking state.

e. Abrasion Resistance. The wear index of the composition shall not exceed 82 when tested in accordance with ASTM C501 using a CS-17 wheel and under a load of 1000 grams for 1000 cycles.

f. Tensile Strength. The tensile strength of the epoxy composition shall not be less than 6000 psi (41 MPa) when tested in accordance with ASTM D638 using a Type IV specimen [0.125" ± 0.010" (3.18 ± 0.25 mm) thick]. Tests shall be conducted at an ambient temperature of 75 ± 5°F (24 ± 3°C). The testing machine shall operate at a speed of 0.20" (5.1 mm) per minute.

The total conditioning or drying period, from the time the epoxy composition is first mixed to the time of testing, shall not be less than 24 hours nor more than 96 hours.

Test specimens for tensile strength determination will be prepared as follows:

A 1/8 inch (3 mm) thick sheet of epoxy material is cast from a reservoir-type mold, fabricated from polytetrafluorethylene (PTFE), 1/8" deep x 10" x 10" (3 mm deep x 250 mm x 250 mm).

Prior to casting, the mold is sprayed with a suitable release agent. A sufficient amount of epoxy composition is mixed in the proper proportions (A:B) and poured level with the top of the mold. Care should be taken so as not to decrease or exceed the 1/8" (3 mm) thickness.

After a period of 1 to 4 hours, the material will have set into a semi-rigid sheet that is flexible enough to die-cut yet rigid enough to retain its shape. While the material is in this "plastic" state, five (5) specimens shall be die-cut and then placed on a flat, smooth, PTFE surface for the completion of the specified conditioning period.

g. Compressive Strength. The compressive strength of the epoxy composition shall not be less than 12,000 psi (83 MPa) when tested in accordance with ASTM D695 except that a compression tool shall not be necessary. The test specimen shall be a right cylinder [0.50 inch diameter by 1.0 inch length (12 mm diameter by 25 mm length)]. Tests shall be conducted at an ambient temperature of 75 ± 5°F (24 ± 3°C).

The total conditioning or drying period, from the time the epoxy composition is first mixed to the time of testing shall not be less than 24 hours nor more than 96 hours.

Test specimens for compressive strength determinations will be prepared as follows:

Five molds will be prepared from 1/2" (12 mm) I.D., 1/16" (1.5 mm) wall

thickness acrylic tubing, cut in 1 1/2" (38 mm) lengths. After spraying the inside of the mold with a suitable release agent,<sup>(1)</sup> the cylindrical tubes are placed in a vertical position on a PTFE sheet base. A sufficient amount of epoxy composition is thoroughly mixed in the proper proportions (A:B) and poured into the mold to a depth of approximately 1 1/4" (32 mm). After a minimum of 72 hours curing, the specimens are removed from the molds and machined to a length of 1" ± 0.002" (25 mm ± 0.05 mm).

- h. Hardness. The epoxy composition when tested in accordance with ASTM D2240 shall have a Shore D hardness of between 75 and 100. Samples shall be allowed to dry for not less than 24 hours nor more than 96 hours prior to testing.

B. Reflective Glass Spheres/Beads

Reflective glass spheres for drop-on application shall conform to the following requirements:

The glass spheres shall be colorless; clean; transparent; free from milkiness or excessive air bubbles; and essentially clean from-surface scarring or scratching. They shall be spherical in shape and at least 80% of the glass beads shall be true spheres when tested in accordance with ASTM D1155. At least 80% of the Type IV beads shall be true spheres as measured by the visual method.

The refractive index of the spheres shall be a minimum of 1.50 as determined by the liquid immersion method at 77°F (25°C).

The silica content of the glass spheres shall not be less than 60%.

The crushing resistance of the spheres shall be as follows: A 40 lb. (18 kg) dead weight, for 20 to 30 (850 µm to 600 µm) mesh spheres shall be the average resistance when tested in accordance with ASTM D1213.

The glass spheres shall have the following grading when tested in accordance with ASTM D1214.

M247 AASHTO Type 1 Glass Spheres

<u>U.S. Standard Sieve</u>	<u>% Retained</u>	<u>% Passing</u>
#20 (850µm)	0	100
#30 (600µm)	5-25	75-95
#50 (300µm)	40-65	15-35
#100 (150µm)	15-35	0-5
Pan	0-5	

Type 4 Large Spheres

<u>U.S. Standard Sieve</u>	<u>% Retained</u>	<u>% Passing</u>
#10 (2000 µm)	0	100
#12 (1680 µm)	0-5	95-100
#14 (1410 µm)	5-20	80-95
#16 (1190 µm)	40-80	10-40
#18 (1000 µm)	10-40	0-5
#20 (850 µm)	0-5	0-2
Pan	0-2	

The AASHTO M247 Type 1 glass spheres shall be treated with a moisture-proof coating. They shall show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps. They shall flow freely from dispensing equipment at any time when surface and atmosphere conditions are satisfactory for marking operations. The moisture-resistance of the glass spheres shall be determined in accordance with AASHTO M247 test method 4.4.1.

Type IV glass spheres shall be treated with an adhesion coating. They shall show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps. They shall flow freely from dispensing equipment at any time when surface and atmosphere conditions are satisfactory for marking

operations. The adhesion coating property of the Type IV beads shall be tested in accordance with the dansyl-chloride test.

C. Black Epoxy Contrast Markings

Epoxy Resin Requirements: The two-component, 100% solids, paint shall be formulated and designed to provide a simple volumetric mixing ratio (e.g. 2 part component A to 1 part component B) specifically for service as a hot-spray applied binder for black aggregate in such a manner as to produce maximum adhesion. The material shall be composed of epoxy resins and pigments only.

The paint shall be well mixed in the manufacturing process and shall be free from defects and imperfections that may adversely affect the serviceability of the finished product. The paint shall not thicken, curdle, gel, settle excessively, or otherwise display any objectionable properties after storage. Individual components shall not require mixing prior to use when stored for a maximum of 6 months.

The overall paint composition shall be left to the discretion of the manufacturer, but shall meet the following requirements:

Composition:	<u>Component</u>	<u>Percent By Weight</u>
	Carbon Black (ASTM D476 Type III)	7±2 percent, by weight
	Talc	14±2 percent, by weight
	Epoxy Resin	79±4 percent, by weight

D. Black Aggregate

The moisture resistant aggregate shall meet the gradation requirements (AASHTO T27) as follows:

<u>Sieve Size</u>	<u>Percent Retained</u>
#30	18-28%
#40	60-80%
#50	2-14%

The moisture resistant aggregate shall have a ceramic coating. The aggregate shall be angular with no dry dispensement pigment allowed.

<u>Hardness:</u>	The black aggregate hardness shall be 6.5-7 on Moh's Mineral Scale.
<u>Porosity:</u>	The black aggregate porosity shall be less than two (2) percent.
<u>Moisture Content:</u>	The black aggregate moisture content shall be less than a half (.5) percent.

E. Packaging and Shipment

Epoxy pavement marking materials shall be shipped to the job site in strong substantial containers. Individual containers shall be plainly marked with the following information:

- a. Name of Product
- b. Lot Number
- c. Batch Number
- d. Test Number
- e. Date of Manufacture
- f. Date of expiration of acceptance (12 months from date of manufacture)
- g. The statement (as appropriate)  
Part A - Contains Pigment & Epoxy Resin  
Part B - Contains Catalyst
- h. Quantity
- i. Mixing proportions, Application Temperature and Instructions

- j. Safety Information
- k. Manufacturer's Name and Address

Reflective glass spheres shall be shipped in moisture resistant bags. Each bag shall be marked with the name and address of the manufacturer and the name and net weight of the material.

F. The Department reserves the right to randomly take a one-quart sample of white, yellow and hardener, of the epoxy material or glass spheres without prior notice for testing to ensure the epoxy material meets specifications.

Epoxy Application Equipment:

Application equipment for the placement of epoxy reflectorized pavement markings shall be approved by the Department, prior to the start of work.

At any time throughout the duration of the project, the Contractor shall provide free access to his epoxy application equipment for inspection by the Engineer or his authorized representative.

In general, the application equipment shall be a mobile, truck mounted and self contained pavement marking machine, specifically designed to apply epoxy resin materials and reflective glass spheres in continuous and skip-line patterns. The application equipment shall be maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. In addition, the truck mounted unit shall be provided with accessories to allow for the marking of legends, symbols, crosswalks, and other special patterns.

The Engineer may approve the use of a portable applicator in lieu of truck mounted accessories, for use in applying special markings only, provided such equipment can demonstrate satisfactory application of reflectorized epoxy markings in accordance with these specifications.

The applicator shall be capable of installing up to 20,000 lineal feet (6,100 lineal meters) of epoxy reflectorized pavement markings in an 8-hour day and shall include the following features:

1. The applicator shall provide individual material reservoirs, or space, for the storage of Part A and Part B of the epoxy resin composition; for the storage of water; and for the storage of reflective glass spheres.
2. The applicator shall be equipped with heating equipment of sufficient capacity to maintain the individual epoxy resin components at the manufacturer's recommended temperature for spray application and for heating water to a temperature of approximately 140°F (60°C).
3. The glass spheres shall be gravity dropped upon 20 mils (500 um) of epoxy pavement markings to produce a wet-night-reflective pavement marking. The large spheres (Federal Spec. Type 4) shall be applied at a rate of 12 pounds per gallon (1.4 kg/L) of epoxy pavement marking material, immediately followed by a second drop of AASHTO M-247 Type 1 glass spheres applied rate of 12 pounds per gallon (1.4 kg/L) of epoxy pavement marking material. This application rate and the following gradation shall conform to FHWA's FP-96: Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (pages 757-761 Type 3 and Type 4 Beads).
4. The applicator shall be equipped with metering devices or pressure gauges, on the proportioning pumps. Metering devices or pressure gauges shall be visible to the Engineer.
5. The applicator shall be equipped with all the necessary spray equipment, mixers, compressors, and other appurtenances to allow for the placement of epoxy reflectorized pavement markings in a simultaneous sequence of operations as described below in Construction Details, D. Applications of Epoxy Reflectorized Pavement Markings of this Special Provisions.

Construction Details.

- A. General: All pavement marking and patterns shall be placed as shown on the Plans or as directed by the Engineer.

Before any pavement markings work is begun, a schedule of operations shall be submitted for the approval of the Engineer. This schedule shall be submitted 2 weeks prior to the application of the striping.

At least five (5) days prior to starting striping the Contractor shall provide the Engineer with the epoxy manufacturer's written instructions for use. These instructions shall include but not be limited to: mixing ratios, application temperatures, and recommendations for use of water spray.

The application of pavement markings shall be done in the general direction of traffic. Striping against the direction of traffic flow shall not be allowed.

The Contractor shall be responsible for removing, to the satisfaction of the Engineer, tracking marks, spilled epoxy or epoxy markings applied in unauthorized areas.

The hot water spray shall not be used in conjunction with markings applications on any pavement surface, or on any existing durable type marking, unless specifically recommended by the manufacturer of the epoxy material.

- B. Atmospheric Conditions: Epoxy pavement markings shall only be applied during conditions of dry weather and on substantially dry pavement surfaces. At the time of installation the pavement surface temperature shall be a minimum of 35 °F (2 °C) and the ambient temperature shall be a minimum of 35 °F (2 °C) and rising. The Engineer shall be the sole determiner as to when atmospheric conditions and pavement surface conditions are such to produce satisfactory results.
- C. Surface Preparations: The Contractor shall clean the pavement or existing durable marking to the satisfaction of the Engineer.

Surface cleaning and preparation work shall be performed only in the area of the epoxy markings application.

At the time of application all pavement surfaces and existing durable markings shall be free of oil, dirt, dust, grease and similar foreign materials. The cost of cleaning these contaminants shall be included in the bid price of this item. Also, the item shall include the cost of removal of the curing component in the area of the epoxy markings application, if concrete curing compounds on new portland cement concrete surfaces have been used. Waterblasting will not be permitted for removal.

- D. Application of White/Yellow Epoxy Reflectorized Pavement Markings: White/yellow epoxy reflectorized pavement markings shall be placed at the widths and patterns designated on the Contract Plans.

Markings operations shall not begin until applicable surface preparation work is completed, and approved by the Engineer.

White/yellow epoxy pavement markings shall be applied at a minimum uniform thickness of 20 mils (500 µm) on all Portland cement concrete and bituminous concrete pavement, including Stone Matrix Asphalt.

Large reflective glass spheres (Federal Spec. Type 4) shall be applied at the rate of 12 pounds per gallon (1.4 kg/L) of epoxy pavement marking material, immediately followed by a second drop of AASHTO M-247 Type 1 glass spheres applied at a rate of 12 pounds per gallon (1.4 kg/L) of epoxy pavement marking material. Glass spheres shall uniformly cover the length and width of the pavement marking.

- E. Application of Black Epoxy Contrast Pavement Markings: Black epoxy contrast pavement markings shall be placed at the widths designated on the Contract Plans.

Markings operations shall not begin until applicable surface preparation work is completed, and approved by the Engineer.

Black epoxy contrast pavement markings shall be applied at a minimum uniform thickness of 20 mils (500 µm) on all Portland cement concrete surfaces followed by a single drop of graded black aggregate.

The width of black epoxy line shall be applied for the following situations:

Center Skip Line - On Portland cement concrete pavements a black contrast skip line shall be 10 feet (3

m) in length of the same width as the white epoxy reflectorized skip. It is to lead the white skip and stop at the beginning of the white skip. The black contrast skip is to have a single application of graded black aggregate.

Edge Lines - All edge lines on Portland cement concrete pavements shall have a base of black contrast markings which is 4 inches (100 mm) wider than the reflective white or yellow marking. The black contrast marking is to be applied first with a single drop of graded black aggregate. Once it has cured sufficiently so as not to track, the reflectorized white or yellow line is to be applied on top of it. The reflective line is to be centered along the black contrast line such that a minimum of 2 inches (50 mm) of black contrast marking is visible on either side of the reflective marking.

F. Defective Epoxy Pavement Markings: Epoxy reflectorized pavement markings, which after application and curing are determined by the Engineer to be defective and not in conformance with this specification, shall be repaired. Repair of defective markings shall be the responsibility of the Contractor and shall be performed to the satisfaction of the Engineer as follows:

1. Insufficient film thickness [(less than 20±1 mils (500 µm) as applicable] and line widths; insufficient glass bead coverage or inadequate glass bead retention.

Repair Method: Prepare the surface of the defective epoxy marking by shot blasting, sand blasting, or water blasting. No other cleaning methods will be allowed. Surface preparation shall be performed to the extent that a substantial amount of the reflective glass spheres are removed and a roughened epoxy marking surface remains.

Immediately after surface preparation remove loose particles and foreign debris by brooming or blasting with compressed air.

Repair shall be made by re-striping over the cleaned surface, in accordance with the requirements of this specification and at a full 20±1 mils (500 µm) minimum line thickness as applicable.

2. Uncured or discolored epoxy (brown patches); insufficient bond to pavement surface (or existing durable marking).

Uncured epoxy shall be defined as applied material that fails to cure (dry) in accordance with the requirements of this specification under MATERIALS, A, 2d. DRYING TIME (FIELD); or applied material that fails to cure (dry) within a reasonable time period under actual field conditions, as defined by the Engineer.

Discoloration (brown patches) shall be defined as localized areas or patches of brown or grayish colored epoxy marking material. These areas often occur in a cyclic pattern and also, often are not visible until several days or weeks after markings are applied.

Repair Method: The defective epoxy marking shall be completely removed and cleaned to the underlying pavement surface to the satisfaction of the Engineer.

The extent of removal shall be the defective area plus any adjacent epoxy pavement marking material extending one foot (300 mm) any direction.

After surface preparation work is complete, repair shall be made by re-applying epoxy over the cleaned pavement surface in accordance with the requirements of this specification.

3. Reflectivity for epoxy resin paint.

After satisfactory completion of all striping work and written notification from the Contractor, the Department shall test the striping to ensure it has the minimum reflectivity. The testing will be completed within 30 calendar days from notification. The Contractor may request that tests be conducted on completed phases or portions of the work. Approval of such a request will be at the discretion of the Engineer. Testing will be done using a Delta LTL 2000 Retrometer (30 meter geometry). Five readings will be taken per line per mile (1.6 km). Projects less than 1 mile (1.6 km) in length will have a minimum of 5 readings per line. These readings will then be averaged for the overall project average.

The required average minimum initial reflectivity reading in millicandellas shall be:

White 450  
Yellow 325

Any single reading shall not be less than 350 millicandellas for white and 250 millicandellas for yellow. Without exception, any pavement markings installed that does not meet the above average minimum initial reflectivity numbers shall be removed and replaced, at the installation contractor's expense.

Other defects not noted above, but determined by the Engineer to need repair, shall be repaired or replaced as directed by and to the satisfaction of the Engineer.

All work in conjunction with the repair or replacement of defective epoxy reflectorized pavement markings shall be performed by the Contractor at no additional cost to the State.

**Method of Measurement:**

The quantity of permanent pavement striping (white, yellow, or black epoxy resin paint) will be measured by the number of linear feet (meters) of pavement striping line and number of square feet (meter) of symbol installed on the pavement and accepted in accordance with the Plans.

**Basis of Payment:**

The quantity of permanent pavement striping (white, yellow, or black epoxy resin paint) payment will be paid for at the Contract unit price per linear foot (meter) for 4", 6", 8", 10", 12", 16" (100 mm, 150 mm, 200 mm, 250 mm, 300 mm, or 400 mm) line and the Contract unit price per square foot (meter) of symbol. The quantity of permanent pavement marking (white, yellow, or black epoxy resin paint) will be paid for at the Contract unit price per linear foot (meter) of line and the Contract unit price per square foot (meter) of symbol. Price and payment shall include cleaning and preparing the pavement surface, and placing all materials, for all labor, tools, equipment and incidentals necessary to complete the work.

**NOTE:**

For information only:

The following manufacturers are known to us which manufacturer Epoxy Resin Paint for Pavement Striping. The Department does not endorse or require the use of any of the manufacturers listed below. However, a bidder wishes to use another manufacturer's product, it shall be submitted for review and approval prior to submitting a bid proposal. Should the product be deemed unacceptable by the Department, the successful bidder will be required to use only an approved product.

1. POLY CARB, Inc.  
33095 Bainbridge Road  
Solon, Ohio 44139  
Tel. 1-800-CALLMIX
2. IPS - Ennis Paint  
P.O. Box 13582  
Research Triangle Park, North Carolina 27709  
Tel. 1-877-477-7623
3. Epoplex  
One Park Avenue  
Maple Shade, NJ 08052  
Tel. 1-800-822-6920
4. Or an approved equal.

4/22/2010

**748512 - RETROREFLECTIVE PREFORMED PATTERNED MARKINGS, 6"**  
**748513 - RETROREFLECTIVE PREFORMED PATTERNED MARKINGS, 12"**

**748512 - RETROREFLECTIVE PREFORMED PATTERNED MARKINGS, 6"**  
**748513 - RETROREFLECTIVE PREFORMED PATTERNED MARKINGS, 12"**  
**748514 - RETROREFLECTIVE PREFORMED PATTERNED MARKINGS, 8"**  
**748519 - RETROREFLECTIVE PREFORMED PATTERNED MARKING, 4"**  
**748529 - RETROREFLECTIVE PREFORMED PATTERNED MARKING, SYMBOL/LEGEND**  
**748547 - RETROREFLECTIVE PREFORMED PATTERNED CONTRAST MARKINGS, 9"**  
**748556 - RETROREFLECTIVE PREFORMED PATTERNED CONTRAST MARKINGS, 16"**

### **Description:**

This work shall consist of furnishing and installing retroreflective preformed patterned pavement marking in accordance with this provision and in conformance to the existing pavement markings or as established by the Engineer. The Contractor is required to have all subcontractors involved in the placement of these markings attend the pre-placement meeting along with the tape manufacturer representative and Department representatives to coordinate this operation. The subcontractor for pavement markings shall be approved by the Department prior to the preconstruction meeting.

### **Materials:**

**General:** The preformed patterned markings shall consist of white or yellow films with clear microcrystalline ceramic beads incorporated to provide immediate and continuing retroreflection. The markings shall be suitable for application on new or existing P.C. Concrete or bituminous pavements with a pre-coated pressure sensitive adhesive

The preformed marking material must be used prior to one year from date of manufacture. When not placed by inlaid method a surface preparation adhesive shall be used. The markings shall be capable of providing retroreflection during both wet and dry conditions.

The markings shall be highly durable retroreflective pliant polymer materials designed for longitudinal and word/symbol markings subjected to high traffic volumes and severe wear conditions such as shear action from crossover or encroachment on typical longitudinal configurations such as edge lines and lane lines. This film shall be manufactured without the use of lead chromate pigments or other similar, lead-containing chemicals.

**Composition:** The pavement marking shall consist of a mixture of high quality polymeric materials and pigments with glass beads distributed throughout the base cross-sectional area, with a reflective layer of microcrystalline ceramic beads bonded to a durable polyurethane topcoat surface. The patterned surface shall have approximately 50% plus or minus 15% of the surface area raised and presenting a near vertical face, angled from 0 degrees to 60 degrees, to traffic from any direction. The channels between the raised areas shall be substantially free of exposed beads or particles. The marking shall have a precoated pressure sensitive adhesive. The edges of the markings shall be clean cut and true.

**Retroreflectance:** The white and yellow markings shall have the initial expected retroreflectance values as shown in Table 1 under dry, wet, and rainy conditions. The photometric quantity to be measured shall be coefficient of retroreflected luminance ( $R_L$ ) and shall be expressed as millicandelas per square foot per foot-candle [ $(\text{mcd} \cdot \text{ft}^{-2}) \cdot \text{fc}^{-1}$ ]. The metric equivalent shall be expressed as millicandelas per square meter per lux [ $(\text{mcd} \cdot \text{m}^{-2}) \cdot \text{lx}^{-1}$ ].

Retroreflectance values shall be measured under dry conditions in accordance with the testing procedures of ASTM D4061. Retroreflectance values shall be measured under wet conditions in accordance with ASTM E2176 or ASTM E2177. Wet retroreflectance values measured under a "condition of continuous wetting" (simulated rain) shall be in accordance with ASTM E2176. Wet retroreflectance values measured under a "condition of wetness" shall be in accordance with ASTM E2177.

<b>Table 1</b>		
<b>Expected Initial <math>R_L</math> under dry, wet, and rainy conditions</b>		
<u>White</u>	<u>Dry</u>	<u>Wet &amp; Rainy</u>
Entrance Angle	88.76°	88.76°
Observation Angle	1.05°	1.05°
Retroreflected Luminance	500	250
$R_L [(mcd \cdot m^{-2}) \cdot lx^{-1}]$		
<u>Yellow</u>	<u>Dry</u>	<u>Wet &amp; Rainy</u>
Entrance Angle	88.76°	88.76°
Observation Angle	1.05°	1.05°
Retroreflected Luminance	300	250
$R_L [(mcd \cdot m^{-2}) \cdot lx^{-1}]$		

**Beads, Index of Refraction:** All “dry-performing” microcrystalline ceramic beads bonded to the polyurethane-coated, patterned surface of the material shall have a minimum index of refraction of 1.70 when tested using the liquid oil immersion method. All “wet-performing” microcrystalline ceramic beads bonded to the polyurethane-coated, patterned surface of the material shall have a minimum index of refraction of 2.30 when tested using the liquid oil immersion method. The glass beads mixed into the pliant polymer shall have a minimum index of refraction of 1.5 when tested by the liquid oil immersion method.

**Beads, Acid Resistance:** The beads shall show resistance to corrosion of their surface after exposure to a 1% solution (by weight) of sulfuric acid. The 1% acid solution shall be made by adding 5.7 cc of concentrated acid into 1000 cc of distilled water.

**Color:** The markings shall consist of white and/or yellow films with pigments selected and blended to conform to standard highway colors.

**Skid Resistance:** The patterned surface of the markings shall provide an initial average skid resistance value of 45 BPN when tested according to ASTM E 303.

**Patchability:** The pavement marking material shall be capable of use for patching worn areas of the same type in accordance with manufacturer's instructions.

**Thickness:** The patterned material without adhesive shall have a minimum caliper of 0.065 inches (1.651mm) at the thickest portion of the patterned cross section and a minimum caliper of 0.020 inches (.508mm) at the thinnest portion of the cross section.

**Tolerance:** The Contractor will be responsible for applying these markings in a straight manner not exceeding 1/2" (12 mm) per 40' (12 m). Any markings exceeding the 1/2" (12 mm) tolerance will require the Contractor to make corrective action approved by the Engineer and the tape manufacturer representative at no extra cost to the Department.

#### **Construction Methods:**

The Contractor shall be certified, by the manufacturer, in the installation of the pavement marking material prior to the start of the markings. The Contractor shall install the pavement marking material in accordance with the manufacturer's published recommendations.

The manufacturer shall provide technical assistance as required to ensure successful installation of the markings. This shall include a representative on site for the start of the markings, training, product information, problem solving, etc.

Installation of the pavement markings shall be performed in a neat and workmanlike manner. The Contractor shall premark the pavement to ensure correct location of markings and such layout work shall be incidental to the price bid for the pavement marking items. The method for premarking should be as recommended by the manufacturer. A thin layer of paint as a premarking is not recommended. Particular care shall be taken to ensure that the leading edges of the markings are secured to the pavement.

General application rules:

- The Air and surface temperature shall be a minimum of 40° F.
- The pavement must be clean and dry. 24 hours of dry weather where no rain is expected.
- When not placed by inlaid method a surface preparation adhesive shall be used.
- Do not overlap tape - use butt splice.
- Do not apply tape on longitudinal seams or joints or cracks.
- Do not apply tape on deteriorating pavement surfaces.
- Existing markings must be 80% removed.

After application, the markings shall be immediately ready for use by traffic.

#### **Inlay into Fresh Bituminous Concrete:**

When markings are specified in the contract for newly paved asphalt concrete surfaces, they shall be applied before public traffic is allowed on the freshly paved surface - the pavement markings shall be inlaid in the fresh surface during final rolling of the mat, in accordance with the manufacturer's recommendations unless otherwise directed by Engineer.

The Contractor shall show how the pavement mats will be placed to avoid applying the tape on longitudinal seams or joints or cracks and maintain correct marking location.

The Contractor shall employ a sufficient number of workers to premark the pavement and install the markings such that all markings are inlaid into the hot pavement prior to the finish rolling. No paving shall be permitted unless the striping crew and materials are on the project site.

- \* General procedure for inlay application on fresh asphalt surfaces:
- \* Tape is applied after the compaction roller and before the finish roller using minimum water, slow speed and no vibration.
- \* Tape shall be applied using equipment recommended by manufacturer
- \* Tamping shall be done by the finish roller and in the same direction the tape was applied. A separate roller of a size approved by the tape manufacturer may be required to meet the manufacturer's requirements.
- \* Roller shall use minimum speed to prevent wrinkling the tape.
- \* Asphalt temperatures shall be between 180°F (66°C) and 120°F (49°C) when tape is applied.

**NOTE:** Even though the tape will stand these high temperatures the contractor is to use caution to assure the asphalt is firm enough to walk on above 140°F (60°C).

#### **Placement on new P.C. Concrete Pavement:**

When markings are specified in the contract for new P.C. concrete pavement surfaces they shall be applied after the concrete has adequately cured as determined by the Engineer and prior to opening to traffic.

1. When a membrane curing compound has been applied to the concrete surface, it shall be removed by sandblasting prior to applying the markings. Cost for such sandblasting shall be incidental to the price bid for the pavement marking item. The road shall be cleaned by sweeping and with high pressure air.
2. The manufacturer shall specify a primer/solvent for the pavement surface.
3. The tape shall be applied with an approved applicator.
4. The tape shall be tamped with a roller tamper cart with a minimum 200 lb (90 kg) load or by slowly (2-3 mph [3-5 km/hr]) driving over the tape with a vehicle tire. Do not twist or turn on the tape. A minimum of three passes back and forth over the tape will be required. All edges of the tape shall be thoroughly tamped.

**Placement on Existing Pavement:**

When markings are specified in the contract for existing pavement, the pavement surface shall be free of any existing markings.

1. The road shall be cleaned by sweeping and with high pressure air.

Steps 2 through 4 are the same as for new P.C. C. pavement.

**Method of Measurement:**

This work will be measured for payment by the number of linear feet (meters) of line or square foot (meter) of symbol/legend of Retroreflective Preformed Patterned Markings installed on the pavement and accepted in accordance with the plans.

**Basis of Payment:**

This work will be paid for at the contract unit price bid per linear foot (meter) of line or square meter of symbol/legend as measured for item "Retroreflective Preformed Patterned Markings" of the type specified. This price shall include cleaning and preparing the pavement surface, furnishing and placing all materials, for all labor, tools, equipment, maintenance bond and incidentals necessary to complete the work.

**WARRANTY**

The Contractor shall warrant to the Department that the installed retroreflective preformed patterned pavement markings are free of defects, as hereafter defined, for one calendar year beginning at the initial acceptance of the marking installation by the Department. The initial acceptance of the marking installation will occur upon the satisfactory correction of all deficiencies noted in the marking installation during the Final Inspection of the project. The markings shall show no fading, lifting, shrinking, tearing, rollback, distortion or chipping due to vehicular traffic or normal maintenance activities including snow plowing. Although some wear is expected, the markings shall remain intact and serviceable (as defined below) for no less than 95% of the total item quantities in the first year of installation.

The Contractor shall repair all defective areas identified by the Department after initial installation or during the Warranty Period. All repairs shall begin immediately following the notice to the Contractor unless weather limitations prevent the corrective work. Should the contractor not commence work within seventy-two hours, weather permitting, and pending severity, the Department reserves the right to remedy the condition and charge the contractor for the work. Any corrective work shall be as recommended by the manufacturer of the marking material and approved by the Department. The Department shall be given notification before the Contractor begins corrective work to allow for inspection of the operation. All costs associated with the repair work shall be the responsible of the contractor. These costs shall include, but are not limited to, removal, material, maintenance of traffic, etc.

**Maintenance Bond:**

Upon completion of the work, the Contractor shall submit to the Department a Maintenance Bond to insure the State of Delaware during the above Warranty periods. The Maintenance Bond shall meet the following requirements:

- a) A sum equal to 100% of the value of all Retroreflective Preformed Patterned Markings Items paid to the Contractor;
- b) All signatures are original signatures, in ink, and not mechanical reproductions or facsimiles of any kind;
- c) The Contractor is the named principle;
- d) The term of the bond is for one full year;
- e) The term of the Maintenance Bond will be for a period of one year beyond completion of Retroreflective Preformed Patterned Markings; and
- f) Written by a Surety or insurance company that is in good standing and currently licensed to write surety bonds in the State of Delaware by the Delaware Department of Insurance.

**MANUFACTURER’S RESPONSIBILITY:**

The following information is for use by DelDOT only. The Contractor will not be held responsible for the time frames listed in the chart below.

After satisfactory completion of the one-year warranty period, the contractor will be relieved of his responsibility and the Department shall work directly with the Manufacturer to guarantee the remainder of the warranty as specified below.

In addition, the pavement markings shall warrant the material to retain a minimum reflective value of 150 millicandelas per square foot (meter) per lux for the first year after initial acceptance.

- 1. All reflectance measurements shall be made on a clean, dry surface at a minimum temperature of 40°F (4°C).
- 2. All reflectance measurements shall be made using a "LTL 2000" retroreflectometer.
- 3. One year from initial installation acceptance all pavement marking material shall meet the minimum retained coefficient of dry retroreflection value of 125 millicandelas per foot squared per foot-candle (in accordance with ASTM E1710), and meet the minimum retained coefficient of wet retroreflection value of 75 millicandelas per foot squared per foot-candle (in accordance with ASTM E2177) for the following Warranty Periods.

<b>Warranty Periods</b>		
<b>Application</b>	<b>Dry Retroreflectivity Warranty Period</b>	<b>Wet Retroreflectivity Warranty Period</b>
Longitudinal Markings	4 years	2 years
Symbols and Legends	2 years	1 year

03/04/2011

**748525 - TEMPORARY MARKINGS, TAPE, 4"**  
**748526 - TEMPORARY MARKINGS, TAPE, 6"**  
**748527 - TEMPORARY MARKINGS, TAPE, WORDS/SYMBOLS**

**Description:**

This work shall consist of furnishing, installing, removing or obliterating pavement markings in work zones in accordance with this provision and in reasonably close conformity with the dimensions and lines shown on the plans or established by the Engineer.

**Materials:**

The markings shall consist of white or yellow retro reflective pavement marking on a conformable backing.

The quality of the pavement marking shall be such that the performance requirements for the marking shall be met.

The markings shall be precoated with a pressure sensitive adhesive and shall be capable of being adhered to Asphalt concrete or Portland cement concrete at temperatures as low as 50°F (10°C) in accordance with the manufacturer's recommendations. A surface preparation adhesive recommended by the manufacturer shall be used for all applications to improve initial and long term adhesion.

When stored in a cool dry area indoors, the materials shall be suitable for use for one year after the date of purchase.

**Classification:**

The removable retro reflective pavement marking tape must be designed and constructed in such a manner that it can be readily removed when the markings are no longer applicable. The tape shall be capable of performing for the duration of a normal construction season and shall then be capable of being removed intact or in large pieces. The tape shall be wet and dry reflective throughout its useful life. (A normal construction season is defined as the time after the last snowplowing in the spring and before the first snowplowing in the fall/winter. In non-snow removal locations, a normal construction season is limited to the calendar year at the time of installation.)

**Requirements:**

Composition

The removable, retro reflective pavement markings shall consist of a highly reflective white or yellow enclosed lens pavement marking with a thin, flexible, conformable backing which is precoated with a pressure sensitive adhesive.

Retro reflectance

The enclosed lens white and yellow pavement markings shall have the initial minimum retroreflectance values as shown in Table 1 under dry, wet, and rainy conditions at 1.05° observation angle and 88.76° entrance angle. These angles represent a simulated driver viewing geometry at 30 meters distance. The photometric quantity to be measured shall be the coefficient of retroreflected luminance ( $R_L$ ), and shall be expressed as millicandelas per square meter per lux  $[(mcd \cdot m^{-2}) \cdot lx^{-1}]$ . The English equivalent shall be expressed as millicandelas per square foot per foot candle  $[(mcd \cdot ft^{-2}) \cdot fc^{-1}]$

Retroreflectance values shall be measured under dry conditions in accordance with ASTM D 4061. The angular aperture of both the photoreceptor and light projector shall be 6 minutes of arc. The reference center shall be the geometric center of the sample, and the reference axis shall be taken perpendicular to the test sample.

Values measured under wet conditions shall be measured in accordance with ASTM E 2176 or ASTM E 2177 using a portable retroreflectometer. Wet retroreflectance values measured under a "condition of continuous wetting" (simulated rain) shall be in accordance with ASTM E 2176. Wet retroreflectance

values measured under a “condition of wetness” shall be in accordance with ASTM E 2177.

Visually, the reflective performance shall be similar whether the material is dry or wet.

Table 1: Minimum initial $R_L$ under dry, wet and rainy conditions		
	White	Yellow
Entrance Angle	88.76°	88.76°
Observation Angle	1.05°	1.05°
Retroreflected Luminance	750	450
$R_L [(mcd \cdot m^{-2}) \cdot lx^{-1}]$		

**Removability**

The marking film shall be removable from Asphalt concrete and Portland cement concrete intact or in large pieces, at temperatures above freezing without the use of heat, solvents, grinding or blasting without permanently scarring the roadway surface.

**Skid Resistance**

The surface of the markings when new provides an average skid resistance value of 50 BPN when tested according to ASTM E 303.

**Color**

The x,y chromaticity co-ordinates for dry markings shall lie within the regions defined by the following corner points:

	1		2		3		4	
	x	y	x	y	x	y	x	y
White	0.355	0.355	0.305	0.305	0.285	0.325	0.335	0.375
Yellow	0.560	0.440	0.460	0.400	0.420	0.440	0.490	0.510

**Daytime appearance<sup>1</sup>**

The appearance of the marking in daylight or under road lighting conditions can be determined by measuring the reflection in diffuse conditions. The luminance coefficient in diffuse illumination (Qd) is measured using a portable Qd reflectometer incorporating “30 meter” geometry. The Qd shall be greater than 130 [(mcd · ft<sup>-2</sup>) · fc<sup>-1</sup>] when newly applied.

**Note:** The luminance coefficient (Qd) under diffuse illumination represents the brightness of a road marking as seen by drivers of motorized vehicles in typical or average daylight or under road lighting conditions.

<sup>1</sup>Reference CEN Standard EN 1436.

**Construction Methods:**

Pavement markings in work zones shall be placed in accordance with the following provisions:

At the end of each day's work, pavement markings shall be in place on each paving lift that is open to normal traffic flow. Materials requiring removal shall be specified above, and marking configurations shall be in accordance with the Manual on Uniform Traffic Control Devices.

The pavement markings shall be maintained and replaced by the Contractor without additional compensation until they have served their purpose, at which time the contractor will be required to remove them.

Pavement markings shall be applied to clean dry surfaces in accordance with the manufacturer's installation

instructions or a method approved by the Engineer.

**Method of Measurement:**

Linear pavement markings will be measured in linear feet complete-in-place for the width specified.

Removal or obliteration of pavement markings in construction work zones will not be measured for payment, but shall be considered incidental to the work.

**Basis of Payment:**

Retro reflective pavement markings will be paid for at the contract unit price, which price shall be full compensation for cleaning and preparing the pavement surface, for furnishing and placing all materials, and for all materials, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item

Pay Unit

Temporary Marking, Tape, linear  
Temporary Marking, Tape, words/symbol

Linear Foot  
Square foot

2/3/05

**748530 - REMOVAL OF PAVEMENT STRIPING**

**Description:**

This work consists of removing pavement markings of all kinds including paint, tape, etc., in accordance with this special provision, notes on Plans and/or as directed by the Engineer. The Contractor shall coordinate with the Engineer for maintaining traffic during the operation, prior to starting the work.

**Materials and Construction Methods:**

Paint and Epoxy Resins:

Shot/abrasive grit blasting or water blasting equipment shall be used for removal of markings from pavement surfaces.

Alkyd Thermoplastic:

In addition to the removal techniques discussed for paint and epoxy, burning or grinding (erasing machines) equipment may also be used for removal of markings from pavement surfaces.

The removal operation shall be performed in a manner that will not damage the pavement surface.

The Contractor shall collect and dispose of all shot/abrasive grit and pavement marking materials removed from the pavement surface. Washing or sweeping such material to the roadside will not be permitted.

After removal of striping on bituminous concrete, approved flat black paint or asphalt sealer shall be used to cover any exposed aggregate or embedded paint at no additional cost.

**Method of Measurement:**

The quantity of pavement striping removal will be measured as the number of square feet (meters) of pavement striping removed and accepted. The area of lines will be calculated by multiplying the nominal width of line times the length and the area of symbols will be as specified in Subsection 748.10 of the Standard Specifications.

**Basis of Payment:**

The quantity of pavement striping removal will be paid for at the Contract unit price per square foot (meter) for "Removal of Pavement Striping". Price and payment shall be full compensation for furnishing all materials, removing the pavement markings, disposing of the removed marking material, covering up the exposed aggregate, and for all labor, equipment, tools and incidentals necessary to complete the work.

**Note:**

There will be no measurement and payment for removal of pavement markings placed incorrectly by the Contractor.

01/09/06

**749500 - EXTRUDED SIGN PANEL OVERHEAD TYPE IX SHEETING (FEDERAL)**  
**749578 - EXTRUDED SIGN PANEL GROUND MOUNTED TYPE III SHEETING (FEDERAL)**

**Description:**

This work consists of furnishing all materials, fabrication, and erection of new extruded aluminum sign panels, complete with demountable copy, connections to supports, and other incidentals as are shown on the Plans, or described in the special provisions to be used for all federally funded projects.

The item shall also include removing and transporting of the existing sign panels before fabricating and erecting new sign panels, if such requirement is specified on the Plans.

**Design:**

Sign panels and their connections to supports shall be designed for applicable loadings and allowable stresses specified for supports. All panels, stiffeners and subframing shall conform with any pertinent requirements set forth in the 2001 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals" with subsequent revisions. No method of stiffening will be allowed which would require rivets, bolts, screws, or nuts perforating the message face. The Contractor shall submit detail drawings showing the details for fabrications of the panels and support connections for prior approval.

**Extruded Aluminum:**

Extruded aluminum sign panels shall have demountable copy. After installation of the signs is completed, they will be inspected. If specular reflection is apparent on any sign, its positioning shall be adjusted by the Contractor, as directed by the Engineer.

**Sign Panel Size:** Sizes of sign panels having demountable copy shall be based on the manufacturer's spacing charts. All letters shall be placed in accordance with manufacturer's spacing charts. Overall horizontal and vertical dimensions shall be in 6" (150 mm) increments.

**Materials:**

The overhead sign sheeting shall be wide angle, prismatic, retroreflective sheeting. The coefficients of retroreflection,  $R_A$ , shall not be less than the minimum values specified in the following table when tested in accordance with ASTM E 810. This table contains "core" values as found in ASTM D 4956. The 0.1 observation angle is not required for this item.

Minimum Coefficient of Retroreflection $R_A$ (Candelas per lux per square meter)							
<b>TABLE 3 Type IX Sheeting<sup>A</sup></b>							
Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue
0.1° <sub>B</sub>	-4°	660	500	250	66	130	30
0.1° <sub>B</sub>	+30°	370	280	140	37	74	17
0.2°	-4°	380	285	145	38	76	17
0.2°	+30°	215	162	82	22	43	10
0.5°	-4°	240	180	90	24	48	11
0.5°	+30°	135	100	50	14	27	6.0
1.0°	-4°	80	60	30	8.0	16	3.6
1.0°	+30°	45	34	17	4.5	9.0	2.0

<sup>A</sup> Minimum Coefficient of Retroreflection ( $R_A$ )  $\text{cd}\cdot\text{lx}^{-1}\cdot\text{m}^{-2}$ .

<sup>B</sup> Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

The ground mounted sign sheeting shall meet or exceed the following values. The coefficients of Retroreflection shall be determined in accordance with ASTM E-810. This table contains "core" values as found in ASTM D 4956. The 0.1 observation angle is not required for this item.

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° <sub>B</sub>	-4°	300	200	120	54	54	24	14
0.1° <sub>B</sub>	+30°	180	120	72	32	32	14	10
0.2° <sub>B</sub>	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

<sup>A</sup> Minimum Coefficient of Retroreflection ( $R_A$ ) cd/ft<sup>2</sup> (cd·lx<sup>-1</sup>·m<sup>-2</sup>).

<sup>B</sup> Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

**WARRANTY**

The sheeting manufacturer shall submit with each lot or shipment, a warranty that states the material supplied will meet all the requirements listed herein.

**Field Performance Requirements:**

The retroreflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retroreflection is less than the minimum specified for that sheeting during that period listed. The sheeting will be tested at an observation angle of 0.2 and an entrance angle of -4.

- 80% of values listed in Table 7 Type III after 10 years.
- 80% of values listed in Table 3 Type IX for years 1-7.
- 70% of values listed in Table 3 Type IX for years 8-12.

All measurements shall be made after sign cleaning according to sheeting manufacturer’s recommendations.

**Sheeting Manufacturer’s Replacement Obligation:**

Where it can be shown that retroreflective signs supplied and used according to the sheeting manufacturer’s recommendations, have not met the performance requirements of this specification the sheeting manufacturer shall cover restoration costs as follows for sheeting shown to be unsatisfactory during:

The entire 12 years (Type IX) and 10 years (Type III): the sheeting manufacturer will replace the sign in its entirety inclusive of the sign panel, sign sheeting, labor, and M.O.T required to restore the sign surface to at least 70% of value for Type IX and 80% of value for Type III.

**Extruded Aluminum:**

**Extruded Aluminum Sign Panels and Edge Strip.** Extruded aluminum sign panels and edge strip shall conform to B221, alloy 6063 T6.

**Hardware:** hardware shall be clear anodized, conforming to one of the following: B209, alloy 2024 T4; B211, alloy 2024 T4, 6262 T9, 6061 T6, 7075 T6 or 2017 T4.

**Extruded Aluminum:**

The front faces of the sign panels shall be degreased according to the manufacturer’s specifications.

**Construction Methods:**

**Sign Face Finishing:** All retroreflective sheeting, backgrounds, letters, numerals, symbols, and borders shall be clean-cut and sharp, and the messages on all signs shall be as indicated on the plans. Application of retroreflective sheeting to aluminum panels shall be in accordance with sheeting manufacturer’s recommendations. Retroreflective sheeting shall be color matched and marked. The height of characters and the alphabet series to be employed for the signs shall conform to the Plans and their references. The alphabet series used on the sign panels shall be those of the publication titled "Standard Alphabets for Highways Signs" of the Federal Highway Administration.

The working drawings prepared by the Contractor shall clearly indicate the proposed spacing of the letters and the locations and arrangements of symbols and borders.

After the panel has been degreased and etched, the retroreflective sheeting shall be applied by a method described elsewhere in these Special Provisions.

Whenever it is necessary to construct the background of a sign face with two or more pieces of retroreflective sheeting, they must be carefully matched for color prior to application and sign fabrication, to provide uniform appearance and brilliance, day and night. Each full width section of retroreflective sheeting mounted adjacent to another full width section taken consecutively from the same roll shall be rotated and mounted 180 degrees with respect to that adjacent section. This rule shall also be observed as a guide when partial width sheets of retroreflective sheeting are used.

Non-conformance may result in non-uniform shading and an undesirable contrast between adjacent widths of applied sheeting which will render signs unacceptable. The entire background of each sign shall be uniform in color, brilliance, texture, and general appearance as seen in the daytime and under typical automobile illumination at night. No more sections of retroreflective sheeting shall be used for backgrounds than is necessary; remnants, scraps, and odd sized pieces of sheeting shall not be used in the fabrication of any signs manufactured for this contract. Joints between retroreflective sheeting sections shall either butt or overlap no more than 3/8" (9.5 mm). Horizontal joints between retroreflective sheeting sections shall not be allowed.

Sign Panel Erection: Signs shall be slip-sheeted, packed, and shipped in such manner as to ensure arrival at their respective places of erection in an undamaged condition. All signs arriving at the erection site(s) in a condition which in the opinion of the Engineer, renders them unsuitable for use, shall be removed and replaced by the Contractor at his sole expense. Sign Panels shall not be shipped for erection in such a manner that results in horizontal joints of the retroreflective sheeting.

It is not anticipated that there will be any sign panels which are required to be mounted whose messages will be inappropriate to the guiding of traffic at the time of sign erection. However, in the event that the Engineer determines that certain sign messages are inappropriate, the panels of such signs shall be covered by an opaque material, until such time as the sign messages become appropriate. The covering material and the manner of securing the material to the sign panel(s), shall meet with the approval of the Engineer. The Engineer will indicate to the Contractor which signs, if any, must be covered, and when to remove the covers.

Sign Covers: Sign covers shall be 10 ounce (280 g) cotton duck conforming to ASTM D-320, Army Duck, and dyed to a dark green approximating the green for sign backgrounds.

Identification Tags: The Contractor shall furnish and place identification tags or decals which state the Contract number, month and year of erection on the lower reverse side of the panel, near the point closest to the roadway shoulder.

**Method of Measurement:**

The quantity of sign panels will be measured as the actual number of square feet (meters) of front sign face surface area of all sign panels construction, installed and accepted. The area will be computed from the maximum width and height dimensions of each sign panel, as shown on the Plans, or on the approved sign panel shop drawings, (verified by field measurements). All sign panels will be considered either square or rectangular in shape, as the case may be, and no area deductions will be made for rounding of corners.

**Basis of Payment:**

The quantity of sign panel will be paid for at the Contract unit price per square foot (meter). Price and payment will constitute full compensation for furnishing, fabricating, and erecting sign panels complete in place and accepted, with retroreflective materials, copy, symbols, borders, connections to supports, degreasing, etching, covering and uncovering sign messages where necessary, and for all labor, materials, tools, equipment, and incidentals required to complete the item.

Unless otherwise indicated on the Plans, the cost of removing and transporting to the nearest highway maintenance yard the existing sign panels and accessories shall also be included under this item if such requirement is indicated on the Plans.

4/21/10

**749510 - INSTALLATION OR REMOVAL OF SIGN ON OVER HIGHWAY STRUCTURE**  
**749511 - INSTALLATION OR REMOVAL OF SIGN ON ROADSIDE I-BEAM STRUCTURE**  
**749512 - INSTALLATION OR REMOVAL OF SIGN ON SPAN WIRE OR MAST ARM**

**Description:**

This work consists of installing or removing a sign on an over-highway structure, roadside I-beam structure, span wire, or mast arm. The sign may be mounted to an existing structure or one installed under this contract.

The largest sign panel or single sign to be installed on over-highway structures will be 96 square feet (9 square meters) to be raised to a height not to exceed 35 feet (11 meters) measured from ground to top of sign.

**Materials:**

The Department will supply the signs to be installed. The signs may be supplied with pre-drilled holes for use in mounting the sign.

The Contractor will supply:  
Galvanized 3/8"(9 mm) U-bolts  
Galvanized washers  
Galvanized nuts

For signs 15 SF (1.4 sq m) and less, four to six U-bolts will be needed.

**Construction Methods:**

Sign installation shall be performed as specified by the Engineer. Care shall be taken to prevent any damage to the sign panel, span wire, mast arm, over-highway structure, roadside I-beam structure, or any electrical cable attached to the span wire, or any lights attached to the sign panel.

Sign installation on over-highway structure or roadside I-beam structure may require the sign to be assembled in panels. The sign may be made from several panels to make one complete sign. Signs on roadside I-beam structures shall be installed at a height of 7 feet (2.1 m) from the bottom of the sign to the near edge of pavement.

Sign removal shall be performed as specified by the Engineer. Care shall be taken to prevent any damage to the sign panel, span wire, mast, any electrical wire attached to the span wire or any lights attached to the sign panel. If the panel has lights attached to the sign panel, the contractor will be required to disconnect the wiring prior to removing the sign panel. Removal of the wiring that operates the lights will be at the direction of the Engineer and paid for under other items of this specification. All materials removed shall be returned to the Department at the Dover Sign Shop.

**Method of Measurement:**

The quantity of overhead and roadside signs will be measured as the number of square feet (meter) of complete signs installed as per these specifications, complete, in place, and accepted or removed and returned to the Department at the Dover Sign Shop.

**Basis of Payment:**

The quantity of overhead and roadside signs will be paid for at the contract unit price per square feet (meter). Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

04/02/04

**749513 - INSTALLATION OF SIGN OVERLAY 16 S.F. OR LESS**  
**749514 - INSTALLATION OF SIGN OVERLAY OVER 16 S.F.**

**Description:**

This work consists of furnishing, installing and maintaining a new sign face overlay on an existing sign in accordance with the "Delaware Traffic Controls for Streets and Highways Construction, Maintenance, Utility & Emergency Operations" (latest edition with all revisions made up to the date of the Advertisement of this Contract), and from hereon referred to as the Traffic Manual, notes and details on the Plans and as directed by the Engineer. The sign overlay may be assembled in panels to make a complete sign. Sign overlays may be installed on signs that are mounted to mast arms, span wires, roadside structures, or over-highway structures. The largest single sign overlay to be installed shall be 96 square feet (9 square meters).

**Materials:**

Materials and construction of all overlay signs shall meet all requirements, including reflectorization, of the Traffic Manual.

Lane closings necessary for the installation of overlay signs shall be in accordance with the requirements of the Traffic Manual.

Overlay signs shall be retroreflective and shall have rounded corners as per FHWA publication "Standard Highway Signs".

The Contractor will supply all related hardware.

**Construction Methods:**

The overlays shall be lifted to the mounting area by a suitable lifting device. Any old small overlays, such as route markers, arrows, etc. must be removed before installing the new overlay. The removal of old overlays is to be considered as part of this item. The new sign overlay is to be mounted by drilling 3/8" (9 mm) holes directly through the new overlay and existing sign as directed by the Engineer.

**Method of Measurement:**

The quantity of sign overlays will be measured as the number of complete sign overlays furnished and installed by the Contractor under this item, complete, in place, and accepted.

**Basis of Payment:**

The quantity of sign overlays will be paid for at the contract unit price per each. Price and payment will constitute full compensation for providing certification, furnishing, installing, and maintaining the overlay signs, any hardware, materials and all labor, equipment, tools, and incidentals required to complete the work.

4/21/10

**749516 – REINFORCED CONCRETE SIGN FOUNDATION, W-6**  
**749517 – REINFORCED CONCRETE SIGN FOUNDATION, W-8**  
**749518 – REINFORCED CONCRETE SIGN FOUNDATION, W-10**  
**749519 – REINFORCED CONCRETE SIGN FOUNDATION, W-12**  
**749520 – REINFORCED CONCRETE SIGN FOUNDATION, W-14**

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**Description:**

This work consists of furnishing all material and installing sign foundations.

**Materials:**

Bar Reinforcement shall conform to the requirements of Subsection 603.02 of the Standard Specifications.

Portland Cement Concrete shall be Class B and shall conform to the requirements of Section 812 of the Standard Specifications.

Anchors shall be fabricated from 304 Stainless Steel for the threaded ferrule portion, and 1058 steel rod and coil for cage portion of anchor.

Nuts, Bolts and Cap Screws shall meet AASHTO M 164 (m 164M). All nuts, bolts and cap screws shall be within a hardness range of Rockwell C23 to C31 prior to hot dip galvanizing per AASHTO M232/M 232M.

**Construction Methods:**

The bases shall conform to the dimensions as indicated on the Standard Construction Detail.

Excavation for the foundation may not exceed the dimension of the foundation by more than 1 foot (300 mm) in any one direction. If a form is used in the excavation more than 18 inches (460 mm) below the ground surface, it is necessary that the excavation be filled and tamped on all sides in layers not to exceed 6 inches (150 mm).

The excavated material shall be disposed of and the area shall be properly graded. After grading, the area shall be returned to its original condition around the supports with mulching, seeding or other landscaping as necessary or as directed by the Engineer.

Anchor bolts shall be set to template for alignment and elevation and shall be secured in position to prevent displacement while concrete is being placed. The steel reinforcement and conduit elbows shall have been placed and secured before the placing of concrete.

**Method of Measurement:**

The quantity of sign foundations will be measured as the number of foundations for the specified size of beam constructed in accordance with these specifications, complete in place, and accepted.

**Basis of Payment:**

The quantity of sign foundations will be paid for at the contract unit price per each foundation of the type specified. Price and payment will constitute full compensation all materials and sign foundation installation complete in place and for all labor, equipment, tools, and incidentals required to complete the work. Payment will also include returning the area around the sign post to its original conditions by mulch, seeding or other landscaping necessary.

8/5/03

- 749521 - SUPPLY OF BREAKAWAY I-BEAM SIGN POSTS, W-6**
- 749522 - SUPPLY OF BREAKAWAY I-BEAM SIGN POSTS, W-8**
- 749523 - SUPPLY OF BREAKAWAY I-BEAM SIGN POSTS, W-10**
- 749524 - SUPPLY OF BREAKAWAY I-BEAM SIGN POSTS, W-12**
- 749525 - SUPPLY OF BREAKAWAY I-BEAM SIGN POSTS, W-14**
- 749563 - SUPPLY OF BREAKAWAY I-BEAM SIGN POSTS, W-4**

**Description:**

This work consists of furnishing all materials for ground mount breakaway type sign posts and breakaway assemblies to the job order site in conformance with the details and notes shown on the Plans, and as directed by the Engineer.

**Materials:**

Structural Steel shall meet the applicable requirements of Subsection 605.02 of the Standard Specifications and AASHTO M 270/M 270M, GR36 (GR250), GR50 (GR345), or GR50W (GR 345W) as detailed on the plans. Steel posts shall be galvanized in accordance with the requirements of AASHTO M 111/M 11M.

Breakaway Couplings shall be made from alloy steel which conforms to AISI 4340, 4130 or an equivalent material, and shall have a minimum tensile yield stress of 175,000 psi (1200 MPa). The Rockwell C hardness shall be 26 minimum. The couplings shall have tensile breaking strength ranges as noted below; and shall be of the type as shown on the Plans:

Type A	17,000 – 21,000 lb (75 – 93 kN)
Type B	47,000 – 57,000 lb (209 – 253 kN)

This steel shall conform to the requirements of the current ASTM designation A-370.

The couplings shall be clean, dry and free from any foreign material and shall be primed and coated with a suitable paint which shall be baked or fused with a polyurethane additive. The color of the coating shall be as follows:

Type A	Yellow
Type B	Red

Chipped areas on the coating surface shall be repaired. All threaded surfaces, after coating, shall be cleaned to all them to function properly.

Brackets shall be made from aluminum alloy 6061 T-6 or an equivalent material. Upper brackets shall incorporate the load concentrating member or bass which shall be made from the following material:

Type A	Aluminum alloy 6061 T-6 or equivalent as part of brackets
Type B	Stainless steel 416 or equivalent ASTM A582-Rockwell C35-C45

The type of bass shall be as shown on the Plans.

Location holes for the breakaway coupling shall be accurately positioned relative to the load concentrating member in accordance with the Engineer’s requirements. All Brackets shall be permanently labeled with bracket number to reflect the hole positioning.

Hinge Plates shall be made from alloy steel which conforms to AISI 4340, 4130 or an equivalent material and shall have a minimum tensile yield stress of 90,000 psi (620 MPa). The hinge plates shall have tensile breaking strength ranges as follows:

HI-10	11,450 – 13,900 lb (50.9 – 61.8 kN)
HI-1	16,400 – 19,700 lb (72.9 – 87.6 kN)
HI-2	6,700 – 8,100 lb (29.8 – 36.0 kN)

Nuts, Bolts and Cap Screws shall meet AASHTO M 164 (m 164M). All nuts, bolts and cap screws shall be within a hardness range of Rockwell C23 to C31 prior to hot dip galvanizing per AASHTO M232/M 232M.

**Construction Methods:**

Working Drawings. Working drawings shall be submitted in accordance with subsection 105.04 of the Standard Specifications. Minor variations in details may be permitted; however, any major departure from the design will not be accepted.

Fabrications. Loading, transporting, unloading and erection of structural materials shall be done so that the metal will be kept clean and free from injury in handling.

Structural materials shall be stored above the ground upon platforms, skid or other supports and shall be kept free from accumulation of dirt, oil, acids or other foreign matter.

Structural material which has been deformed shall be straightened before being laid out, punched, drilled or otherwise worked upon in the shop. Sharp kinks or bends will be cause for rejection.

When sign support structures are subcontracted, the subcontract shall be in accordance with Subsection 108.01 of the Standard Specifications except that the value of the subcontract will be based on the value of the work for fabrication.

Repair Galvanizing. Galvanized areas damaged during shipping or erection shall be repaired by any of the three methods specified under ASTM A780. In all cases, the repair shall achieve the minimum coating thickness specified.

Erection. Material shall not be dropped, thrown or dragged over the ground. The Contractor shall supply detailed, written instructions and drawings for the erection of all sign structure components.

**Method of Measurement:**

The quantity of supplying ground mount breakaway type sign posts and breakaway assemblies will be measured as linear feet for the length and size of ground mount breakaway sign post furnished as specified and accepted.

**Basis of Payment:**

The quantity of supplying ground mount breakaway type sign posts and breakaway assemblies will be paid for at the Contract unit price per linear feet for the length and size of ground mount breakaway sign post specified. Price and payment will constitute full compensation for furnishing hinge plates, breakaway couplings, nuts, bolts and cap screws and all other materials for the sign posts and breakaway assemblies in accordance with the details and notes shown on the Plans, and as directed by the Engineer; and for all labor, equipment, tools and incidentals necessary to complete the work.

3/6/08

**749550 - INSTALLATION OF BREAKAWAY I-BEAM SIGN POSTS**  
**749551 -REMOVAL OF BREAKAWAY I-BEAM SIGN POSTS**

**Description:**

This work consists of installing or removing breakaway I-beam sign posts and breakaway assemblies on sign bases previously installed or installed under other items in this contract.

**Materials:**

Steel I-beams and all mounting hardware to be used will be paid for under other items of this contract or may be furnished by the Department. The supply of the material will be designated in the job order. All I-beams will be cut to the correct length and marked for the area they are to be installed.

**Construction Methods:**

The I-beams are to be installed in a manner as not to damage the base that the I-beam is to be installed on and care taken to not interfere with overhead utility lines.

When re-installing an existing sign post and breakaway assemblies, removal of broken couplings and bolts in existing I-beams and removal of broken anchor bolts in existing bases shall be considered part of this item.

Where an existing sign has been knocked down, this item will pay for the repair of breakaway couplings and standing up the existing sign. No additional compensation will be made for removal or installation of sign unless a new sign is required.

In the removal of the I-beams, all hardware is to be returned to the Department at the Dover Sign Shop.

**Method of Measurement:**

The quantity of installation or removal of breakaway posts and breakaway assemblies will be measured as the number of breakaway posts and breakaway assemblies installed as specified, complete and in place, or removed and returned to the Department at the Dover Sign Shop.

**Basis of Payment:**

The quantity of installation or removal of breakaway posts and breakaway assemblies will be paid for at the contract unit price per each. Price and payment will constitute full compensations for all labor, equipment, tools, and incidentals required to complete the work.

10/26/05

**749559 - SUPPLY OF JERSEY BARRIER MOUNTED I-BEAM**

**Description:**

This work consists of furnishing all jersey barrier mounted I-beam post (i.e. safety barrier sign connection) to the job order site in conformance with the details and notes shown on the Plans, and as directed by the Engineer.

**Materials:**

All prefabricated square tubing shall conform to ASTM A500 grade C with Fy minimum – 50 KSI.

All miscellaneous plate material for base plates shall conform to ASTM A709 grade 50 with Fy minimum – 50 KSI.

Anchor bolts shall conform to ASTM A709 grade 50 with 50 KSI minimum yield strength and be hot-dipped galvanized. Welding to high strength anchor bolts will not be permitted.

All structural steel shall be hot-dipped galvanized in accordance with AASHTO M III (ASTM A-123).

**Construction Methods:**

Working Drawings. Working drawings shall be submitted in accordance with subsection 105.04 of the Standard Specifications. Minor variations in details may be permitted; however, any major departure from the design will not be accepted.

Fabrications. Loading, transporting, unloading and erection of structural materials shall be done so that the metal will be kept clean and free from injury in handling.

Structural materials shall be stored above the ground upon platforms, skid or other supports and shall be kept free from accumulation of dirt, oil, acids or other foreign matter.

Structural material which has been deformed shall be straightened before being laid out, punched, drilled or otherwise worked upon in the shop. Sharp kinks or bends will be cause for rejection.

When sign support structures are subcontracted, the subcontract shall be in accordance with Subsection 108.01 of the Standard Specifications except that the value of the subcontract will be based on the value of the work for fabrication.

Repair Galvanizing. Galvanized areas damaged during shipping or erection shall be repaired by any of the three methods specified under ASTM A780. In all cases, the repair shall achieve the minimum coating thickness specified.

Erection. Material shall not be dropped, thrown or dragged over the ground. The Contractor shall supply detailed, written instructions and drawings for the erection of all sign structure components.

**Method of Measurement:**

The quantity of supplying jersey barrier posts will be measured as per each as specified and accepted.

**Basis of Payment:**

The quantity of supplying jersey barrier posts will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for furnishing, nuts, bolts and cap screws and all other materials for the sign posts in accordance with the details and notes shown on the Plans, and as directed by the Engineer; and for all labor, equipment, tools and incidentals necessary to complete the work.

3/6/08

**749560 - INSTALLATION OF JERSEY BARRIER MOUNTED I-BEAM**

**Description:**

This work consists of furnishing all jersey barrier mounted I-beam post and the (i.e. safety barrier sign connection) to the job order site in conformance with the details and notes shown on the Plans, and as directed by the Engineer. This is inclusive of the mounting plates, hardware and necessary adhesives.

**Materials:**

All prefabricated square tubing shall conform to ASTM A500 grade C with Fy minimum – 50 KSI.

All miscellaneous plate material for base plates shall conform to ASTM A709 grade 50 with Fy minimum – 50 KSI.

Anchor bolts shall conform to ASTM A709 grade 50 with 50 KSI minimum yield strength and be hot-dipped galvanized. Welding to high strength anchor bolts will not be permitted.

All structural steel shall be hot-dipped galvanized in accordance with AASHTO M III (ASTM A-123).

The adhesive anchor bolt system shall be capable of providing the following unfactored load capacity simultaneously:

Tension = 4 kips/ BOLT MIN.

Shear = 0.7 kips/BOLT MIN.

Minimum number of bolts, diameter and embedment depths shown on the plans shall be maintained.

**Construction Methods:**

Working Drawings. Working drawings shall be submitted in accordance with subsection 105.04 of the Standard Specifications. Minor variations in details may be permitted; however, any major departure from the design will not be accepted.

**Method of Measurement:**

The quantity will be measured per each as specified and accepted.

**Basis of Payment:**

The quantity of supply will be paid for at the contract unit price per each. Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required.

10/26/05

**749561 - INSTALLATION OF SIGN ON JERSEY BARRIER MOUNTED I-BEAM**  
**749562 - REMOVAL OF SIGN FROM JERSEY BARRIER MOUNTED I-BEAM**

**Description:**

This item consists of installing or removing a sign on jersey barrier mounted posts. The sign may be mounted to existing supports or ones installed under this contract.

**Materials:**

All materials shall be either supplied by the Contractor or by the Department as indicated in the job order.

**Construction Methods:**

Sign installation shall be performed as specified by the Engineer.

**Method of Measurement:**

The quantity of installation or removal of signs will be measured by the square footage of the signs installed or removed as per these specifications, complete, in place and accepted or removed and returned to the Department at the Dover Sign Shop.

**Basis of Payment:**

The quantity of installation or removal of signs will be paid for at the contract unit price per square each sign. Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

**749687 – INSTALLATION OR REMOVAL OF TRAFFIC SIGN ON SINGLE SIGN POST**

**Description:**

This work consists of installing or removing traffic sign(s) on a single post at the locations indicated on the Plans or as directed by the Engineer. This specification also includes installation of posts in boring holes constructed under other items.

Signs totaling more than 9 square feet shall be installed on multiple sign posts under Item 749690 – Installation or Removal of Traffic Sign on Multiple Sign Posts.

**Materials:**

The Department will provide all sign materials to be used on this project. The Contractor shall contact the DelDOT Sign Shop Supervisor with project plans and quantity sheets at 302-760-2581. Sign fabrication orders require a minimum of four (4) weeks for completion. Orders placed with less than 4 weeks lead-time will result in a delay. Any delay caused by inadequate lead-time due to a late order will be the sole responsibility of the Contractor. The Contractor shall pick-up the sign materials from the DelDOT Sign Shop and deliver them to the job site without any damage to the sign materials.

**Construction Methods:**

The Contractor shall pick-up necessary signs, sign posts, hardware, and extensions from the Department and install the signs in the locations indicated on the Plans in accordance with the DelDOT MUTCD or as directed by the Engineer. The Contractor shall be responsible for obtaining all necessary utility clearances before the signs may be installed. For sign removals, the sign posts shall have all nuts, bolts, and other connectors removed. The disturbed ground shall be graded and backfilled accordingly. All signing materials removed from the project shall be returned to the DelDOT Sign Shop without any damage to the sign materials.

**Method of Measurement:**

The number of single sign installations or removals will be measured as the actual number of sign posts installed or removed and accepted.

**Basis of Payment:**

The quantity of single sign post installations or removals will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for installing or removing signs and sign materials, pick-up and delivery of sign materials, grading disturbed areas, and for all labor, equipment, tools, and incidentals required to complete the work. Signs that are not installed in accordance with the DelDOT MUTCD or signs installed in the incorrect location shall be moved at no additional cost to the Department.

6/22/09

**759501 - FIELD OFFICE, SPECIAL****Description:**

This Field Office, Special item is a field office complex the work of which consists of erecting, furnishing, equipping, maintaining, and removing two (2) double wide modular field office units, their entrances, and its adjacent parking areas. These field office units may be situated in different locations. The Contractor shall submit a specific location layout drawing and construction details for each field office, its entrance, and its parking area for approval by the Engineer. Each field office and its parking area shall be for the exclusive use of Department Officials, Engineers, Consultants, and Inspectors.

Each field office structure shall be free of asbestos and/or other hazardous materials. Each field office, its entrance, and its parking area shall be constructed and installed in accordance with all applicable city, county, state, and federal codes. The Contractor shall be responsible for obtaining all required licenses and permits for installation and placement of each field office, its entrance, and its parking area. The costs of obtaining such licenses and permits are to be incidental to the "Field Office, Special" Item. Each field office shall be available for use by the Department continuously throughout the duration of the project.

**Construction of and Equipment for the Field Offices:**

Each field office shall be new and have a minimum floor space of 1,200 square feet with minimum exterior dimensions of 50'-0" length by 24'-0". The floor to ceiling height of each field office shall be nominal 8'-0". The exterior walls, ceiling, and floor of each field office shall be insulated. Each field office shall be of weather-proof construction, tightly floored and roofed, constructed with an air space above the ceiling for ventilation, supported above the ground, safely secured to its support if the support is an inground anchored foundation or otherwise by tie-downs to the ground, and fully skirted with rigid watertight covering overlapping the bottom of the exterior siding to the existing ground.

The Contractor shall provide entries to each field office by constructing a stair and deck platform with canopy at each exterior door. These entries shall be fabricated using treated dimension lumber, be constructed with hand and safety railing, be designed to last the life of the Contract, and conform to the requirements of the Architectural Accessibility Board and other federal, state and local boards, bodies and/or courts having jurisdiction in the Contract limits.

The Contractor shall construct and maintain an all weather parking area adjacent to each field office of at least 6000 square feet and having a minimum of 12 functional parking spaces striped for full size cars. An entrance shall be constructed to each field office from its point of access to its parking area as determined by its approved location layout drawing and construction details, the cost to be incidental to the "Field Office, Special II" Item. All weather pathways from the parking area to the entrances of each field office shall also be constructed and maintained. This parking area and entrance pathways shall have a minimum of 2" type "C" hot mix on top of minimum 6" graded aggregate subbase. Snow and/or ice shall be removed from the entrance, the parking area, and the entrance pathways of each field office within 12 hours after each occurrence. Costs for furnishing, placing, and maintaining the aggregate base and hot mix, and for snow and/or ice removal, to be incidental to the "Field Office, Special" Item.

The ground area 30'-0" from around the perimeter of each field office shall be landscaped and maintained. If the earthen grounds do not have a stand of weed free grass, the surface of this area shall be loosened to a depth of 4" and a satisfactory seedbed shall be prepared free of debris and extraneous matter. The area shall be seeded to a healthy stand of grass or sodded, after which the area shall be watered, mowed, and trimmed a minimum of three times a month during the growing seasons. Cost for this landscaping and maintenance is incidental to the "Field Office, Special" Item.

Each field office shall have full carpeting, kitchenette facilities, and interior and exterior paneling, lighting, and plumbing fixtures. Each field office shall have a minimum of two (2) exterior doors, each door having a passage and a deadbolt lock. These door locks shall be keyed and at least 2 complete sets of keys shall be supplied to the Engineer's representatives. The exterior doors of each field office shall be insulated or have storm doors. Each field office shall have a minimum of six (6) windows, each window having a minimum glass area of 1,150 square inches and a horizontal mini-blind covering the full glass area. The windows of each field office shall be insulated or have storm windows, shall be equipped with a locking device, and shall have screens installed and repaired when damaged.

At least two (2) outside water service connections shall be provided at each field office. Each water connection shall have a 3/4" frost proof hose bib with vacuum breaker and shall include 100 linear feet of 5/8" minimum diameter reinforced, industrial or commercial grade, soft rubber hose per connection.

Each field office shall be provided with sufficient natural and artificial light and shall be adequately heated and cooled to provide comfortable working conditions.

Each field office shall have satisfactory lighting, electrical outlets, heating equipment, and exhaust fan and air-conditioning connected to an operational power source. Plan and drawing areas shall have individual fluorescent lights situated over their worktables. Replacement fluorescent lights shall be furnished as required. Electrical current, water, and any fuel for heating equipment shall be furnished and the cost of such shall be borne by the Contractor. Maintenance of the heating, exhaust fan, and air-conditioning equipment for each field office shall be provided for by validated service contracts for the length of the Contract. These service contracts shall allow a Department authorized project person to deal directly with the service organization to request repair.

The Contractor shall furnish and maintain two fire extinguishers and provide one lighted "Exit" sign for each exterior passage door of the field offices. Fire extinguisher(s) may be chemical or dry power and shall be UL Classification 10-B:C(min.) and shall be suitable for Types A:B:C fires. A commercial or industrial type first aid and safety kit suitable for project conditions and hazards (including snakebite) shall be provided and maintained to full capacity on a monthly basis in each field office.

The Contractor shall provide an alarm system in each field office for security with electronic, direct connection to a security service provider. The security systems shall have interior motion, window, and entrance detectors and built in manual fire alarms. All windows of each field office shall be covered with steel bar grids as a deterrent to forced entry. The Contractor shall provide validated monitoring and service contracts for the length of the Contract for each field office. These contracts shall allow a Department authorized project person to deal directly with the security service provider to request service and/or repair.

The Contractor shall furnish and maintain in each field office an adequate supply of cold potable water, a minimum 23 cubic foot new refrigerator, and a minimum 900-watt new microwave oven. Maintenance of the potable water supply equipment, refrigerator, and microwave shall be provided for by validated service contracts for the length of the Contract. These service contracts shall allow a Department authorized project person to deal directly with the service organization to request repair.

Suitable indoor toilet facilities, conforming to the requirements of the State and Local Boards of Health or of other bodies or courts having jurisdiction in the area, shall be provided for each field office. When separate facilities for men and women are not available or required, a sign with the wording "Rest Room" {letter heights of 1" minimum} shall be placed over the doorway and an adequate positive locking system shall be provided on the inside of the doorway to insure privacy. The facility(s) shall be maintained by the Contractor to be clean and in good working condition and shall be stocked by the Contractor with adequate lavatory and sanitary supplies at all times during the period of the Contract.

For each field office the Contractor shall be responsible for performing or for making arrangements for all necessary telephone connections and/or for their maintenance; for providing a new telephone equipment system, for payment of all connections and the new telephone system equipment and its installation; and for final disconnection of the telephones.

The telephone system for the field office complex shall have a total of 9 lines consisting of 8 direct single lines with call forward busy feature and 1 dedicated facsimile line and have 8 key sets consisting of 1 master key set having privacy feature, and 12 six-button key sets having privacy feature (1 set which may be for wall mounting) and 1 TLS or T1 circuit line for data transmission, all for the official and exclusive use of the Engineer and other representatives of the Department. Location of telephone lines shall be as directed by the Engineer. Arrangement shall be made to allow a Department authorized project person to deal directly with the telephone company to report outages and/or request repair. The Contractor shall arrange for the installation and initial setup of the specified telephone system including phone company provision of a termination point with smart-jack. Initial installation and setup costs shall be the responsibility of the Contractor as well. All subsequent monthly billings, after initial installation and setup, for the field office telephone system and the TLS or T1 circuit line shall be received and paid by the Contractor. A copy of each of these subsequent bills shall be forwarded to the Project Resident for reimbursement on the contract pay estimate and the reimbursement will be for the amount of the bill only and shall not include any additional mark-up or profit.

For all other utilities, the Contractor shall be responsible for performing or for making arrangements for all necessary utility connections and/or for their maintenance; for payment of all utility connections, installations, service fees and bills; and for final disconnection of utilities.

The field office interiors shall be furnished by the Contractor. The Contractor shall provide new and maintain the following office furnishings, all which are to be approved by the Engineer prior to installation in the field office

complex. Placement of these furnishings shall be as directed by the Engineer. These furnishings consist of 4 drafting tables with sufficient drawers for standard size plans, either attached to the tables or in cabinet form, each drafting table to have an ergonomic design spring back stool with five leg base having wheel casters, 12 full size office desks each with filing drawer and fully adjustable ergonomic design swivel chair with armrests and five leg base having wheel casters, 2 computer stations with acoustical panels having minimum 60 NRC rating for privacy screen and fully adjustable ergonomic design swivel chair with armrests and five leg base having wheel casters, 1 large conference table for a minimum of 12 people with surrounding chairs with armrests, 4 folding tables minimum 6'-0" by 3'-0" each with ergonomic design straight back chair with armrests, 2 work tables, 2 supply cabinets, 1 or more clothes closets of ample size to meet inspection manpower requirements, 4 rough plan racks, 4 legal size filing cabinets with 4 drawers, 2 legal size fire-resistant filing cabinets with lock and key with 4 drawers and meeting fire underwriters' approval for not less than one hour test, 2 stackable steel flat file cabinets for 43" by 32" size plan sheets each cabinet having 5 drawers with full suspension, rear hood, and hinged front depressor, 2 book shelves minimum 3'-6" by 4'-6" each, 3 vertical surface legal size three compartment pockets, 2 dry erase boards minimum 4' by 3' each with markers and erasers, and 2 cork bulletin boards minimum 3' by 2'. These office furnishings will remain the property of the Contractor at the conclusion of the project.

The Contractor shall also furnish new and maintain the following office equipment for the field office complex, all which are to be approved by the Engineer prior to installation. Location of the office equipment shall be as directed by the Engineer. The required equipment will enable the Department to synchronize project record keeping and office functions. The equipment shall be delivered in working and useable condition:

8 heavy-duty calculators having extra large 12-digit fluorescent display, full size keyboard with contoured keys, two-color ribbon printer, and AC powered;

1 Printer, multifunction having print, scan, copy, and e-media interface capability having print resolution up to 2400x1200 optimized dpi from 1200x1200 input dpi and optimization from photo paper selected, margins roll 0.2x0.2x0.2x0.2 in, ink cartridges cyan, gray, magenta, matte black, photo black and yellow, minimum line width 0.02 mm (GL/2 addressable and guaranteed line width 0.06 mm (ISO/IEC 13660:2001; Scan resolution up to 600 dpi, maximum scam size 36x93.6 in and maximum scan thickness 0.03 in; Copy reduction/enlargement 25 to 400%, copier setting - quality, color, roll, content type, original paper type, background removal, contrast and de-skew; Media handling - printer: sheet feed, 2 automatic roll feeds, automatic roll-switching and automatic cutter - scanner: straight-through scan paper path for sheet and cardboard originals, media types - printer bond and coated paper, technical paper, film, photographic paper, backlit and self adhesive - scanner: non-abrasive paper, vellum, translucent, Mylar, recycled, blueprints and cardboard; Memory, 32GB (virtual) and 160GB hard disk; and Connectivity - interfaces (standard): Gigabit Ethernet (1000Base-T), Hi-Speed USB 2.0 certified, EIO Jetdirect accessory slot - printing languages (standard) ... eMFP: TIFF, JPEG, HP-GL/2, HP-RTL, CALS G4 and HP PCL 3 GUI ... PostScript eMFP: Adobe PostScript 3, Adobe PDF 1.7, TIFF, JPEG, HP-GL/2 HP-RTL, CALS G4, and HP PCL 3 GUI, including drivers supporting the printing languages;

1 Muratec MFX-2855D or Toshiba e-STUDIO 2330c or approved equal all-in-one copier which includes scanner, printer, and fax. Copier to have high speed wireless and network capability. Copier shall have all necessary software and cables for proper operation and shall be connected to high speed wireless and connected for use to share on a local network. Copier to have zoom and preset reduction and enlargement features, automatic two (2) sided copying, automatic document feeder with minimum 30 sheet capacity with automatic stapling capacity;

1 compact plain paper copying machine and cabinet with stationary platen, bypass feeding, and dual loading cassette system with cassettes for letter, legal, and ledger size paper. Copy machine to have zoom and preset reduction and enlargement features, automatic two (2) sided copying, automatic document feeder with minimum 30 sheet capacity, and 20 bin collator with automatic stapling capacity;

1 micro cassette recorder, having fast playback, voice-activated system, three-digit tape counter, silent auto-stop and pause, two tape speeds, one-touch and follow-up, built-in condenser microphone, cue and review, and rechargeable with combination battery charger/AC adapter;

1 telephone answering machine having all-digital recording, 14 minute message capacity, selectable message time, voice prompt assistance, day/time stamp, call screening, two-digit LED message indicator, toll saver, power failure memory back-up, and message interrupt from any station;

12 compact digital cameras with 10 megapixels or greater, maximum dimensions of 3" x 5" x 3, built in flash, autofocus, video mode LCD for review of images, LCD viewfinder acceptable, removable memory compatible

with compact flash, or secure digital (SD) or secure digital high capacity (SDHC), ISO compatible with 100, 200, 400 standard of quality of better, and memory cards supported by camera of 8 GB or better;

1 Canon Vixia HF M300, Panasonic HDC SD60, Samsung HMX-R10 or approved equal digital video camera, 1080p, CMOS optical sensor, digital format H.264, digital photo mode, camcorder sensor resolution 3.2 mega-pixels or greater, SD memory expansion card for still images, connection type, HDMI, USB, component video/audio output;

1 video projector, DLP projector, resolution of 1280x720 or greater, 16.7 million colors, contrast ratios of minimum 2000:1 or greater, video inputs to include SUGA, HDMI, S-Video and RGB, component, video modes minimum 720p or greater;

1 heavy duty 3-hole punch with minimum 40 sheet capacity;

1 extra heavy duty stapler with anti-jam feature having capacity up to 200 sheets; and

1 comb binding machine with manual punching capacity of 10 sheets having a minimum binding capacity of 150 sheets.

Consumables as required to manage the business of the project for each field office shall be provided for all office equipment for the length of the Contract. These consumables shall be furnished on request and shall include but not be limited to paper, tapes, ribbons, various size plastic combs, rolls, toner, cleaning kits, microcassette tapes and batteries, answering machine cassettes, camera batteries and memory cards/sticks, DVD and CD R/RW media, printer plan size paper rolls and ink cartridges, etc.

Maintenance of all office equipment in each field office shall be provided for by a validated service contract for the length of the Contract. This service contract shall allow a Department authorized project person to deal directly with the service organization to request repair.

### **Computer Requirements for Each Field Office:**

Each field office shall have three (3) IBM compatible Microcomputer Systems to be furnished and maintained by the Contractor for use by the Engineer, the cost to be incidental to the "Field Office, Special" Item. The specified computer systems will synchronize the construction management functions of the Department to monitor, report, and perform the accounting of the project work. The computer systems and all their related equipment specified below shall be furnished new and remain the property of the Contractor at the conclusion of the Contract. A detailed listing of the proposed computer systems and all their related equipment to be provided by the Contractor shall be submitted for approval by the Engineer prior to furnishing the Microcomputer Systems. The Microcomputer Systems shall be Laptop Computer Systems each with docking station, unless otherwise determined by the Engineer. In each field office both of the three (3) Microcomputer Systems shall consist of:

#### **Central Processing Unit (CPU) – Lap Top**

Intel I5, version2, processor and wireless networking capability included,

Minimum 4.0 GB RAM with expansion capability to at least 8.0 GB and clock/calendar card equivalent, and

Microsoft "Windows® 7 Professional with 64 bit support or Microsoft Windows® license downgrade to "Windows® XP Professional" operating system;

#### **Memory (Storage)**

CD/DVD +/- RW with double layer write capability, and 120GB hard drive minimum, integrated Ethernet 10/100. Included software shall support double layer media writing and automatic backup of data;

#### **Monitor (LCD)**

Monitor for docking station and docking station. 21" minimum diagonal visual area flat panel capable of multiple frequency color graphics, 1440 x 900 (wide) or 1280 x 1024 or better resolution, 16.7 million display colors, 5 ms response time, D-Sub and DVI video input ports;

Laptop - shall have 15.4" display minimum;

#### Color Graphics Card

PCIe video card or integrated video;

#### Keyboard

Keyboard shall be ergonomic, enhanced layout minimum with keyboard interface cable;

#### Printers

Laser printer, color, capable of printing 8-1/2"x 11", 11"x17" and envelope, having wireless and hard line network connectivity, printers shall have all necessary software and cables for proper operation and shall be connected to high speed wireless and connected for use to share on a local network;

#### Software

The latest version programs for application management (operating system), word processing, spreadsheet, and anti-virus shall be provided with all user manuals. Upgrades, maintenance, and full technical support by the manufacturer shall be provided for the length of the Contract. The required software will enable the Department to synchronize accounting and record keeping functions between the project, District, and Department offices. A list of programs to be provided shall be submitted to the Engineer for approval. Software, other than for application management and anti-virus, is to be delivered unopened to the Department's administrative office. All software is to be compatible with and for use to run on "Windows® 7 Professional" or "Windows XP Professional". The required applications software follows and is to be latest version unless noted:

collection - "Office 2010 Business Professional" with Word, Excel,

antivirus - "Norton™,

replication - Adobe Acrobat X Suite Software w/Adobe Photoshop® CS5 suite, and

software supporting creation of DVD +/- R/RW disks (supporting double layer media writing) and DVDR and DVDRW disks using DVDRW drive, for example: Ahead Nero, Roxio DVD/CD Creator, or some equivalent product. Note: software commonly included as part of the standard CDRW upgrade/standalone package is acceptable if included with the unit;

#### Related Equipment

Wireless networking hub/router, 802.11g or better, with all associated hardware (adapters, cables, etc) and software to enable wireless networking for resource/equipment sharing among all office computers and printers, the cost of wireless and network connections and service to be incidental to the "Field Office, Special " Item,

An electrical outlet with dedicated circuit for the main computer unit,

A wireless optical mouse with proper driving software having complete Microsoft emulation,

Necessary cables for proper operation,

An uninterruptible power supply (UPS) units for protection from power loss or fluctuation, minimum of 6 outlets, adequate to provide a minimum of 30 minutes backup power for an orderly shut down of the computer system with software and connections for automatic system shutdown,

24 bit Sound Blaster compatible PCI soundcard with quality desktop speakers,

A combination surge, spike, and noise protection device with receptacles for all peripherals (may be in combination with the UPS power supply),

A wrist rest suitable for use with the furnished keyboard,

All cards, hardware, and operating, anti-virus, and equipment software to be fully installed and operational;

**Maintenance and Service**

Maintenance of all specified equipment and components shall be provided for by a validated service agreement for the length of the Contract. Maintenance (upgrades, replacement, full technical support) for each software application shall be provided for by validated maintenance agreement for the length of the Contract. These agreements shall allow an authorized project person to deal directly with the service organization to request repair or the maintenance organization to request assistance; and

**Supplies**

Consumables as required to manage the business of the project shall be provided for the Microcomputer Systems in each field office for the length of the Contract. These consumables shall be furnished on request and include but not be limited to memory cards/sticks compatible with provided digital cameras having 8 GB or greater capacity and compatible with provided computers, DVDR and DVDRW media compatible supporting operational minimum to maximum speed of the DVD/RW drive unit, cut sheet paper and labels compatible with the printers, hardware and screen cleaners, printer ink cartridges, and toner cartridges.

**Maintenance Requirements for Each Field Office:**

Maintenance of each field office including its entrance and adjacent parking area, for the time required, shall consist of maintenance and/or replacement of all provided items, security system, furniture and equipment, computer systems, providing lavatory supplies, providing trash containers and waste baskets, providing entrance mats at each door, providing replacement items for lighting fixtures, maintaining all utilities, providing vermin and pest control by professional exterminator(s), providing satisfactory and sanitary janitorial and waste disposal services twice a week, providing cleanup of trash and debris on the parking lot and landscaped area once a week, and shall be included in the monthly unit cost.

The Contractor shall provide and deliver for each field office a current copy of all validated field office equipment and computer maintenance, service, assistance and/or monitoring agreements and/or contracts as mentioned hereinabove to the Department's administrative office on or before the first day each field office is ready for use.

**Method of Measurement:**

This item will not be measured but will be paid for on a monthly basis. Partial months will be paid at the rate of 0.033 months per day.

**Basis of Payment:**

The field office complex will be paid for on a unit price bid per month, which price shall be full compensation for performing the work specified and the furnishing of all materials, labor, tools, equipment and incidentals necessary to maintain each field office, their entrance, and their adjacent parking area and restore each field office area, entrance, and adjacent parking area to match their original site condition. No separate payment will be made for costs involved for removing hazardous material or underground tanks to install these field offices, their entrances, and their parking areas. One (1) unit of payment will constitute erecting, furnishing, equipping, maintaining, and removing two (2) double wide field offices and their entrances and parking areas.

Payment will be made only for the actual number of months that the field office complex is acceptably provided by the Contractor.

The field offices, their entrances, and their parking areas shall be ready for use not later than forty-five (45) calendar days after the date of the fully executed Contract or before construction operations begin.

4/12/11

**760504 - RUMBLE STRIPS, HOT MIX**  
**760506 - RUMBLE STRIPS, CONCRETE**

**Description:**

This work consists of furnishing a pavement cutting machine and cutting rumble strips in bituminous concrete pavement or P.C.C. concrete pavement in accordance with the details and notes on the Plans and as directed by the Engineer.

**Construction Method:**

The machine shall be one with a proven record for use in cutting strips in bituminous concrete pavement or P.C.C. concrete pavement. The strips shall be cut in accordance with the dimensions as detailed on the Plans, and materials resulting from cutting the pavement shall be disposed of and the slots shall be properly cleaned. The machine shall produce a smooth cut without tearing or snagging and be equipped with guides to provide uniformity and consistency in alignment of each cut with respect to the roadway.

**Method of Measurement:**

The quantity of rumble strips will be measured longitudinally along edge of pavement in linear feet (meters) of rumble strip cut in the pavement and accepted.

**Basis of Payment:**

The quantity of rumble strips will be paid for at the Contract unit price per linear feet (meter). Price and payment will constitute full compensation for furnishing the machine and operator as discribed herein and cutting the strip slots, for disposing of satisfactorily the discarded materials and cleaning the rumble strip area for all labor, tools, equipment and necessary incidentals to complete the work.

11/8/01

**760507 - PROFILE MILLING, HOT-MIX**  
**760508 - PROFILE MILLING, CONCRETE**

**Description:**

This work consists of furnishing a pavement-milling machine or cold planer and planing the existing bituminous concrete pavement or P.C.C. Pavement at the locations and to the nominal depths shown on the Plans and/or as directed by the Engineer to obtain a smooth profile on the existing roadway surface. Unless otherwise noted on the Plans or specifications the Contractor shall reuse, salvage and/or dispose of the milled material.

**Equipment:**

The milling equipment shall be a commercially designed and manufactured milling machine capable of performing the work in a manner satisfactory to the Engineer. The machine shall be power-operated and self-propelled, shall have sufficient power, traction and stability to remove a thickness of material to a specified depth. In addition, the machine must accurately and automatically establish profile grades by referencing the existing pavement surface. This shall be accomplished by means of 1.) a ski of 30' (9 m) minimum length with an accuracy of  $\pm 0.125''$  in 30' (3 mm in 9 m) or 2.) a minimum of three (3) ultra sonic, non-ground contacting sensors with an accuracy of  $\pm 0.100''$  in 25' (2.5 mm in 7.5 m). If noted on the Plans, a profile grade shall be established independent of the existing pavement surface. In such case the machine shall be capable of following the independent grade line (e.g. string line). The machine shall have an automatic system for controlling grade elevation and cross slope. The machine shall also be equipped with a means to effectively control dust generated by the cutting operation.

**Construction Methods:**

The surface resulting from the planing operation shall be in accordance with notes and details on the Plans and shall be characterized by uniform, discontinuous longitudinal striations and shall not be gouged or torn. Imperfections exceeding 5/16" (8 mm) at any point along the surface as a result of missing teeth or faulty operation shall be removed by approved methods.

Before opening the milled surface to traffic, all loose material shall be removed from the surface with a power vacuum sweeper.

Whenever the milling operation causes water to pond or lay within the wheelpaths of the roadway the Contractor shall alleviate this problem by cutting bleeders into the shoulder or median to provide positive drainage. Cost for such work will be incidental to this item.

If the road is to remain open to traffic, longitudinal vertical drop-offs in excess of 2" (50 mm) at lane lines or at the centerline shall not be left overnight.

Transverse faces at the beginning and end of the milling operation existing at the end of a work period shall be tapered 20:1 or flatter in a manner approved by the Engineer to avoid a hazard for traffic.

Surface material that cannot be removed by cold planing equipment because of physical or geometrical restraints shall be removed by other methods acceptable to the Engineer.

If independent grade reference is required, it shall be designated in the Plans and/or Contract documents and elevations shall be provided by the Plans or at the direction of the Engineer.

If a severe bump exist in the pavement surface extra effort shall be taken at these locations to improve the profile. Manual changes to the cutter head may be needed at these locations to achieve this. It is the intent to remove bumps and irregularities in the pavement and produce a smooth milled surface for hot-mix resurfacing.

If the existing bituminous surface is over concrete the intent is to remove all of the existing bituminous material to the top of the concrete surface unless otherwise directed by the Plans or the Engineer.

If milling to remove open graded hot mix, the milling operation must remove all of the open graded hot mix from the roadway surface.

**Method of Measurement:**

The quantity of pavement milling will be measured as the number of square yards per inch (square meters per 25 mm) of depth as shown on the Plans or established by the Engineer. The nominal depth shown on the Plans and initially set on the milling machine, even though it will vary automatically during profiling, will be the depth measured and paid.

**Basis of Payment:**

The quantity of pavement milling will be paid for at the Contract unit price per square yard per inch (square meter per 25 mm) of depth. Price and payment will constitute full compensation for furnishing an accepted pavement-milling machine and operator, for removal and disposal of the milled material or delivery to a designated site, for transporting equipment, for all labor, tools equipment and incidentals necessary to complete the item.

5/02/02

**763500 - MAINTENANCE OF TRAFFIC**

**Description:**

This item shall consist of all work performed by the Contractor to maintain vehicular, bicycle and pedestrian traffic through the project's work zones, including, but not limited to, the passage through the area of persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA) Title II, paragraph 35.130. All work associated with this item shall be completed as shown on the Plans or as directed by the Engineer.

All work shall be performed in a manner that will reasonably provide the least practicable obstruction to all road users, including vehicular traffic, bicycle traffic and pedestrian traffic. All temporary traffic control and temporary traffic control devices shall comply with the contract documents and with the latest edition of the manual titled "Delaware Department of Transportation Manual on Uniform Traffic Control Devices (MUTCD)," hereafter referred to as the "Delaware MUTCD", including all revisions as of the date of the advertisement of this Contract.

This item shall include installing, maintaining and/or relocating the temporary traffic control devices depicted in the approved Temporary Traffic Control (TTC) Plan, standard Delaware MUTCD TTC Cases and as required by project phasing.

The safety measures outlined within this Contract and the Delaware MUTCD are not necessarily sufficient in every instance to guarantee the protection of the traveling public or the persons working on the project. Therefore, the provisions of this Contract do not relieve the Contractor of the sole responsibility for the safety of all persons working within or traveling through the work zone throughout the duration of the project. The Contractor shall implement any additional safety measures that are not expressly required by the Contract and are necessary to ensure the safety of all persons. The Contractor shall submit to the Engineer justification for deviations from the TTC plan or additions to the TTC plan included in the contract documents. Final approval of the deviations or additions shall rest with the Engineer.

The Department reserves the right to stop the Contractor's operations, if in the opinion of the Engineer:

1. The Contractor's operations are not in compliance with the Delaware MUTCD, the specifications or the Plans.
2. The Contractor's operations are unsafe.

**Construction Methods:**

If the Contractor desires to deviate from the Temporary Traffic Control Plan (TTCP) provided in the Contract Documents or desires changes to the phasing or scope of the TTCP, the Contractor shall submit a new TTCP to the Engineer for approval prior to the start of work at each and every location. The TTCP shall be prepared, signed and sealed by a Professional Engineer registered in the State of Delaware and shall be prepared in accordance with all applicable DelDOT standards. The TTCP shall be submitted 14 calendar days in advance of starting work. Longitudinal dimensions for maintenance of traffic configurations may be adjusted slightly to fit field conditions as directed by the Engineer.

The Contractor shall be required to have an American Traffic Safety Services Association (ATSSA) certified Traffic Control Supervisor on the project during all working hours. The working hours for an ATSSA supervisor is limited to a 12 hour shift. After working 12 consecutive hours, a new ATSSA certified Control Supervisor shall replace him/her. The ATSSA certified Traffic Control Supervisor's sole responsibility shall be the maintenance of traffic throughout the project. This responsibility shall include, but is not limited to, the installation, operations, maintenance and service of temporary traffic control devices. Also required is the daily maintenance of a log to record maintenance of traffic activities, i.e. number and location of temporary traffic control devices; and times of installation, changes, and repairs to temporary traffic control devices. He/she shall also serve as the liaison with the Department concerning the Contractor's maintenance of traffic. The name(s) and contact information for the ATSSA certified Traffic Control Supervisor(s) shall be provided to the Engineer at the Preconstruction Meeting. A copy of the certifications for the ATSSA certified Traffic Control Supervisor(s) proposed for the project shall be submitted to the Department with the Contractor's bid package.

The cost of the ATSSA certified Traffic Control Supervisor(s) shall be incidental to this item.

The Department will not make payment to the Contractor for any and all temporary traffic control devices where the Contractor sets up temporary traffic control to perform work, but fails to perform any work. This does not include long-term temporary traffic control set-ups that are installed as part of the maintenance of traffic plans outlined in the contract documents.

Temporary traffic control devices shall be maintained in good condition in accordance with the brochure entitled "Quality Guidelines for Temporary Traffic Control Devices", published by the American Traffic Safety Services Association (ATSSA). Any temporary traffic control devices that do not meet the quality guidelines shall be removed and replaced with acceptable devices. Failure to comply will result in work stoppage with time charges continuing to be assessed.

Any existing signs that conflict with any temporary or permanent construction signs shall be covered as needed or as directed by the Engineer. The Contractor shall stake out locations of permanent warning signs in the field and receive approval from the Engineer for the location and method of mounting prior to ordering the signs. The Contractor, with the Engineer, shall inventory all existing signs within the Contract limits. Signs that must remain in place during the project shall be maintained by the Contractor. Any other existing signs shall be removed and properly stored by the Contractor to prevent loss or damage. Immediately prior to the final inspection, the Contractor and the Engineer shall again inventory the traffic signs and account for any lost or damaged signs. The Contractor shall replace or reimburse the Department for any lost or damaged signs.

Access to all businesses and residences within the Project limits shall be maintained throughout the duration of this Contract. Any temporary closure of a driveway or entrance for tie-in purposes shall be coordinated with the Engineer and the property owner in advance of the closure.

Access to all transit stops located within the project limits shall be maintained unless otherwise directed by the Plans or the Engineer. Maintaining access to the transit stop shall include maintaining an area for the transit vehicle to stop to pick-up and drop-off passengers and also an accessible path for pedestrians to safely access the transit stop.

The Contractor shall provide all property owners and residents who live adjacent to the work zone with written notice, 48 hours in advance of the start of construction work. This notification shall include the scope of work, working hours, anticipated start and completion dates, a summary of construction activities which may interfere with access to the property including a schedule and access coordination plan, Contractor's name and address, and a DelDOT contact phone number. Failure to give proper notice will result in a suspension of the work requiring notice, until proper notice is provided. The Contractor shall provide written verification to the Engineer that the property owners and residents were notified.

All roadway closures or lane closures beyond those specified and approved in the Contract Documents, shall be approved by the Chief Traffic Engineer or Designee a minimum of 48 hours in advance of the proposed restriction.

The Contractor shall notify the Engineer no less than fourteen (14) calendar days prior to the start of any detours and road closures and the Engineer will then notify the following entities:

- Local 911 Center
- Local schools
- Local post offices
- DelDOT's Transportation Management Center (TMC)
- Town Managers
- Local Police
- Local Fire Department and Emergency Medical Services
- DelDOT's Public Information Center
- Delaware Transit Corporation (DTC)

Immediately prior to the implementation of any lane or roadway closures, the Engineer shall notify the DelDOT TMC at (302) 659-4600. Notifications shall also be given to the TMC when the closure is lifted. The Engineer shall notify the TMC and the district Safety Officer if lane closures cannot be removed prior to the end of the allowable work hours.

The Contractor shall notify the local 911 center if access to a fire hydrant is temporarily restricted. The Contractor shall provide written confirmation to the Engineer that the local 911 center was notified.

The Contractor shall conduct construction operations in a manner that will minimize delays to traffic, and shall meet the following requirements:

1. If work is being conducted within 200 feet in advance or up to 200 feet beyond an intersection that is controlled by a traffic signal, the Flagger shall direct the flow of traffic in concert with the traffic signal to avoid queuing unless active work prohibits such action. The Flagger shall direct traffic to prevent traffic from queuing through an intersection (i.e., blocking an intersection).
2. If work is being conducted within a signalized intersection or series of signalized intersections, the Engineer shall notify the DelDOT TMC no less than 24 hours in advance of the operation. If work is being conducted within a signalized intersection, a Traffic Officer may direct traffic against the operation of the traffic signal only until the operation occurring within the intersection is completed. When the operation within the intersection is complete, the Engineer shall notify the DelDOT TMC that the intersection is no longer impeded by construction activities.
3. Work in the vicinity of traffic signals shall be scheduled to minimize the time during which the signal is operated without detectors. Prior approval of the Engineer shall be required for such work to be scheduled. The Contractor shall submit a schedule to the Engineer for approval seven (7) days in advance of the proposed start date of this work. The DelDOT Transportation Management Center (TMC) requires 48 hours advance notice of the cutting of a loop detector, and immediate notification once the loop detector has been reinstalled. The Contractor shall coordinate with the Engineer sufficiently in advance of loop detector work to ensure that these requirements are met.
4. When a lane adjacent to an open lane is closed to traffic, the temporary traffic control devices shall be set 2' (0.61 m) into the closed lane from the edge of the open lane, unless an uncured patch exists or actual work is being performed closer to the open lane with minimum restriction to traffic.
5. Except for "buffer lanes" on high volume and/or high speed roadways, lanes shall not be closed unless construction activity requiring lane closure is taking place or will take place within one hour. Lanes shall be reopened immediately upon completion of the work. For moving operations the lane closure shall be shortened as work progresses and as traffic conditions warrant to keep the length of the closure to a minimum. The Contractor shall conduct construction operations in a manner so as to minimize disruption to traffic during peak hours and periods of heavy flow. The Department reserves the right to stop the Contractor's operations if, in the opinion of the Engineer, such operations are impeding traffic unnecessarily.

It is required that all traffic control work and related items shall either be performed entirely by the Contractor's own organization, or totally subcontracted. Maintenance of equipment shall not be subject to this requirement.

Any deficiencies related to temporary traffic control that are reported to the Contractor in writing shall be corrected within 24 hours or as directed by the Engineer. Corrective actions on severe deficiencies shall be taken immediately unless otherwise directed by the Engineer. Failure to comply will result in non-payment for those devices that are found to be deficient for the duration of the deficiency. Serious deficiencies that are not corrected immediately could result in possible suspension of work until items identified are brought back into compliance and/or the holding of the pay estimate until the serious deficiencies are corrected.

At the end of each workday, the Contractor shall correct all pavement edge drop-offs in accordance with Table 6G-1 in the Delaware MUTCD. This corrective work shall be accomplished with Temporary Road Material (TRM) unless an alternate method is specified in the Plans. All ruts and potholes shall be filled with TRM as soon as possible, but no later than by the end of each workday. Placement of TRM shall be completed in accordance with the applicable sections of the Delaware Standard Specifications and shall be incidental to the appropriate item in the Contract. If temporary elimination of a drop-off hazard cannot be accomplished, then the area shall be properly marked and protected with additional temporary barriers, barricades, warning signs, flashing lights, etc. as required by Section 6G.21 of the Delaware MUTCD.

If an open trench accessible by vehicular traffic cannot be backfilled prior to the end of the working day, steel plates may be used to protect the trench area. Shop drawings for the steel plates shall be submitted to

the Engineer for approval prior to starting construction. The Engineer shall forward the shop drawings to the Bridge Design Section for review and approval. The shop drawing shall show the intended method to brace, sheet, support or shore the excavation and to prevent a trench failure while the walls of the trench are under the load of traffic. The plan should include details of the plating design, the method of fastening plates, plate thickness, span, bearing and the method of preventing the movement of the plates. This design shall be prepared and signed by a Professional Engineer registered in the State of Delaware. Whenever steel plates are placed on a travel lane or shoulder, the associated temporary traffic control related to the use of steel plates shall follow the standards presented in Table 6G-1 of the Delaware MUTCD. The Contractor is required to provide a ramp (wedge) around the steel plate using bituminous temporary roadway material (TRM) placed at a slope of 20 to 1 or flatter. The cost for the wedge material shall be incidental to the item being constructed. If steel plates are used, the cost of furnishing and installing steel plates, bracing, sheeting, supporting or shoring the excavation and the preparation of shop drawings shall be incidental to the item being constructed. Steel plates are not permitted between November 1 and April 1, without the prior approval of the Engineer.

If pavement marking information is not provided in the Plans, the Contractor shall submit detailed drawings (including but not limited to, lane and shoulder widths, turn lane lengths, locations of stop bars, turn arrows, crosswalks and railroad crossings) that depict the existing pavement markings for each project location prior to beginning construction. These drawings will be reviewed by the Department's Traffic Section to determine if any changes to the final pavement markings are required.

At the end of each day's operation and before traffic is returned to unrestricted roadway use, temporary striping shall be applied to locations that require permanent striping. Temporary pavement striping shall match permanent pavement striping as shown on the Plans or as directed by the Engineer. Prior to the start of any activity which will affect the pavement surface and require the placement of temporary striping, the Contractor shall show the Engineer proof that he has scheduled placement of the necessary temporary striping to ensure that the temporary striping can be completed prior to fully opening the roadway to traffic. The Contractor is responsible for maintaining the temporary markings in good condition such that the pavement is properly delineated at all times. The Contractor shall refresh the temporary pavement markings as required or as directed by the Engineer.

The Contractor shall apply temporary pavement markings in accordance with the requirements of Section 748 of the Delaware Standard Specifications and Part 3 of the Delaware MUTCD. Payment for temporary pavement striping shall be made at the unit price bid for the applicable temporary striping or symbol items. Payment for final striping will be included in the applicable striping item. Temporary pavement markings shall match the Plan dimensions and layout or the approved drawings of the "permanent markings" and shall be installed in accordance with Part 3 of the Delaware MUTCD. All conflicting striping is to be removed as directed by the Engineer according to the specifications for Item 748530 – Removal of Pavement Striping. Painting over the conflicting striping will not be accepted unless specifically allowed by the Plans.

Travel lane and ramp closings on multilane highways and Interstates shall not be permitted during the following holiday periods:

- December 24 through December 27 (Christmas Day)
- December 31 through January 3 (New Years Day)
- Friday prior to Easter through Easter Sunday
- Thursday prior to Memorial Day through the Tuesday following Memorial Day
- Dover International Speedway Race Weekends (Thursday prior to the race event through the day after the race event)
- July 3 through July 5 (Independence Day)
- Thursday prior to Labor Day through the Tuesday following Labor Day
- Wednesday prior to Thanksgiving Day through the Monday following Thanksgiving Day

Additional time restrictions may apply as noted in the project plans or as directed by the Engineer. Any requests to waive any restrictions must be made in writing to the Engineer for review and approval. A copy of the request shall be provided to the District Safety Officer for review.

**Certification:**

Temporary traffic control devices used on all highways open to the public in this State shall conform to the Delaware MUTCD. All devices shall be crashworthy in accordance with the National Cooperative Highway Research Program (NCHRP) Report 350, the memorandum issued August 28, 1998 by The USDOT Federal Highway Administration, and/or in accordance with the latest edition of the Manual for Assessing Safety Hardware (MASH), published by the American Association of State Highway and Transportation Officials (AASHTO).

The Contractor shall submit certification for temporary traffic control devices used specifically on this project at or prior to the pre-construction meeting.

Certification of compliance with NCHRP report 350 and/or MASH is required for the following categories of temporary traffic control devices:

**Category I** contains small and lightweight channelizing and delineating devices, which includes cones, tubular markers, flexible delineator posts and drums, all without any accessories or attachments.

**Category II** includes temporary traffic control devices that are not expected to produce significant vehicular velocity changes to impacting vehicles. These devices, which shall weigh 45 kg (100 lbs.) or less, include Type III barricades, portable sign supports with signs, and intrusion alarms. Also included are drums, cones, and vertical panels with accessories or attachments.

**Category III** includes temporary traffic control devices that are expected to cause significant vehicular velocity changes to impacting vehicles. These devices, which weigh more than 45 kg (100 lbs.), include temporary barrier, temporary impact attenuators, and truck-mounted attenuators.

**Category IV** includes portable or trailer-mounted devices such as arrow panels, variable message signs, temporary traffic signals and temporary area lighting. Note that certification compliance to NCHRP Report 350 or MASH criteria is not required for Category IV devices.

For Category I devices, the manufacturer or Contractor may self-certify that the devices meet the NCHRP-350 and/or MASH criteria. The Contractor shall supply the Federal Highway Administration's NCHRP-350 and/or MASH acceptance letter for each type of device that falls under Category II and III devices.

**Basis of Payment:**

Payment will be made at the lump sum bid price for "Maintenance of Traffic", for which price and payment constitutes full compensation for all maintenance of traffic activities accepted by the Engineer and for maintaining and/or relocating all temporary traffic control materials required, including submission of temporary traffic control plans, submitting certifications, ATSSA supervision, traffic cones, correction of edge drop-offs and for all labor, equipment, tools, and incidentals necessary to complete the item. Payment to furnish and maintain temporary traffic control devices (including, but not limited to plastic drums, temporary and permanent warning signs, portable P.C.C. safety barrier, truck mounted attenuators, variable message signs, arrow panels, temporary pavement markings and portable light assemblies) will be made at the contract unit price for each item. The cost to move temporary traffic control devices in accordance with the temporary traffic control plan or as necessary to address safety issue is included in this item.

**NOTE:**

\_\_\_ If the Contractor does not complete the contract work within the contract completion time (including approved time extensions), the Contractor shall be responsible for providing the necessary temporary traffic control devices that are required to complete any remaining work. The cost of such temporary traffic control shall be borne by the Contractor. No additional payment will be made to the Contractor to maintain traffic in accordance with the Delaware MUTCD, contract plans and specifications. Temporary traffic control items shall include, but not be limited to, warning lights, warning signs, barricades, plastic drums, P.C.C. safety barrier, flaggers, traffic officers, arrow panels, message boards, portable light assemblies and portable impact attenuators.

8/2/10

**763501 - CONSTRUCTION ENGINEERING**

**Description:**

This work consists of construction lay out including; stakes, lines and grades as specified below. Subsection 105.10 Construction Stakes, Lines and Grades of the Standard Specifications is voided.

Based on contract plans and information provided by the Engineer, the Contractor shall stake out right-of-way and easements lines, limits of construction and wetlands, slopes, profile grades, drainage system, centerline or offset lines, benchmarks, structure working points and any additional points to complete the project.

The Engineer will only establish the following:

- (a) Original and final cross-sections for borrow pits.
- (b) Final cross-sections for all excavation items.
- (c) Line and grade for extra work added on to the project plans.

**Equipment:**

The Contractor shall use adequate equipment/instruments in a good working order. He/she shall provide written certification that the equipment/instrument has been calibrated and is within manufacturer's tolerance. The certification shall be dated a maximum of 9 months before the start of construction. The Contractor shall renew the certification a minimum of every 9 months. The equipment/instrument shall have a minimum measuring accuracy of [3mm+2ppmxD] and an angle accuracy of up to 2.0 arc seconds or 0.6 milligons. If the Contractor chooses to use GPS technology in construction stakeout, the Contractor shall provide the Engineer with a GPS rover for the duration of the contract. The GPS rover shall be in good working condition and of similar make and model used by the Contractor. The Contractor shall provide up to 8 hours of formal training on the Contractor's GPS system to a maximum of four Engineer's appointees. At the end of the contract, the Engineer will return the GPS rover to the Contractor. If any of the equipment/instruments are found to be out of adjustment or inadequate to perform its function, such instrument or equipment shall be immediately replaced by the Contractor to the satisfaction of the Engineer.

**Engineering/Survey Staff:**

The Contractor shall provide and have available for the project an adequate engineering staff that is competent and experienced to set lines and grades needed to construct the project. The engineering personnel required to perform the work outlined herein shall have experience and ability compatible with the magnitude and scope of the project. Additionally, the Contractor shall employ an engineer or surveyor licensed in the State of Delaware to be responsible for the quality and accuracy of the work done by the engineering staff. When individuals or firms other than the Contractor perform any professional services under this item, that work shall not be subject to the subcontracting requirements of Subsection 108.01 of the Standard Specifications. The Contractor shall assume full responsibility for any errors and/or omissions in the work of the engineering staff described herein. If construction errors are caused due to erroneous work done under Construction Engineering the Contractor accepts full responsibility, no matter when the error is discovered. Consideration will not be given for any extension of contract time or additional compensation due to delays, corrective work, or additional work that may result from faulty and erroneous construction stakeout, surveying, and engineering required by this specification.

**Construction Methods:**

**Performance Requirements:**

- (a) Construction Engineering shall include establishing the survey points and survey centerlines; finding, referencing, offsetting the project control points; running a horizontal and vertical circuit to check the accuracy of given control points. Establishing plan coordinates and elevations marks for culverts, slopes, subbase, subsurface drains, paving, subgrade, retaining walls, and any other stakes required for control lines and grades; and setting vertical control elevations, such as footings, caps, bridge seats and deck screed. The Contractor shall be responsible for the preservation of the Department's project control points and benchmarks. The Contractor shall

establish and preserve any temporary control points (traverse points or benchmarks) needed for construction. Any project control points (traverse points) or benchmarks conflicting with construction of the project shall be relocated by the Contractor. The Contractor as directed by the Engineer must replace any or all stakes that are destroyed at any time during the life of the contract. The Contractor shall re-establish centerline points and stationing prior to final cross-sections by the Engineer. The Vertical Control error of closure shall not exceed 0.05 ft times [Square root of number of miles in the level run] (0.01 m times [square root of number of kilometers]). The Horizontal Control accuracy ratio shall not exceed an error of closure of 1 foot per 20,000 feet (1 meter per 20,000 meters or 1:20,000) of distance traversed prior to adjustment.

- (b) The Contractor shall perform construction centerline layout of all roadways, ramps and connections, etc. from project control points set by the Engineer. The Contractor using the profiles and typical sections provided in the plans shall calculate proposed grades at the edge of pavement or verify information shown on Grades and Geometric sheets.
- (c) The Contractor shall advise the Engineer of any horizontal or vertical alignment revisions needed to establish smooth transitions to existing facilities. The Contractor shall immediately bring to the attention of the Engineer any potential drainage problem within the project limits. The Engineer must approve any proposed variation in profile, width or cross slope.
- (d) The Contractor shall establish the working points, centerlines of bearings on bridge abutments and on piers, mark the location of anchor bolts to be installed, check the elevation of bearing surfaces after they are ground and set anchor bolts at their exact elevation and alignment as per Contract Plans. Before completion of the fabrication of beams for bridge superstructures, the Contractor shall verify by accurate field measurements the locations both vertically and horizontally of all bearings and shall assume full responsibility for fabricated beams fitting and bearing as constructed. After beam erection and concurrently with the Department project surveyors, the Contractor shall survey top of beam elevations at a maximum of 10-ft (3.0-meter) stations and compute screed grades. These shall be submitted to the Engineer for review and approval before the stay in place forms are set. Construction stakes and other reference control marks shall be set at sufficiently frequent intervals to assure that all components of the structure are constructed in accordance with the lines and grades shown on the plans. The Contractor will be responsible for all structure alignment control, grade control and all necessary calculations to establish and set these controls.
- (e) The Contractor, using contract plans, shall investigate proposed construction for possible conflicts with existing and proposed utilities. The Contractor shall then report such conflicts to the Engineer for resolution. All stakes for advanced utility relocation, which will be performed by others, shall be paid for under item 763597 – Utility Construction Engineering.
- (f) The Contractor shall be responsible for the staking of all sidewalk and curb ramp grades in accordance with the plans and the Departments Standard Construction Details. The Contractor shall review the stakeout with the Engineer prior to construction. The Engineer must approve any deviation from plans, Department Standard Construction Details and Specifications in writing. The Contractor shall be responsible for any corrective actions resulting from problems created by adjustments if they fail to obtain such approval.
- (g) If wetland areas are involved and specifically defined on the Plans the

following shall apply:

- i. It is the intent of these provisions to alert the Contractor, that he/she shall not damage or destroy wetland areas, which exist beyond the construction limits. These provisions will be strictly enforced and the Contractor shall advise his/her personnel and those of any Subcontractor of the importance of these provisions.
- ii. All clearing operations and delineation of wetlands areas shall be performed in accordance with these Special Provisions. Before any clearing operation commences the Contractor shall demarcate wetlands at the Limits of Construction throughout the entire project as shown on the Plans labeled as Limits of Construction or Wetland Delineation to the satisfaction of the Engineer.
- iii. The material to be used for flagging the limits of construction shall be orange vinyl material with the wording "Wetland Boundary" printed thereon. In wooded areas, the flagging shall be tied on the trees, at approximate 20-foot (6.1 meter) intervals through wetland areas. In open field and yard areas that have been identified as wetlands, 3 foot (one meter) wooden grade stakes shall be driven into the ground at approximate 20 foot (6.1 meter) intervals and tied with the flagging.
- iv. If the flagging has been destroyed and the Engineer determines that its use is still required, the Contractor shall reflag the area at no cost to the Department. If the Contractor, after notification by the Engineer that replacement flagging is needed, does not replace the destroyed flagging within 48 hours, the Engineer may proceed to have the area reflagged. The cost of the reflagging by the Engineer will be charged to the Contractor and deducted from any monies due under the Contract.
- v. At the completion of construction, the Contractor shall remove all stakes and flagging.
- vi. The Contractor shall be responsible for any damages to wetlands located beyond the construction limits, which occurs from his/her operations during the life of the Contract. The Contractor shall restore all temporarily disturbed wetland areas to their preconstruction conditions. This includes restoring bank elevations, streambed and wetland surface contours and wetlands vegetation disturbed or destroyed. The expense for this restoration shall be borne solely by the Contractor.

**Submittals:**

All computations necessary to establish the exact position of all work from the control points shall be made and preserved by the Contractor. All computations, survey notes and other records necessary to accomplish the work shall be made available to the Department in a neat and organized manner at anytime as directed by the Engineer. The Engineer may check all or any portion of the stakeout survey work or notes made by the Contractor and any necessary correction to the work shall be made as soon as possible. The Contractor shall furnish the Engineer with such assistance as may be required for checking all lines, grades, and measurements established by the Contractor and necessary for the execution of the work. Such checking by the Engineer shall not relieve the Contractor of his/her responsibility for the accuracy or completeness of the work.

The Contractor shall submit any of the following at the Engineer's request:

- (a) Proposed method of recording information in field books to ensure clarity and adequacy.

- (b) A printout of horizontal control verification, as well as coordinates, differences and error of closure for all reestablished or temporary Control Points.
- (c) A printout of vertical control verification, with benchmark location elevation and differences from plan elevation.
- (d) Sketch of location of newly referenced horizontal control, with text printout of coordinates, method of reference and field notes associated with referencing control.
- (e) Description of newly established benchmarks with location, elevation and closed loop survey field notes.
- (f) All updated electronic and manuscript survey records.
- (g) Stakeout plan for each structure and culvert.
- (h) Computations for buildups over beams, screed grades and overhang form elevations.
- (i) A report showing differences between supplied baseline coordinates and field obtained coordinates, including a list of preliminary input data.
- (j) Any proposed plan alteration to rectify a construction stakeout error, including design calculations, narrative and sealed drawings.
- (k) Baseline for each borrow pit location.
- (l) Detailed sketch of proposed overhead ground mounted signs or signals showing obstructions that may interfere with their installation.
- (m) Copies of cut sheets.

**Method of Measurement:**

The quantity of Construction Engineering will not be measured.

**Basis of Payment:**

Payment will be made at the Lump Sum price bid for the item "Construction Engineering". The price bid shall include the cost of furnishing all labor, equipment, instruments, stakes and other material necessary to satisfactorily complete the work as herein described under this item for all roads and structures that are a part of the contract. Adjustment in payment will be made for the deletion or addition of work not shown in the contract documents.

Monthly payment will be made under this item in proportion to the amount of work done as determined by the Engineer.

8/29/07

**763503 - TRAINEE**

**Description:**

The item shall consist of providing training in the construction crafts in accordance with the requirements stated in the General Notices of this proposal under the Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246).

**Basis of Payment:**

The payment for the item shall be made at a fixed rate of \$.80 per hour toward the hourly rate of the trainee.

5/2/02

**763508 - PROJECT CONTROL SYSTEM DEVELOPMENT PLAN**  
**763509 - CPM SCHEDULE UPDATES AND/OR REVISED UPDATES**

**Description:**

The Project Control System will be set up and maintained by the Department of Transportation to monitor and record work in progress and to coordinate and synchronize construction management functions. The Department will use Critical Path Method (CPM) scheduling to approve the Contractor's work schedule, review work progress, evaluate time extensions, identify problem areas, and recommend solutions to maintain the established work schedule. The Department will designate a Critical Path Method Administrator (CPMA) to oversee the Project Control System.

The Contractor shall designate a Critical Path Method Coordinator (CPMC) having proven experience in construction scheduling and in CPM concepts and scheduling. The CPMC shall be familiar with and have direct contact with both the Contractor's front office and field staff. The CPMC shall be knowledgeable of the status of all parts of the work throughout the length of the Contract in order to properly coordinate the Contractor's work schedule information and shall be available for consultation and preparation of documents on a daily basis. If this condition is not complied with the Contractor shall submit qualifications for a replacement CPMC to the CPMA for approval by the Engineer.

The CPMC shall submit a working drawing schedule, materials schedule, crew schedule; and shall prepare and provide the "look ahead", original, update, revised update, and final (as-built) update CPM work schedules, written CPM schedule narratives, and other CPM schedule information as required by the Project Control System Development Plan. The CPMC shall prepare and provide the Contractor's work schedule information by email as a single compressed database file in CPM format fully compatible with the Windows® version of Primavera Project Planner® used by the Engineer for generation of the CPM schedules.

The CPM format shall be the Precedence Diagram Method with days as the Planning Unit and shall be based on Calendar Days. Schedules will be developed using every day as a workday; schedules with calendars based in any manner on Working Days will not be allowed. The CPMA will receive the Contractor's CPM schedule databases for input to generate the CPM schedules. The generated CPM schedules are the Contractor's own work schedule and will be reviewed for approval by the Engineer. CPM schedules approved by the Engineer will have the word "schedule" in the center title block (layout name) of their graphic outputs and title line of their report outputs.

The Contractor's compliance with the Project Control System Development Plan and CPM Schedule Updates and/or Revised Updates, and the Engineer's approval of the generated Original CPM schedule, its updates and/or revised updates will be required before processing monthly estimates for payment.

It is not the intent of this Contract that the Engineer by approving the CPM schedules agrees that it is reasonable in all respects or that the schedule, if followed, will result in timely completion of the Project. The Engineer's approval is based on a review of general conformity for compliance with the requirements of the Project Control System and on the items or time restrictions that the department and/or the Engineer have control. The Contractor is free to make assumptions regarding field conditions, estimated quantities, and/or subsurface conditions. However the Department's concurrence with the Contractor's schedule based on these assumptions does not relieve the Contractor from making necessary revisions to his schedule should his assumptions fail to hold true. No time extension to the Contract which is due to assumptions made by the Contractor and that do not hold true during construction will be considered by the Department. Discrepancies and/or changes initiated by the Department in proposed quantities or plans that cause an extension to the critical path will be considered by the CPMA. The Department's controls or time restrictions are identified hereinafter and in the Standard Specifications, Special Provisions, and on the Contract Plans as plan notes.

**Development of the Project Control System (PCS):**

The PCS development plan is as follows:

- (a) Within seven (7) calendar days after the date of the fully executed Contract a workshop meeting will be held with the Engineer, CPMA, Contractor, and CPMC. The CPMA will profile the basics and procedures of the Project Control System and discuss schedule model design at this meeting.

Attendance is mandatory,

The Department's partially predetermined Coding Structure (CS) format having a maximum of seventeen (17) code classification levels will be used and will be furnished at the Workshop Meeting. The CS is a specific listing that illustrates the hierarchy of work needed for the project. The hierarchy is categorized into levels or classifications. The CS classifications organize activities into manageable groups through each level of the project, for example; locations, phasing (staging), landmark dates, roadway sections and bridge structures; footings, columns, and caps; contractor and subcontractor.

The CPMC shall assist in determining the breakdown and code title descriptions from south to north and west to east of the location code classification. Activity code values shall be perspicuous for each classification grouping. Additional activity code classifications and values as required by the Engineer from time to time shall be provided and added to the schedule database by the CPMC. The CPMC shall not alter the CS and properly code all activities with the approved CS activity code values for all code classifications including all railroad, waterway, and outside agency activities with approved code values, including classifications as added by the Engineer. Coding enables generation of organized reports and graphics that can summarize any level of the project schedule.

When the Department provides a format database for the Contract, it shall be used by the Contractor as the basis from which to develop their schedule. The CPMC may add, but not insert, code classifications in the format database;

(b) Within fourteen (14) calendar days after the workshop meeting, the CPMC:

(1) Shall submit a working drawing schedule, using the Department's application format or other format as agreed to by the Engineer. This schedule shall also include all other items having content that requires approval to allow any portion of the work to commence or continue. This schedule shall be submitted to the CPMA for approval by the Engineer and shall contain all required working drawings and also include but not be limited to reinforcing bar lists, formwork drawings and calculations, construction procedures, borrow pit security and traffic plans, precast structures, wetland work plans, construction sequencing, load tests, and wave equation analyses. Working drawing information shall include the identification number, description, type, anticipated submittal date, time frame for preparation and review, approval needed by date, and a resubmittal process (if expected) for each listed item. This information shall also give factory leadtime and expected delivery date, if applicable, for each listed item.

The Contractor should be aware that the Department's time frame for review of working drawings and other submittals properly submitted or resubmitted in accordance with Standard Specification Subsection 105.04 will be thirty (30) calendar days duration unless mutually agreed to by the CPMC and CPMA; this 30 day duration supercedes the time frame of the Subsection. If a working drawing or other submittal involves review by railroads, environmental agencies, municipalities, other states, federal agencies, or the U. S. Coast Guard the time frame for review will be sixty (60) calendar days unless mutually agreed to by the CPMC and CPMA. The time frame will begin on the date of receipt of the drawings by the reviewer and will end on the date of transmittal returning the drawings to the Contractor by the Department. No drawings will be accepted for review until an initial working drawing schedule has been accepted unless agreed to by the Engineer.

The working drawing schedule shall be updated and correlated with the activities of the "look ahead" and all other CPM schedules;

(2) Shall submit a materials schedule using the Department's application format or other format as agreed to by the Engineer. This schedule shall be

submitted to the CPMA for approval by the Engineer and shall contain all required materials, samples, and sources of supply. The materials schedule information shall include the identification number, description, generic or brand name, sample requirement, and manufacturer's and supplier's name, address, and phone number for each listed item. The schedule shall also give the anticipated submittal date, time frame for preparation and review, approval needed by date, factory leadtime, and expected delivery date, if applicable, for each listed item.

The materials schedule shall be updated and for materials having long factory leadtimes shall be correlated with the activities of the "look ahead" and all other CPM schedules;

- (3) Shall submit a crew schedule. This schedule shall be submitted to the CPMA for approval by the Engineer and shall be accompanied by a written narrative and shall contain all crews and their work plan.

The crew schedule shall be updated and correlated with the activities of the "look ahead" and all other CPM schedules;

- (4) Shall prepare and provide a written narrative of the Contractor's work plan and an acceptable "look ahead" schedule database in CPM format. This schedule database shall reflect activities for the Contractor's overall work plan for the entire project detailing the "look ahead" period and shall be submitted to the CPMA for acceptance by the Engineer. The "look ahead" period shall be as determined by the Engineer. The "look ahead" schedule shall be maintained and updated until an Original CPM schedule is approved. The "look ahead" schedule shall also reflect the Sequence of Construction in the plans unless otherwise approved by the Engineer. This "look ahead" schedule, its updates and/or revised updates shall also be incorporated into the Original CPM schedule database. Issue of the Notice to Proceed is contingent upon receipt and acceptance of this schedule in accordance with Standard Specification Subsections 108.02 and 108.03; and

- (5) Shall begin meeting with the CPMA at their office every third business day to prepare and provide a written narrative of the Contractor's work plan and a CPM schedule database until a useable, logical draft of the full CPM schedule network, responsive to the project requirements and correlated with the required schedules has been developed as determined by the Engineer. The CPMA will generate an initial CPM schedule from the CPMC's logical draft CPM schedule database for review by the Engineer. This initial schedule shall reflect the Sequence of Construction in the plans unless otherwise approved by the Engineer. This initial CPM schedule database, if acceptable, may be used to fulfill the Contractor's "look ahead" schedule requirements;

- (c) If the initial CPM schedule is not acceptable to the Engineer, the CPMC shall continue to meet with the CPMA on every third business day and prepare and provide the Contractor's written narrative and CPM schedule database as necessary until a generated CPM schedule is acceptable to the Engineer; and

- (d) Within twenty-eight (28) calendar days after the workshop meeting, an initial CPM schedule must be generated having the requirements for the Engineer's approval. This schedule shall reflect a clear understanding of the Contractor's work plan, be adequate to determine the Department's staffing requirements, have correct physical logic, incorporate construction and traffic phases, and display clarity of presentation for review and processing. Upon approval the CPMA will furnish the Contractor a graphic and report output of this CPM schedule. This CPM schedule, or Original CPM schedule, is the Contractor's own work schedule and the Contractor's responsibility to maintain.

The ending (cut-off) day for each monthly estimate period shall be proposed by the Contractor subject to Department approval. In the event of a conflict, the Engineer will have the authority to establish the ending

day.

Processing of monthly estimates for payment will begin or continue only if the Contractor is in compliance as determined by the Engineer with the PCS Development Plan.

Any information required by the Engineer for analysis of the CPM schedules, their updates and/or revised updates; clarification of charts and other schedules; and evaluation of proposed changes or change orders shall be prepared and provided by the CPMC. A copy of the current approved CPM schedule, its updates and/or revised updates shall be on display at the field office of both the Department and the Contractor.

**CPM schedule information and requirements:**

The CPMC shall prepare and provide the Contractor's work schedule information in the form of work step and restraint activities:

- (a) Work step activities are single step construction elements,
- (b) Restraint activities are not construction elements but affect the start of other activities.

When setting forth work steps and restraints the breakdown on these activities shall address the following factors:

Work Step factors affecting the duration and/or sequence of activities;

1. Work at locations done at different times or requiring different crews,
2. Work requiring different materials,
3. Work requiring different crew or craft requirements,
4. Work requiring different equipment,
5. Work requiring different responsibility (subcontractors),
6. Structural work having distinct subdivisions,
7. Labor and equipment resource availability,
8. Work as reflected in the Contractor's estimating or accounting breakdown,
9. Work as reflected in the state's breakdown for bidding or payment,
10. Public, private, and/or Contractor utility work and limiting or outage schedules of public and/or private utility organizations, and
11. Maintenance of traffic.

Restraint factors affecting the start of other activities;

1. Preparation of working drawing and materials submittals,
2. Approval, return, and/or resubmittal of working drawings and materials,
3. Specialized material testing,
4. Long lead purchases - material and equipment availability,
5. Material and equipment fabrication time,
6. Testing of special equipment and in place testing,
7. Delivery of unusual shipment or scarce material,
8. Dependency on completion of utility work,
9. Dependency on the Department's approval of issues involving public, private, and/or other governmental agencies,
10. Dependency on completion of part or all of another Department contract or construction of other organizations, whether contiguous or not,
11. Protection and restoration of property, forest protection, special traffic controls, erosion control and water pollution, environmental controls and suspensions, safety, and foreseeable archeological and/or historical evidence delays,
12. Procurement of permits, and
13. Conditions as set forth in Standard Specification Subsection 107.01.

Activities must be identified by a name, symbol, and coding, and shall have duration, sequence, responsibility, and resources.

Activity names or titles shall be descriptive and be single identifiable work steps or restraints. A sample breakdown list of activity titles may be furnished to the Contractor by the Engineer on request. Activities

shall be selected, as a minimum, on a structure by structure and/or section by section basis where relevant and have further breakdown into secondary components. Activities shall be inclusive and representative of the Contract work. Activity symbols, or ID's, shall be unique and systematic.

Activity codes shall have classifications and values. The approved CS will determine activity code classifications and values. The CPMC shall identify activities using these classifications and code values. Additional activity codes as required by the Engineer shall be provided by the CPMC.

Activity durations, or Original Durations, shall be reasonable and representative of the scope of the activity. If durations are considered excessive or insufficient, the industry standard will be used. Original Durations may not exceed thirty (30) calendar days unless approved by the Engineer. Durations of activities shall be determined by using productivity rates based on calendar days, not work days. Original Durations of activities may not be less than two (2) calendar days unless agreed to by the CPMA. The use of calendar day productivity rates in CPM scheduling allows for customary days during the work week that the Contractor does not work and for normal weather delays. Productivity rates used to establish durations shall reflect the time periods when work can be scheduled and exclude the non-work period of the activity's calendar. Activity calendars allow activities to be scheduled only when allowed by the nature of or restraints on the work. Calendars shall not exclude weekends, holidays, or other times the Contractor does not work.

All activities shall be identified by entry of their appropriate Calendar. A minimum of fourteen (14) shall be used and the first fourteen (14) shall be ordered and entitled as follows: 1) Full schedule, 2) Environmental, 3) Winter Condition, 4) Concrete Work, 5) Concrete Work Winter, 6) Concrete Deck, 7) Concrete Paving, 8) GABC, 9) Asphalt Base, and 10) Asphalt Surface, 11) SMA, 12) Night Paving Asphalt Base, 13) Night Paving Asphalt Surface, 14) Night Paving SMA. Calendar non-work periods shall reflect the average Delaware weather history of and the environmental regulations for the location of the Contract work. The Contractor may perform work during its calendar non-work period when favorable weather allows the work to be performed without compromising its specification and at no cost to the Department. When the Department provides a format database from which to develop the CPM schedule, the Contractor shall not modify the Calendars in the format database unless approved by the Engineer. The non-work periods of the calendars follow:

CALENDAR	NON-WORK PERIOD
1) Full schedule,	N/A
2) Environmental:	Varies; project specific,
3) Winter Condition:	December 1 thru March 15,
4) Concrete Work:	December 1 thru March 15,
5) Concrete Work Winter:	N/A (Protection provided at no cost to the Department)
6) Concrete Deck:	November 15 thru March 31,
7) Concrete Paving:	December 1 thru March 15,
8) GABC:	November 15 thru March 15,
9) Asphalt Base:	November 15 thru March 15,
10) Asphalt Surface:	November 15 thru March 15,
11) SMA	November 15 thru March 31,
12) Night Paving Asphalt Base:	October 15 thru April 30,
13) Night Paving Asphalt Surface:	October 15 thru April 30, and
14) Night Paving SMA:	October 15 thru April 30.

Activity durations are based on Calendar Days and shall reflect all time necessary to complete an activities work and its requisites. The Contractor shall include in their original schedule narrative their work day to calendar day conversion factors with a discussion of how these factors were determined. When scheduling using multiple resources each resource unit shall have a corresponding activity. All time to complete the activity shall include as a minimum all Contractor unscheduled work days, all Contractor holidays, and allowance for normal weather delays, except for software generated calendars. Inclement weather and failure of a contractor and their subcontractors to provide sufficient resources are not means to recover costs or time due to delay.

Activity sequence shall be typical of proficient scheduling practice. The sequence must be logical and representative of the Contractor's order of the work. Successors and predecessors determine the job logic or activity sequence. Successors are activities that follow an activity. Predecessors are activities that precede an activity. A given activity cannot start until all predecessors have been completed. The Precedence

Diagram Method (PDM) shall be used. The PDM places the activities on nodes and the dependencies between them are defined by arrows. Only finish to start dependency relationships (links) shall be used; lag times may not be used unless approved by the CPMA. The Department reserves the right to request a resequencing of activities to effect competent scheduling practice and realistic job logic.

Activities shall be sequenced to reflect resource apportionment. When one crew (resource) is being utilized to perform all of many similar activities, these activities must be linked together in some sequence to reflect that one crew is performing the work. Additionally, when several crews are performing similar activities, these activities must have separate linked sequences equal to the number of crews performing the work. Activities shall be logically connected and coded to reflect the crew (resource) performing the operation. A summary list of crews, their crew codes, and their operation(s) shall be included with each schedule submission unless unchanged. Resource loading will not be required unless otherwise directed by the Engineer. If resource loading is directed, payment will be incidental to the Item "763509 – CPM Schedule Updates and/or Revised Updates".

Activity responsibility shall be identified for each activity except those performed by the Contractor, if requested by the Engineer. Subcontractors, DBE's, utilities, performers of other contracts, and performers of adjoining work on other advertised contracts shall be identified by coding when responsibility for an activity is requested.

Activity resource loading shall be required only if the Contractor demonstrates the inability to maintain the CPM schedule. In this event, the Engineer shall have the authority to require resource information for all activities affecting project completion. Resource information includes manpower, equipment, materials, and/or services and has cost and has a range and amount of availability. Lack of sufficient resources will not be considered cause to extend durations when preparing the CPM schedule. By bidding to contract the work, the Contractor has ensured that sufficient resources are available or will be available in a suitable time frame to perform the work within the Contract Time, even if a resequencing of activities requires an activity or activities to shorten their Remaining Duration. In the event the Contractor demonstrates the inability to maintain the CPM schedule, the Engineer may require the Contractor to increase the number of shifts, begin overtime operations, work extra days including weekends and holidays, supplement construction plant and equipment, or all or any of the foregoing as a step to improve the Contractor's work progress all without additional cost to the Department.

Work activities shall as a minimum be representative of all construction work for each operation, each phase (stage), and each location.

Working drawings shall be included as activities. Preparation and leadtime (order, manufacture, and delivery time), shall be included as activities for each applicable working drawing item. A separate activity shall be used to begin the submittals of working drawings. Time extension(s) will not be considered when submittal activity(s) affects the critical path except for owner caused delay as recognized by the Engineer. If working drawings require resubmittal(s), activities for their preparation and activities for their approval (having the Department's review time) shall be included in the next CPM schedule update database. Time extension will not be considered when resubmittal activity(s) affects the critical path except for owner caused delay as recognized by the Engineer. Working drawing activities and leadtime activities not requiring submittal shall not be on the critical path of the Original CPM schedule.

Materials having long leadtime and/or manufacture time or that are difficult to acquire and/or fabricate shall have materials approval and leadtime activities included in the schedule for each applicable material item. A separate activity shall be used to begin the submittal of these materials. These material approval and leadtime activities shall not be on the critical path of the Original CPM schedule.

Administrative milestones shall be included as activities. Each milestone of the bidding through first chargeable day process shall be an activity.

Utility work shall be included as activities and shall be identified accordingly. Each utility item on the plans or listed in the Contract's Utility Statement shall be an activity. The activity description shall indicate the utility company and include the number of each listed item or be numbered according to the item's order in the Utility Statement. A separate activity shall be used to begin utility work. Utility activities shall not be impactive on the Original CPM schedule unless authorized by the Engineer.

Agency agreements and/or arrangements and other submittals for approval shall be included as activities.

A separate activity shall be used to begin the agency items and other submittals for approval.

The effect of other Department contracts or construction of other organizations on the completion of part or all of this Contract shall be included as activities. A separate activity shall be used to begin these items.

Phasing (staging) shall be included as activities. These activities shall be correlated with the sequence or suggested sequence of construction on the plans and/or in the specifications. A separate start and finish milestone activity shall be used to start and to complete each phase.

When multiple crews are performing an operation or a string of operations, each crew shall be logical connected and coded to reflect the crew performing the operation.

Surcharge durations and special testing, if applicable, shall also be included as activities. Sufficient duration times for these activities will be allowed as per the plans and specifications or as agreed to by the Engineer.

Activity types must be either "task", "start milestone", or finish milestone. "Hammock" type activities may be allowed as agreed to by the Engineer. If the Department requires resource loading, "task" activities may be converted to "independent" type as agreed to by the Engineer.

Date constraints, float and duration constraints, and/or flags for activities will not be allowed. Milestones that do not constrain the schedule shall be allowed as agreed to by the Engineer when unique or unusual events cause a restraint to the Contractor's work schedule. The use of "Start No Earlier Than" (SNET) and "Zero Free Float" (ZFF) constraints for activities may be allowed for the purpose of schedule clarity or definitude if acceptable to the CPMA.

Total Float is defined as the difference between the current schedule finish date and the Contract Completion Date that is entered by constraint ("Project must finish by:" date) in the schedule.

Free float is defined as the amount of time between when an activity "can finish" (the early finish) and when an activity "must finish" (the late finish). Free float is float shared with all other activities and is defined as the amount of time an activity can be delayed without affecting the critical path of the schedule. It shall be understood by the Contractor and the Department that free float is a shared commodity, not for the exclusive use or financial benefit of either party. Either party has the full use of the free float until it is depleted.

The critical path is defined as the series of activities in a CPM schedule network that has the longest path in time. The submitted activity sequence and durations must generate a CPM schedule having only one (1) critical path; a schedule with multiple or near multiple critical paths will not be allowed. Work like project wide Maintenance of Traffic, Construction Engineering, or Temporary Erosion Control that by their nature are ongoing for long durations or the duration of the project and are basically complementary to other activities, shall be divided and condensed into "establish" and "conclude" activities to prevent this type of work from being the major portion of the critical path or its entirety.

The Project Start Date, or initial Data Date, of the Original CPM schedule shall be the first chargeable day of work. The first schedule activity related to productive work shall be entitled "First Chargeable Day" and shall be a start milestone. Nonproductive work and administrative activities may begin and/or end prior to the Project Start Date and shall be stuated as such in the Original CPM Schedule. The submitted activity sequence and durations must generate an Original CPM schedule using all the Contract Time and a critical path having zero total float. An early completion schedule will not be allowed. The Contractor's original schedule shall reflect the use of the entire Contract Time. The schedule ending date that uses all the Contract Time in the Original CPM schedule will be the original Contract Completion Date. This Contract Completion Date shall be fixed (Project must finish by:) in the Original CPM schedule and shall remain unchanged unless a time extension is awarded.

The Contractor's Original CPM schedule shall allocate the work over the entire Contract Time. The Contractor shall not anticipate early completion in bid preparation and shall distribute all time-driven and/or time-dependent costs uniformly over every day of the Contract Time when preparing the bid. No early completion schedules will be accepted.

After the Original CPM schedule utilizing all the allocated Contract Time has been approved, job

conditions or logic changes may occur which require revision to the schedule. Only an update may be revised. These revised updates must be reflective of the Contractor's actual intent in constructing the project. The revision may cause the project completion date to be earlier than the completion date of the current approved schedule. This is acceptable to the Department; but no claims will be considered for time-driven and/or time-dependent costs (such as delay and/or extended overhead expense) which are a result of not meeting this new project "early finish" date. Consideration for these costs would occur only for approved extensions that force actual project completion past the originally advertised Contract Time including authorized time extension(s). However, no credits for non-expended overhead will be requested should a Contractor successfully achieve completion of the project prior to the use of all the Contract Time.

If the project is delayed, the contractor must demonstrate the inability to perform other critical or near critical work to receive consideration for an extension of Contract Time.

CPM schedule databases shall be calculated using the relevant Data Date prior to submittal to the CPMA. The Data Date of CPM schedule updates and revised updates shall be the next day after the end of the update period. Schedule calculations of CPM databases shall be based on retained logic, contiguous durations, and total float as finish float.

Activity Log (memo) information is allowed, but must be factual; shall be removed, if redundant; and shall not be masked, but indicated for printing to output reports. Punctuation is not required for activity and Activity Log information unless necessary for clarity.

Statusing or contract progress of activities for updates is the entering of Actual Start dates, Suspend Date(s), Resume Date(s), Actual Finish dates, and changes in Remaining Durations to the database. An activity's Original Duration may not be changed. An activity that begins (has an Actual Start Date) must have its Remaining Duration reduced by at least 1 day.

Activity Suspend and/or Resume Dates shall be added to the activity record and the factual reasons for the cause shall be added to the respective activity Log. If an activity is suspended again it shall be curtailed and assigned an Actual Finish Date equal to the latest suspension date, and a new activity (portion 2) comprising the balance of remaining duration shall be created and inserted in succession; both activities shall indicate by log comment the facts causing this condition.

Log statusing shall be used when an activity has out-of-sequence progress and no Actual Finish Date. Out-of-sequence progress occurs when any previous predecessor of an activity has no Actual Finish date. Log statusing is the entering of the Actual Start date to the Activity Log of the database in the Departments format. These entries are not to be masked, but indicated for printing to output reports. Changes in Remaining Durations shall be entered to the database but not the Activity Log. When progress is no longer out-of-sequence or all previous predecessors of the activity have Actual Finish dates, the activity's Actual Start shall be taken out of log status and entered to the database. Log statusing provides schedule output that prevents graphic distortion of schedule activities and preserves the design sequence of the CPM schedule plan. The Engineer shall have the authority to require a revision of the CPM schedule because of out-of-sequence progress. A suspended activity that requires log statusing shall be treated in the same manner as though it was suspended again.

Each original, update, and revised update schedule database and subsequent draft submitted for approval shall have a unique and manifest Project Name and shall be uniquely identified by entry (Number/Version) in the schedule database.

Corrections are defined as entries to the database that rectify coding and activity identification errors. Corrections shall be identified by written narrative and/or as agreed to by the CPMA. Exception(s) taken in PCS or other Department correspondence shall be complied with in the subsequent update and/or a revised update of the CPM schedule.

Written narratives shall be included with each submission of initial or revised update databases. The narratives must conceptualize work plans, modifications, and/or corrections but may be summary unless otherwise directed by the Engineer. These narratives shall describe where and the crews and order of what is to be done; narratives that are a listing of the work will not be acceptable. The Department will only accept schedule databases that reflect the work plans, modifications, and/or corrections reflected by their respective written narratives.

Inaccurate and/or faulty databases of any CPM schedule update and/or revised update will be unacceptable and shall be summarily corrected and resubmitted. Resubmittals shall be labeled "2nd Draft", "3rd Draft", etc. as appropriate and identified by entry (Number/Version) in the schedule database.

Any activity(s) or activity information that is necessary to generate a CPM schedule acceptable to the Engineer and/or schedule information that is requested by the Engineer shall be prepared and provided by the CPMC.

The CPMA will generate the CPM schedule network reflecting the Contractor's scheduling information. Upon approval of the Original CPM schedule and subsequent CPM schedule updates and/or revised updates, the CPMA will furnish the Contractor graphic and report outputs of these schedules. These CPM schedules are the Contractor's own work schedule and the Contractor's responsibility to maintain.

**Monthly CPM Schedule Updates:**

The CPMC shall meet with the Contractor and Resident Engineer and prepare the required work schedule progress information (status reports) to update the CPM schedule. This information shall be submitted on status forms provided by the Department that are generated from the Original Schedule and thereafter from the previous CPM schedule update or revised update(s). This update information shall reflect the current state of completed project work. The update information shall include all activities on which work was performed and/or there was progress during the update period and shall include as a minimum their actual start dates, suspend dates, and resume dates; and the estimated remaining durations or actual finish dates. The update information shall be as agreed to and signed-off and dated by the Resident Engineer and the CPMC. The CPMC shall use the signed-off and dated information to status and/or log status the update database.

The Contractor shall submit the CPM schedule database update and a copy of the signed off update information within five (5) calendar days after the end of each monthly update period. The database and signed off information must match. The CPMA will generate a CPM schedule update reflecting the Contractor's update information. The five (5) calendar day submittal period will enable the Department to discuss current schedule information at the monthly progress meeting held the following week.

If the critical path of the generated CPM schedule update has less than minus ten (-10) calendar days of total float the CPM schedule update shall be revised.

Upon approval of the CPM schedule update, the CPMA will furnish the Contractor a graphic and report output of this update. This CPM schedule update is the Contractor's own updated work schedule and the Contractor's responsibility to maintain.

**CPM Schedule Revised Updates:**

The CPM schedule shall be revised if the critical path has less than minus ten (-10) calendar days of total float, conditions require the Contractor to modify the work schedule, the Contractor chooses to make a significant change in the sequence of work, or the Department requests the schedule to reflect the current state of the work and/or the Contractor's acknowledged work plans. The revised update shall reflect the Contractor's current order of work and include new and/or previous activities affected by the change and shall include a written narrative of these changes. Revision as required by this Specification or as requested by the Department does not constitute acceleration unless agreed to by the Engineer. Revisions shall be identified as the revised update of the current approved CPM schedule update. Revisions are to be singular in modification and not lumped together in the same revised update unless otherwise directed by the Engineer. Additional revision(s) of the same update is therefore acceptable. The Department reserves the right to request a resequencing of activities to effect a completion date within the Project Time.

The CPMC shall meet as needed with the CPMA at the Engineer's office within five (5) calendar days after revision is required, formal request for a revision, or the Contractor announces intent to submit a revision. The purpose of the meetings shall be to prepare the Contractor's revised update CPM schedule database and its written narrative of changes. These meetings shall continue until a useable, logical draft of the revised update CPM schedule network, responsive to the modification requirements, has been developed that will generate a workable, CPM schedule revised update having a completion date using or within the Contract Time or that allowable by this specification. The submitted CPM schedule database revised update must reflect its written narrative. Revised updates inconsistent with their written narratives will not be acceptable. The CPMA will generate the CPM schedule revised update reflecting the Contractor's new

information. The reports generated by the CPM schedule revised update shall be used to prepare the update information for the next CPM schedule update.

Reduction of activity durations will not be considered acceptable criteria for revision to bring the project back on schedule unless activity quantities have been reduced or the Contractor provides a narrative describing how their means and methods to construct the work shall change and/or their resource allocation to perform the work shall increase.

For activities using like resources, modification of activity relationships to be concurrent (run parallel) with each other will not be considered acceptable criteria for revision to bring the project back on schedule unless the Contractor provides a narrative describing how their crews and/or resource allocation to perform the work shall increase.

A CPM revised update having the requirements for the Engineer's approval must be completed before preparation of the next CPM schedule update. Processing of the next monthly estimate for payment will begin only after the Engineer's approval of the signed CPM schedule revised update.

Upon approval of the CPM schedule revised update, the CPMA will furnish the Contractor a graphic and report output of this revised update. This CPM schedule revision is the Contractor's own revised work schedule and the Contractor's responsibility to maintain.

In the event that the Contractor fails to maintain his CPM schedule in a satisfactory manner, the Engineer reserves the right to enforce the provisions as set forth in Standard Specification Subsection 108.10.

**Change Orders and adjustment of completion time:**

A Change Order will only be considered for extension of Contract Time when the modified critical path shows requirement of additional time because of the added activity or activities and/or there is justifiable delay as recognized and determined by the Engineer. For any change order that affects the schedule, the Department reserves the right to request a resequencing of activities to effect a completion date within the Project Time.

If the CPM schedule has been updated and/or revised and positive total float has been created, no additional time will be given for added activity(s) unless the modified critical path shows requirement of additional time and/or there is justifiable delay as recognized and determined by the Engineer. Compensation for additional overhead costs will not be considered until all of the original Contract Time has been utilized. The Engineer reserves the right to "bank" (postpone the award of) approved time extensions if the project is ahead of schedule.

If a change order represents issues for which the effect on contract time can be readily determined, then any time adjustment will be agreed upon by the CPMC and CPMA prior to final execution of the change order. Determination of time adjustment will be based on the effect of the issue on the CPM schedule, the current approved CPM schedule update or approved CPM revised update, and the Department's Time Evaluation Worksheet (TEW) submitted by the Contractor.

However, if the issues represented by the change order require further analysis and review in order to accurately and fairly evaluate the effect on contract time, then the change order contract time assessment block may be marked "not considered at this time". This will be done in order to not delay payment to the contractor for completed work included on a particular change order while the time analysis is being performed. In these cases, final resolution of any time related issues would be made as soon as all required information is received and analyzed by the Department and the Contractor.

After signature by all parties, the change order is considered approved, and work activities and any time modifications as shown on the approved TEW that affect the CPM schedule shall be reflected in the next CPM schedule update or revised update and be documented by written narrative. Only activities on the approved TEW may be included as activity(s) in schedule databases. Updates reflecting change order(s) that are inconsistent with their change order narratives will not be acceptable. No change orders will be processed until their effect on the CPM schedule has been determined, unless otherwise approved by the Engineer. A change order may not be included in a monthly estimate for payment unless approved by the Department on or before the cutoff date of the estimate. All official time extensions will be granted by letters from the applicable District Construction Engineer or his/her designated representative.

Issues involving potential time extensions must be addressed in the CPM schedule update period in which they occur or they cannot be considered. If the Contractor proposes a change to the Contract work, any time the Contractor spends in discussion and preparation, and any time the Department requires for review in the approval or disapproval process for this proposed change to the Contract work will not be considered for granting of additional contract time. It is the obligation of the Contractor to complete the project on time according to the original contract documents including current approved changes notwithstanding any change submitted for approval that may or not be accepted. The Contractor is obligated to prosecute the work at any time according to the Contract Documents in covenant at that time.

If an allowance for weather days has been included in the Completion Date section at the beginning of the Contract Special Provisions, these days shall be identified as Contract Weather Days. The following definitions regarding weather days will be utilized:

Weather day – Any Calendar Day (including weekends and Holidays) on which a weather event prohibits contract work on critical path activities. Events include, but are not limited to rain, snow, or extreme temperatures.

Lost day – Any Calendar Day (including weekends and Holidays) on which residual effects from a weather event prohibit contract work on critical path activities. Examples include, but are not limited to, wet conditions from a previous rain event, snow cover, or frozen ground.

Extensions of Contact Time for weather will not be considered until the total of weather days and lost days as defined above exceed the number of Contract Weather Days as listed in the Completion Date section at the beginning of the Contract Special Provisions. The Contractor and the Department will record and agree on weather days and lost days. A day will be considered a weather or lost day if it prevents progress of the current or next work activity on the critical path of the schedule, unless it occurs during a calendar non-work period of the current or next work activity on the critical path of the schedule in which case the day will not be counted as a weather day. Weekends and holidays will also be excluded from consideration for weather and lost days during calendar non-work periods.

When the total of weather days and lost days recorded in the field exceed the advertised Contract Weather Days, the Contractor will be awarded a day for each day weather or conditions due to previous weather events prevent progress of the current or next work activity on the critical path of the schedule. When weather affects an activity not on the critical path and the activity becomes the critical path, the allowable days of time extension will be only for the days the activity was on the critical path. The Contractor and the Department will record and agree on these weather days. Inability to prosecute work not shown as activities in progress on the most recent CPM schedule will not be considered when determining an extension of Contract Time. The Engineer will have the final decision as to the number of calendar days the Contractor's work was limited to because of weather.

**Final (As Built) CPM Schedule Update:**

The CPMC shall meet with the Contractor and Resident Engineer and prepare the required as-built work schedule information and corrective work schedule information to finalize the CPM schedule. The progress reports generated by the previous CPM schedule update or revised update will be used to prepare this update information. This final update information shall reflect the final state of the project work. The final update information shall include all activities on which work was performed and/or corrections since the last update period and shall include as a minimum the activity ID and title, the actual start and finish dates, and the actual completion date. The final update information shall also include any revisions and change orders not previously included in the CPM schedule. These correction, revision, and change order modifications shall be reflected by a final update written narrative. The final update information will be as agreed to and signed off by the Resident Engineer and the CPMC. The CPMC will use the signed off information to status the CPM schedule database to prepare the final update schedule.

The Contractor shall submit the final CPM schedule database and a copy of the signed off final update information within five (5) calendar days after formal request for this update. The database and signed off information must match. The CPMA will generate a final CPM schedule update reflecting the Contractor's new information. Upon approval of the final CPM schedule update, the CPMA will furnish the Contractor graphic and report outputs of this final update.

The CPMC shall submit two (2) signed copies of the final CPM schedule update to the CPMA.

Processing of the final estimate for payment will begin only after these signed copies are received. This final (as built) CPM schedule is the Contractor's final work schedule.

**Method of Measurement:**

The Project Control System will be portioned into two (2) items. The item, "Project Control System Development Plan", will be bid price lump sum. The item, "CPM Schedule Updates and/or Revised Updates", will be unit bid price per each approved update.

**Basis of Payment:**

The item, "763508 - Project Control System Development Plan", will be paid for at the Contract lump sum bid price, on the next monthly estimate after completion of the requirements of the Project Control System Development Plan, which includes approval of the Original CPM schedule.

The item, "763509 - CPM Schedule Updates and/or Revised Updates", will be paid for at the Contract unit bid price per each approved CPM schedule update. Revised updates are incidental to this item, except that each revised update(s) requested by the Department for purposes of incorporating Plan Revisions will be paid as one (1) approved CPM schedule update.

10/28/2010

**763564 - SPECIAL BIDDING PROCEDURE**

**SPECIAL BIDDING PROCEDURE**

The Department of Transportation is using a special bidding procedure for this project for selecting the bidder to perform work.

The process for bidding will take into account not only the price offerings of the bidder but also the speed with which the Contractor can provide a usable facility to the traveling public.

1. Preparation of Proposal Form

The bidder shall establish the number of calendar days that he will require to complete the work, in accordance with the Plans and Specifications, necessary to have the project completed in its ultimate condition with all lanes and shoulders fully open to unrestricted highway traffic. This calendar day number shall be entered on the Proposal Form where indicated. The product of this number of calendar days times the average Road User Cost of \$35,000.00 per day shall be included in the Contractor's total bid price for this proposal. The Total sum will be the amount used as a basis of comparison of bids in establishing the successful bidder.

Consideration of Bids

The total submitted bid shall consist of the following.

Part A = The total dollar amount for all work to be performed.

Total number of calendar days (includes Weather Days as calculated from Table I). The maximum number of calendar days that can be utilized in the calculation of this part of the bid is 1153.

Part B = Proposed Calendar Days x \$35,000/Calendar Day

The total submitted bid will be the sum of Part A and Part B subject to all other governing requirements of the Standard Specifications or Special Provisions.

The successful bid will be determined by the Department as the lowest total submitted bid of all responsive/responsible bidders after bid review. The determination of a responsible/responsive bidder includes a rigorous review of the bid proposal. The lowest responsible/responsive bidder must be prepared to demonstrate that the calendar day portion of the bid is reasonable, rational, and achievable without incurring Liquidated Damages.

The preceding formula shall only be used as a basis of comparison to determine the successful bidder and shall not be used to determine the award amount nor final payment to the Contractor when the project is completed. Only the unit prices bid and the quantities required to complete the project shall be used to determine final payment to the Contractor.

In developing the contract completion time, the adverse weather anticipated for each month is shown in the following table.

Table I: Monthly anticipated adverse weather delay based on a seven (7) calendar day week:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12	10	5	5	4	2	4	3	4	3	2	6

2. Proposal Guaranty

The proposal guaranty shall be based on 10% of the Contractor's total bid price as resulting from the summation of the unit bid prices on the Bid Proposal Forms. (Price of work proposed, Item A in Formula.)

11/29/10

**763626 - DIESEL FUEL COST PRICE ADJUSTMENT**

I. Description: This section defines the criteria for payments to the Contractor to reflect increases or decreases in the cost of diesel fuel consumed in the performance of applicable construction work. To have the Diesel Fuel Cost Price Adjustment provisions apply to this project, a properly completed Diesel Fuel Cost Price Adjustment Option form must be submitted to the Department with the Bidder's bid proposal. If a properly completed Diesel Fuel Cost Price Adjustment Option form is not provided by the bidder, the Department will consider the option to apply the Diesel Fuel Cost Price Adjustment provisions for the project to be declined. No further opportunity to elect Diesel Fuel Cost Price Adjustment for the project will be made available.

a. General. These price adjustment provisions apply to contract items in the contract schedule of prices as grouped by category. Specific pay items to be adjusted are attached as an appendix to this Special Provision. General category descriptions and the fuel usage factors which are applicable to each are as follows:

**1. Categories**

- 1.a. Category A:** Earthwork. The combined total of the applicable item plan quantities must exceed 5,000 CY.
- 1.b. Category B:** Subbase and Aggregate Base Courses. The combined total of the applicable item plan quantities must exceed 500 tons.
- 1.c. Category C:** Flexible Bases and Pavements. The combined total of the applicable item plan quantities must exceed 500 tons.
- 1.d. Category D:** Rigid Bases and Pavements. The combined total of the applicable item plan quantities must exceed 5,000 CY.
- 1.e. Category E:** Structures. Contract items will be based upon the total square foot price for each structure including any associated items of work, i.e. items not grouped under Categories A thru D.

**2. Diesel Fuel Usage Factors – ENGLISH UNITS**

Category	Factor	Units
A – Earthwork	0.34	Gallons per CY
B – Subbase and Aggregate Base Courses	0.62	Gallons per ton
C – Flexible Bases & Pavements	2.98	Gallons per ton
D – Rigid Bases & Pavements	0.98	Gallons per CY
E – Structures	8.00	Gallons per \$1,000 of work performed

**3. Quantity Conversion Factors – ENGLISH UNITS**

Category	Conversion	Factor
B	SY to ton	90 lbs/Inch of depth/SY
C	SY to ton	112.5 lbs/Inch of depth/SY
D	SY to CY	Inches of depth/36

II. The posted index price will be the monthly price most recent data published by the U.S. Department of Energy, U.S. Energy Information Administration. The source information for the posted price for Delaware No 2 Diesel Retail Sales by All Sellers (Cents per Gallon) may be viewed at the following website:

<http://tonto.eia.doe.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=D220612102&f=M>

The release date for the U.S. Department of Energy, U.S. Energy Information Administration average price data occurs the first Monday of the month three months later, i.e. October prices are released the first Monday of January.

The price index, FB, is the index price posted by the Department, determined as specified above, on the project advertisement date.

## PRICE INDEX (FB) FOR DIESEL FUEL

PER GALLON (PER LITER) = \$ 2.256

The price index, FP, will be the index price posted by the Department, determined as specified above, for the month during which the Notice to Proceed (NTP) is issued, and every 90 calendar days thereafter.

III. Price Adjustment Criteria and Conditions. The following criteria and conditions will be considered in determining a price adjustment for diesel fuel cost fluctuations.

- a. Price Adjustment Calculation. When the ratio FP/FB is calculated to be less than 0.95 or calculated to be greater than 1.05, the Department will adjust unit bid price prices in accordance with the following formula:

$$AUP = (FP-FB)(F)+(UBP)$$

where:

AUP = Adjusted Unit Price

FP = Fuel Price Index for the month in which prices are adjusted for applicable construction work.

FB = Fuel Price Index in the Bid Proposal

F = Diesel Fuel Usage Factor

UBP = Unit Bid Price specified in the Contractor's Bid Proposal

- b. Payment of Adjusted Unit Prices. The unit bid prices of work items affected by the fuel escalation will be adjusted by work order, either up or down, at Notice to Proceed and every 90 Calendar Days thereafter.
- c. Expiration of Contract Time. If the Contractor exceeds the authorized allotted completion time, the adjusted item prices on the last authorized allotted work day shall be the prices used during the time liquidated damages are assessed. However, if the posted price for diesel fuel goes down, the item prices shall be adjusted downward accordingly.
- d. Final Quantities. Upon completion of the work and determination of final pay quantities, an adjusting work order will be prepared to reconcile any difference between estimated quantities previously paid and the final quantities. In this situation, the value for FP used in the price adjustment formula will be the average of all FP's previously used for computing price adjustments.
- e. Inspection of Records. The Department reserves the right to inspect the records of the prime contractor and its subcontractors and material suppliers to ascertain actual pricing and cost information for the diesel fuel used in the performance of applicable items of work.
- f. Extra Work. When applicable items of work, as specified herein, are added to the contract as Extra Work in accordance with the provisions of Section 110.03, no price adjustment will be made for fluctuations in the cost of diesel fuel consumed in the performance of the extra work, unless otherwise approved by the Engineer. The current price for diesel fuel is to be used when preparing required backup data for extra work to be performed at a negotiated price. For extra work performed on force account basis, reimbursement for material and equipment along with specified overhead and profit markups will be considered to include full compensation for the current cost of diesel fuel.
- g. Subcontractors. Any Price Increases or Price Rebates that are calculated based on items of work performed by subcontractors will be added to or deducted from payments due to the Contractor in the appropriate pay period. The Contractor shall then accurately record on the appropriate CN-91 or CN-103 form the additions or deductions into adjusted contract value. The Contractor shall make payment to the subcontractor(s) who actually performed the work in accordance with DelCode Title 17, Chapter 8.

01/18/11

<b>Appendix--Item 763626 Diesel Fuel Cost Adjustment</b>		
<b>Contract:</b>	<b>T200809003.01</b>	
		<b>Item No./s</b>
<b>Category A: Earthwork</b>		202000, 207000, 208000, 209001,
Excavation & Embankment		209002, 210000, 212000, 212001
(total qty must exceed 5000 CY)		
<b>Category B: Subbase and Agg.</b>		302007, 302008
GABC, Burrow		
(total qty must exceed 500 T)		
<b>Category C: Flexible Bases and Pavements</b>		
Hot-mix patching, Hot-mix overlay		401654, 401660, 401663, 401665
(total qty must exceed 500 T)		401666, 401667, 401668, 401669
		401708, 401711
<b>Category D: Rigid Bases and Pavements</b>		501006
Concrete, P.C.C. Patching		
(total qty must exceed 5000 CY)		
<b>Category E: Structures</b>		602007, 602011, 602013, 602014,
Bridges, Large P.C.C. Structures		602015, 602017, 603000, 604000,
		605002, 605500, 605511, 605512
		605513, 605523, 605581, 605757
		618540, 618541, 618542, 618543
		618544, 618545, 618546, 618547
		615548, 618549, 618550, 618551, 623002

**763655 - STEEL COST PRICE ADJUSTMENT**

**.01 Description:** The Department will adjust monthly progress payments up or down as appropriate for cost changes in steel used on specific items of work identified in the contract in accordance with this provision.

The following steel items will be eligible for consideration under this provision:

1. structural steel (rolled beams, plate girders, diaphragms, plate bearings, etc.);
2. reinforcing steel (plain & epoxy coated);
3. overhead sign structures;
4. guardrail, posts;
5. standard sign or lighting supports;
6. railing;
7. steel encasement pipe;
8. steel piles (end bearing or friction);
9. steel strand (used for pre-tensioned or post-tensioned finished elements); and
10. sheet piles.

Inventoried materials from the listing of eligible items and fasteners of any kind are specifically excluded for consideration. Fasteners include but are not limited to, bolt, nuts, washers, rivets, and welding rods.

The requirements of this provision shall apply only to material cost changes that occur between the date of bid opening and the date the material is shipped to the fabricator. To be eligible for this price adjustment, the Contractor is required to place purchase order(s) for eligible steel items for price adjustment identified in the contract within 30 days after final execution of the contract by the Department. All items eligible must be submitted and used on the project for any item to be eligible for adjustment.

For steel items to be eligible for adjustment, once shipped to the fabricator, the items shall be specifically stored, labeled, or tagged, recognizable by color marking, and identifiable by project for inspection and audit verification.

This provision allows for price adjustment for embedded steel used for pre-tensioned or post-tensioned precast components where furnishing steel is included in the unit price of the finished bid item. Steel used for post-tensioned or pre-tensioned elements shall be evaluated for price adjustment in the same manner as other steel material eligible under the requirements of this provision except that adjustment shall only apply to the tonnage or poundage of steel strand used in the pre-tensioned or post-tensioned element.

This provision shall only apply to material cost changes of steel that occur between the date of bid opening and the date the material is shipped to the Contractor, subcontractor or supplier/fabricator placing the steel into the finished component.

Submit material price quotes, bid papers, or other documentation satisfactory to the Department within 15 days after the date of the Award letter for the bid items the Contractor is requesting a steel price adjustment. This documentation shall support the completion of the form establishing the average price per pound for the eligible steel bid item. The Contractor must use the format as shown with this provision; no other format for presenting this information will be permitted. Certification is required that all items of documentation are original and were used in the computation of the amount bid for the represented eligible pay items for the month bids were opened. The documentation will be used to support the base line material price ("Base Price") of the steel item only. No adjustment will be made for changes in other components of the contract unit bid price, including, but not limited to, fabrication, shipping, storage, handling, and erection.

Failure to submit specifically required information such as purchase order, price data, bill of lading, material information or other requested information as noted herein will result in the Contractor not being eligible for price adjustment of steel items.

Price adjustment of each qualifying item under consideration will be subject to the following condition:

There must be an increase or decrease in the cost of eligible steel materials in excess of 10% up to a maximum of 60% from the Base Price when compared with the latest published price index (“Price Index”) in effect at the time material is shipped to the fabricator.

The Price Index the Department is using is based on The U.S. Department of Labor, Bureau of Labor Statistics, Producers Price Index (PPI) which measures the average price change over time of the specific steel eligible item from the perspective of the seller of goods. The specific PPI to be used to adjust the price for the eligible steel items is shown in the table below. **Please note:** The PPI is subject to revision four months after original publication, therefore, price adjustments and payments will not be made until the index numbers are finalized.

The following table indicates the PPI steel category index items and the corresponding I.D. numbers to which the steel items will be compared:

Steel Item	Bureau of Labor Statistics PPI Series I. D. Number WPU#
Reinforcing steel (plain & epoxy coated) Steel Strand (Pre-tensioning & Post-tensioning)	WPU101704 ( <a href="http://data.bls.gov/pdq/SurveyOutputServlet?years_option=all_years&amp;output_view=data&amp;periods_option=all_periods&amp;output_format=text&amp;reformat=true&amp;request_action=get_data&amp;initial_request=false&amp;data_tool=surveymost&amp;output_type=column&amp;series_id=WPU101704">http://data.bls.gov/pdq/SurveyOutputServlet?years_option=all_years&amp;output_view=data&amp;periods_option=all_periods&amp;output_format=text&amp;reformat=true&amp;request_action=get_data&amp;initial_request=false&amp;data_tool=surveymost&amp;output_type=column&amp;series_id=WPU101704</a> )
Plate girders & rolled beams (Standard & High strength, diaphragms, plate bearings, etc.) Steel piling (H-pile, pipe piles & sheet piles)	Average of WPU1017 & WPU101 ( <a href="http://data.bls.gov/pdq/SurveyOutputServlet?series_id=WPU1017&amp;data_tool=XGtable">http://data.bls.gov/pdq/SurveyOutputServlet?series_id=WPU1017&amp;data_tool=XGtable</a> & <a href="http://data.bls.gov/pdq/SurveyOutputServlet?series_id=WPU101&amp;data_tool=XGtable">http://data.bls.gov/pdq/SurveyOutputServlet?series_id=WPU101&amp;data_tool=XGtable</a> )
Steel encasement pipe Overhead sign structures, posts, poles, guardrail, sign or lighting supports, & railing	WPU101706 ( <a href="http://data.bls.gov/pdq/SurveyOutputServlet?years_option=all_years&amp;output_view=data&amp;periods_option=all_periods&amp;output_format=text&amp;reformat=true&amp;request_action=get_data&amp;initial_request=false&amp;data_tool=surveymost&amp;output_type=column&amp;series_id=WPU101706">http://data.bls.gov/pdq/SurveyOutputServlet?years_option=all_years&amp;output_view=data&amp;periods_option=all_periods&amp;output_format=text&amp;reformat=true&amp;request_action=get_data&amp;initial_request=false&amp;data_tool=surveymost&amp;output_type=column&amp;series_id=WPU101706</a> )

Steel Item	Bureau of Labor Statistics PPI Series I. D. Number WPU#
Guardrail	Average of WPU1017 & WPU101707 ( <a href="http://data.bls.gov/pdq/SurveyOutputServlet?series_id=WPU1017&amp;data_tool=XGtable">http://data.bls.gov/pdq/SurveyOutputServlet?series_id=WPU1017&amp;data_tool=XGtable</a> & <a href="http://data.bls.gov/pdq/SurveyOutputServlet?years_option=all_years&amp;output_view=data&amp;periods_option=all_periods&amp;output_format=text&amp;reformat=true&amp;request_action=get_data&amp;initial_request=false&amp;data_tool=surveymost&amp;output_type=column&amp;series_id=WPU101707">http://data.bls.gov/pdq/SurveyOutputServlet?years_option=all_years&amp;output_view=data&amp;periods_option=all_periods&amp;output_format=text&amp;reformat=true&amp;request_action=get_data&amp;initial_request=false&amp;data_tool=surveymost&amp;output_type=column&amp;series_id=WPU101707</a> )

The price adjustment will be determined by computing the percentage of change in index value beyond 10% above or below the index on the bid date to the index value on the date the steel material is shipped to the fabricator (Please see included sample examples). Weights and date of shipment must be documented by a bill of lading provided to the Department. The final price adjustment dollar value will be determined by multiplying this percent increase or decrease in the index (after 10%) by the represented quantity of steel shipped by the Base Price per pound subject to the limitations herein.

$A = B \times P \times Q$	
Where:	
A =	Steel price adjustment in lump sum dollars
B =	Average weighted price of steel submitted with bid on project in \$/lb
P =	Adjusted percentage change in PPI average from shipping date to bid date minus 10% (0.10) threshold
Q =	Total quantity of steel in pounds shipped to fabricator for the specific project

Delays to the work caused by steel shortages may be justification for a contract time extension but will not constitute grounds for claims for standby equipment, extended office overhead, or other costs associated with such delays.

The need for application of the adjustments herein to extra work will be determined by the Engineer on an individual basis and, if appropriate, will be specified on the Change Order.

This price adjustment is capped at 60%. This means the maximum “P” value for increase or decrease that can be used in the above equation is 50% (60%-10% threshold).

Calculations for price adjustment will be shown separate from the monthly progress estimate and will not be included in the total cost of work for determination of progress or for extension of contract time.

Any apparent attempt to unbalance bids in favor of items subject to price adjustment may result in rejection of the bid proposal.

**.02 Method of Measurement:**

**Price increase/decrease will be computed as follows:**

Sample Calculation of a Price Adjustment (increase)			
Project bid on	Tuesday, April 28, 2009		
Project has structural steel in the amount of:	<b>450,000</b>	Lbs	
Orders placed in timely manner and according to contract.			
Contractor's F.O.B. supplier price for the structural steel in bid:	<b>\$ 0.28</b>	/lb	

Adjusted** BLS Producers Price Index most recently published average at time of bid:		<b>157.0</b>
** final change after 4 months		
All steel shipped to fabricator in same month, October 2009.	October-09	
Adjusted BLS Producers Price Index (PPI) most recently published average for month of October:		173.7
Adjustment formula is $A = B \times P \times Q$		
Where:	A =	Steel price adjustment in lump sum dollars
	B = \$ 0.28	Average weighted price of steel submitted with bid on project in \$/lb = \$0.28
	P = 0.0064	Adjusted percentage change in PPI average from shipping date to bid date minus 10% threshold = $(173.7-157.0)/157.0 - 0.10 = 0.0064$
	Q = 450,000	Total quantity of steel shipped to fabricator in October 2004 for this project in lb = 450,000 lb
	A = \$ 802.55	$0.28 \times 0.0064 \times 450,000$
	A = \$ 802.55	Lump Sum adjustment paid to Contractor

<b>Sample Calculation of a Price Adjustment (decrease)</b>		
Project bid on April 27, 2009.		
Project has structural steel.	<b>450,000</b>	Lbs
Orders placed in timely manner and according to contract.		
Contractor's F.O.B. supplier price for the structural steel in bid:	<b>\$ 0.28</b>	/lb
Adjusted** BLS Producers Price Index most recently published average at time of bid:		<b>173.7</b>
** final change after 4 months		
All steel shipped to fabricator in same month, October 2009.	October-09	
Adjusted BLS Producers Price Index (PPI) most recently published average for month of October:		<b>157.0</b>
Adjustment formula is $A = B \times P \times Q$		
Where:	A =	Steel price adjustment in lump sum dollars
	B = \$ 0.28	Average weighted price of steel submitted with bid on project in \$/lb = \$0.28
	P = -0.0039	Adjusted percentage change in PPI average from shipping date to bid date minus 10% threshold = $(173.7- 157.0)/157.0 - 0.10 = -0.0039$
	Q = 450,000	Total quantity of steel shipped to fabricator in October 2009 for this project in lb = 450,000 lb
	A = \$ (486.01)	$0.28 \times 0.0039 \times 450,000$
	A = \$ (486.01)	Lump Sum credit from Contractor

**.03 Basis of Payment:** The price adjustments will be made as a lump sum payment for eligible steel products placed and accepted.



**ADDENDUM NO. 4**

**UTILITY STATEMENT**

**STATE CONTRACT NO. T200809003**

**PROJECT ID NO. 04-00180**

**SR1 / I-95 Interchange**

**New Castle County**

The following Companies maintain facilities or propose new facilities within the contract limits:

**Delmarva Power (Gas)**  
**Delmarva Power (Electric Distribution)**  
**Verizon-DE, Inc.**  
**Comcast Cable of New Castle County**  
**United Water Delaware**  
**Artesian Water Company, Inc.**  
**New Castle County Office of Special Services (Sanitary Sewer)**

The following is a breakdown of the utilities involved, adjustments and/or relocations as required (all stations, offsets, lengths and calendar days are approximate):

**Delmarva Power (Gas)**

- A. The Company maintains a 12" Ductile Iron Casing Pipe without a carrier pipe within the limits of Contract No. T200809003.
- B. The proposed changes to the Company's existing facilities include, but are not limited to the following:

**1. State's Contractor Responsibility:**

The State's contractor will provide the following: a level area accessible to the Company's construction vehicles, survey for the Company as required, an area accessible for maintenance during and post construction. As well as select, clearing and grubbing, cuts and fills to within 3 inches (+,-).

**2. The Company's Responsibility:**

The Company proposes to extend the existing 12" Ductile Iron casing pipe at Sta. 741+50, Ramp U baseline, approximately 70' eastward.

The Company will require 25 calendar days to complete the proposed construction listed above.

**Verizon-DE, Inc.**  
**Comcast Cable of New Castle County**  
**United Water Delaware**

### **Contract No. T200809003**

- A. The aforementioned Companies maintain aerial, underground and/or buried facilities within the limits of Contract T200809003 with no apparent conflicts with the proposed construction activities.
- B. Any relocations/adjustments to the aforementioned Companies' existing facilities that may arise during construction will be performed by the appropriate Company's forces during construction of this project. The time to complete any relocations/adjustments will depend on the nature of the work.

#### **Artesian Water Company, Inc.**

- A. The Company maintains underground facilities within the limits of Contract T200809003.
- B. The Company will perform the following relocations during the State contract to eliminate conflicts with the proposed roadway construction.
  - 1. Ramp A, Sta. 1268+50 to Sta. 1268+85, offset 150' left. The Company will relocate the existing 12-in DIP with approximately 100 feet of new 12-in DIP in 20-in STL casing to avoid conflict with the proposed roadway excavation. The Company will require fourteen (14) calendar days to complete the proposed work following twenty-eight (28) calendar days advance notice and completion of the Utility Pre-Construction Meeting for this contract. The State's Contractor shall furnish 50 cubic yards of Borrow Type C for this relocation.
  - 2. Ramp E, Sta. 516+40 to Sta. 517+40, offset 80' right. The company will relocate the existing 16-in DIP with approximately 110 feet of new 16-in DIP to avoid conflict with proposed access ramp. The company will require fourteen (14) calendar days to complete the proposed work following twenty-eight (28) calendar days advance notice and completion of the Utility Pre-Construction Meeting for this contract. The State's Contractor shall furnish 10 cubic yards of Borrow Type C for this relocation.
  - 3. Ramp C, Sta. 1101+60. The Company will install approximately 750 feet of 20-in HDPE carrier pipe in 30-in HDPE casing pipe under existing I-95 by directional drill method to establish a critical second feed to the mall region. The Company will require forty-two (42) calendar days to complete the proposed work following twenty-eight (28) calendar days advance notice and completion of the Utility Pre-Construction Meeting for this contract.

The Company will abandon in place the existing water facilities after the relocated water facilities are installed and activated with services tied over. The Company estimates that the identified relocation activities will take place during Contract No. T200809003 and within the State Contractor's construction phasing and maintenance of traffic plan. In addition, system demands and effected customers may require the Company to perform relocation activities during overnight hours.

#### **Delmarva Power (Electric Distribution)**

- A. The Company maintains aerial, underground and/or buried facilities within the limits of Contract T200809003.
- B. The proposed changes to the Company's existing facilities include, but are not limited to the following:

**NOTE: AT ALL SWITCHGEAR AND TRANSFORMER LOCATIONS, DELMARVA WILL REQUIRE A 12 FOOT CLEARANCE ON THE FRONT SIDE OF THE DEVICE**

**Contract No. T200809003**

**AND A MINIMUM OF 4 FEET ON THE OTHER SIDES WITH NO OBSTRUCTIONS SUCH AS FENCE, WALL, SHRUBS AND ANY OTHER STRUCTURES.**

*Outages on the 12kv and 34kv circuits will only be permitted as load, weather and other system conditions permit.*

**1. State's Contractor Responsibility**

The State's Contractor will provide the following: a level area accessible to the Company's construction vehicles, survey for the Company as required, an area accessible for maintenance during and post construction. As well as select, clearing and grubbing, cuts and fills to within 3 inches (+,-).

**2. The Company's Responsibility**

The Company proposes to relocate the existing two (2) 34kv circuits and one (1) 12kv circuit in a 6 way (6 inch ducts) manhole/ conduit system along Ramp C beginning at approximately Sta. 1104+50, Ramp C baseline to Sta. 1108+00, Ramp C baseline, then continuing along and under the SW Loop ramp from Sta. 1908+50, SW Loop baseline to Sta. 1904+50, SW Loop baseline, then crossing under SW Loop ramp and Ramp C to a proposed manhole, then continuing under Ramp C1 near Sta. 1813+75, then paralleling Ramp G1 from Sta. 1316+50, Ramp G1 baseline to a manhole near Sta. 1317+00. From the manhole near Sta. 1317+00, Ramp G1 baseline, the two 34kv circuits in a 4 way (8 inch ducts) will be bored under SR 1 to a proposed manhole within the Mall parking lot and tie into an 4 way (5 inch ducts) existing ductbank.

The existing 12kv circuit will continue from the proposed manhole near Sta. 1317+00, Ramp G1 baseline to a proposed PMH-9 switchgear, then continue to the south and stub up the proposed terminal pole with guy anchors near Sta. 1320+50, Ramp G1 baseline. The Company will install two additional proposed poles along Stanton Christiana Road and connect to the existing 3 phase 12kv service pole near Sta. 2014+00, Stanton Christiana Road baseline. The 12 kv will also connect to the existing pole near Sta. 2016+50 and the Company will install a pushpole brace on the existing pole.

**LIGHTING - Ramp G1 Location** - The Company will furnish and install a transformer, fed from the proposed PMH-9 switchgear, near the proposed DelDOT lighting cabinet and DelDOT service pedestal adjacent to Ramp G1. This switchgear and transformer will provide three-phase 277/480V service for the lighting cabinet along Ramp G1. DelDOT will furnish and install conduit and cables from the service pedestal to the proposed transformer. The Company will assist DelDOT in making the final connections at the transformer. The Company will furnish and install all conduit and cables from the transformer to the switchgear.

**LIGHTING - Churchmans Road Location** - The Company will furnish and install a base mounted transformer near the proposed DelDOT lighting cabinet and DelDOT service pedestal, which will be located at the Churchmans Road interchange in the quadrant south of Churchmans road and north of I-95. The transformer will provide three-phase 277/480V service for the lighting cabinet along Churchmans Road. DelDOT will furnish and install conduit and cables from the service pedestal to the proposed transformer. The Company will assist DelDOT in making the final connections from at the transformer. The Company will furnish and install all conduit and cables from the transformer to the existing utility pole.

**Scheduling of outage and tie over for Existing Circuits:**

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Overtime will be required in order to splice, terminate and tie in new circuits into the Company's existing electrical system. This will include nights and weekend work. No outages will be permitted during the months of July and August. Outages may be restricted in September in the event of hot weather.

**Company Review of Field Changes**

The Company maintains the right to review/ approve any design changes submitted by the Engineer as well as the right to review any field changes that could impact the construction of the Company's facilities.

**Lead-Time for Cable and Associated Materials (16-23 Weeks)**

The lead time to procure these materials could possibly increase due to the economic situation and suppliers eliminating shifts.

**NOTE: ESTIMATE DOES NOT INCLUDE COSTS FOR THE FOLLOWING:**

REMOVAL/ BLASTING OF ROCK, CLEARING AND GRUBBING, REMOVAL OF SPOILS FROM SITE, SELECT TO BE PROVIDED BY DELDOT, RESTORATION COST NOT INCLUDED, REMOVAL AND DISPOSAL OF ANY CONTAMINATED DIRT OR WATER, MAINTAINING EXISTING U.G. & AERIAL FACILITIES DURING ROAD CONSTRUCTION PHASE.

The Company will require one hundred (100) calendar days to complete the proposed manhole and conduit system and an additional ninety (90) calendar days to complete the cable and splicing work, following twenty-eight (28) calendar days advance notice of completion of clearing and grubbing, cuts and fills made, staking of rights-of-way and completion of the Utility Pre-Construction Meeting for this contract and the procurement of easements by DelDOT and receipt of "NTP".

**New Castle County Office of Special Services (Sanitary Sewer)**

Any adjustments and/or relocations of the County's existing sanitary sewer facilities will be done by the State's Contractor in accordance with the County's Standard Specifications, as indicated on the plans and outlined elsewhere in these Special Provisions.

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**GENERAL NOTES:**

- 1. THE UTILITIES AND THEIR CONTRACTORS DO NOT NORMALLY WORK ON WEEKENDS OR LEGAL HOLIDAYS!**
- 2. IT IS UNDERSTOOD AND AGREED THAT THE STATE'S CONTRACTOR HAS CONSIDERED IN HIS BID ALL PERMANENT AND TEMPORARY UTILITY APPURTENANCES IN THEIR PRESENT OR RELOCATED POSITIONS AS SHOWN ON THE PLANS OR DESCRIBED IN THE UTILITY STATEMENT AND/OR ARE READILY DISCERNIBLE AND THAT NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR ANY DELAYS, INCONVENIENCE, OR DAMAGE SUSTAINED BY HIM/HER DUE TO ANY**

Contract No. T200809003

INTERFERENCE FROM THE SAID UTILITY FACILITIES AND APPURTENANCES OR THE OPERATION OF MOVING THEM, EXCEPT THAT THE STATE'S CONTRACTORS MAY BE GRANTED AN EQUITABLE EXTENSION OF TIME. THE STATE'S CONTRACTOR IS RESPONSIBLE FOR THE SUPPORT AND PROTECTION OF ALL UTILITIES WHEN EXCAVATING.

3. THE STATE'S CONTRACTOR IS RESPONSIBLE FOR ROUGH GRADING AS REQUIRED BY THE ROADWAY CONSTRUCTION PRIOR TO THE UTILITY COMPANY'S PLACING THEIR PROPOSED FACILITIES, UNLESS INDICATED ON THE PLANS AND/OR OUTLINED ELSEWHERE IN THESE SPECIFICATIONS.

4. FOR EXACT LOCATION OF EXISTING FACILITIES, PLEASE CONTACT MISS UTILITY AT (800) 282-8555. 16 DEL. C. § 7405B REQUIRES NOTIFICATION TO AND MUTUALLY AGREEABLE MEASURES FROM THE PUBLIC UTILITY FROM ANY PERSON INTENDING TO CARRY ON ANY FUNCTION, ACTIVITY, WORK OR OPERATION WITHIN DANGEROUS PROXIMITY OF ANY HIGH VOLTAGE OVERHEAD LINE.

5. COORDINATION AND COOPERATION AMONG THE UTILITY COMPANIES AND THE STATE'S CONTRACTOR ARE OF PRIME IMPORTANCE. THEREFORE, THE CONTRACTOR IS DIRECTED TO CONTACT THE FOLLOWING UTILITY COMPANY REPRESENTATIVES WITH ANY QUESTIONS REGARDING THIS WORK PRIOR TO SUBMITTING BIDS AND WORK SCHEDULES. PROPOSED WORK SCHEDULES SHALL REFLECT THE UTILITY COMPANIES' PROPOSED RELOCATIONS.

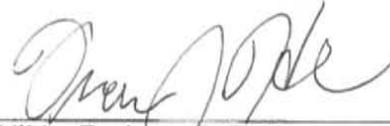
Ted Waugh	Delmarva Power (Gas)	(302) 429-3706
Angel Collazo	Delmarva Power (Electric Distribution)	(302) 454-4370
George Zang	Verizon-DE, Inc.	(610) 280-5574
Knol McRae	Comcast Cable of New Castle County	(302) 661-4431
John Licht	United Water Delaware	(302) 633-5905
Carmen Hunter	Artesian Water Company, Inc.	(302) 453-6900
Kevin Penozza	New Castle County Office of Special Services (Sanitary Sewer)	(302) 395-5723

PREPARED AND RECOMMENDED BY:

  
Rummel, Klepper & Kahl, LLP  
Consulting Engineers

04.01.2011  
Date

APPROVED AS TO FORM:

  
Utilities Engineer, DelDOT

4-13-11  
Date

Contract No. T200809003.01

**STATE OF DELAWARE  
DEPARTMENT OF TRANSPORTATION  
PO BOX 778  
DOVER, DELAWARE 19903**

**CERTIFICATE OF RIGHT-OF-WAY STATUS**

STATE PROJECT NO. T200809003

F.A.P. No. IM-N056(35)

SR 1 / I-95 INTERCHANGE

NEW CASTLE COUNTY

Certificate of Right-of-Way Status – 100%

**As required by 23CFR Part 635, all necessary right of way has been acquired in accordance with current State/Federal rules and regulations covering the acquisition of real property.**

This is to certify that all project rights of way is currently available in accordance with the project right-of-way plans.

**It is further certified that there were no individuals or families displaced by this project. Therefore the provisions of 49 CFR Part 24 is not applicable to the project.**

There are no improvements to be removed or demolished as part of this project.

REAL ESTATE SECTION

Carol V. O'Donoghue  
Assistant Chief, Real Estate

October 19, 2010

Contract No. T200809003.01



STATE OF DELAWARE  
**DEPARTMENT OF TRANSPORTATION**  
800 BAY ROAD  
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CAROLANN WICKS, P.E.  
SECRETARY

## ENVIRONMENTAL REQUIREMENTS

For

SR 1/ I-95 Interchange  
State Contract No.: T200809003  
Federal Aid. No: IM-N056(35)  
November 1, 2010

In accordance with the procedural provisions for implementing the National Environmental Policy Act of 1969, as amended, the referenced project has been processed through the Department's Environmental Review Procedures and has been classified as a Level B/Class III Action. As such, an Environmental Assessment has been prepared to evaluate potential adverse impacts to result from construction of the proposed action (per 23 CFR 771.119) and the following special provisions have been developed to mitigate and/or minimize these impacts:

### PERMIT REQUIREMENTS:

The construction work associated with the SR 1/ I-95 Interchange, New Castle County, Delaware requires permit approval from those agencies listed below. It is the responsibility of the contracting agency, the Department of Transportation, Division of Transportation Solutions to obtain the necessary permits and to ensure that the contractor complies with the requirements and conditions established by the permitting agencies. Copies of the permits must be available on site during all phases of the construction activity. Advanced copies of the permits may be obtained from DelDOT Contract Administration, Highway Administration Building, Dover, DE. As such, the construction work associated with the SR 1/ I-95 Interchange project is authorized under the permits listed below:

### REQUIRED PERMITS AND APPROVAL STATUS:

#### **U.S. Army Corps of Engineers 404 Individual Permit CENAP-OP-R-200300700-11**

Approved February 26, 2007; Modified October 29, 2007, October 21, 2008 & October 7, 2010

#### **DNREC Subaqueous Lands Permit SP-014/06**

Approved December 8, 2006; Modified October 26, 2010

#### **DNREC Wetlands Permit WE-388/06**

Approved December 8, 2006; Modified October 26, 2010



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**DNREC Water Quality Certification WQ-389/06**

Approved December 8, 2006; Modified October 26, 2010

**DNREC Coastal Zone Management Federal Consistency Certification**

Approved December 12, 2005, August 24, 2006 and August 23, 2010 – No Expiration

The contractor will follow and adhere to all permit stipulations and conditions as previously coordinated.

**SPECIFIC REQUIREMENTS:**

Compliance with all requirements of the permits is the responsibility of the contractor. The contractor will follow all special conditions or requirements as stated within those permits. The contractor will be subject to penalties, fines, and risk of shut down as mandated by law if conditions of the permits are violated or ignored. Therefore, all special conditions, general requirements, and/or other required provisions specified within the permits must be followed. Those obligations are indicated or listed within the permit package, which can be obtained from the DeIDOT Contract Administration Office.

Compliance with any additional requirements by DeIDOT not specified within the permits, but listed below, or on the Environmental Compliance Sheets, is also the responsibility of the contractor and is subject to risk of shut down at the contractor's expense.

1. Wetland and stream resources occur within and in the vicinity of the project and are delineated on the plans. Access into these resource areas which is not specifically authorized by the ACOE and DNREC permits (as illustrated on the Environmental Compliance (EC) Sheets), is strictly prohibited. Construction Safety Fence shall be used along the limits of the construction (loc) in all areas where water/wetlands are being impacted (as shown on EC sheets), and also in any area where water/wetlands exist within 20 feet of the loc (as shown on the construction plans). Contractor access beyond the loc is strictly prohibited. It is the contractors responsibility to install and maintain the Construction Safety Fence and to ensure that there is **no access** permitted in these designated areas.
2. Erosion and sediment control measures shall be in place prior to the onset of earth moving or filling activities to ensure that material does not erode into waters and wetlands beyond the limits of those impact areas identified on the ec sheets. They shall remain in place until construction is completed and the disturbed areas have been stabilized.
3. For fills placed in waters and wetlands, only clean fill shall be used. All fill material shall be free of fines, oil and grease, debris, wood general refuse, plaster, and other pollutants, and shall contain no asphalt.
4. There shall be no movement of equipment within regulated wetlands or subaqueous lands not specifically authorized by the permits. The disturbance of wetlands and subaqueous lands authorized by the permits shall be limited to the areas identified on the EC sheets. Any equipment traversing wetlands and subaqueous lands as may be authorized by the permits shall be supported on mats.
5. All regulated areas temporarily impacted pursuant to the permit authorization shall be restored to pre-



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disturbance elevations and conditions and planted with appropriate native vegetation

6. Geotextile fabric shall be placed beneath all authorized temporary fills to ensure that all temporary fill material is removed at the time of restoration.
7. All materials shall be properly stabilized to prevent entry into drainage areas which may eventually impact wetlands or waterways.
8. Temporary and permanent seeding will be done in a timely manner to limit potential impacts from erosion and sedimentation.
9. That any fill material shall be placed, stabilized, and maintained in a manner that precludes its entrance or erosion into adjacent wetlands, waterways, or drainage areas.
10. The disposal of trees, brush and other debris in any water or wetland is prohibited.
11. There shall be no stockpiling of construction materials or storage of construction equipment in any waters or wetlands.
12. No fueling or servicing of equipment shall take place while the equipment is located within waters or wetlands.
13. The contractor will be required to notify the District Engineer for locations to perform fueling and equipment maintenance activities. The contractor shall also employ measures during construction to prevent spills of fuels, degreasers, or lubricants. If a spill should occur, immediate efforts shall be taken to prevent its entry into wetlands and aquatic areas. Any spills entering wetlands and aquatic areas shall be removed immediately. DNREC shall be notified of any spill(s) within six hours of occurrence. DNREC will determine the effectiveness of spill and contamination removal and specify remediation as necessary.
14. The contractor will submit to the District Engineer, the location(s) of permanent disposal sites to be used for the disposition of all clean waste materials (see DNREC regulations regarding clean waste materials) resulting from the construction contract. The contractor will submit at the Preconstruction meeting, a location map and a plot plan (sketch or diagram) of where on the property all material is to be placed. The limits of the site(s) will be physically staked or surveyed on the property. The District Engineer will submit the contractor's disposal site location(s) to the State Historic Preservation Office (DE SHPO) for approval.

The DE SHPO will determine if a cultural resource survey is required before the site can be approved. If additional survey work is required, it will be the contractor's responsibility to hire a qualified professional to assess the site(s) for the presence or absence of cultural resources (historic or prehistoric archaeological sites). The contractor's consultant will be responsible for producing documentation of the survey results for submission to the DE SHPO.

If the contractor proposes the use of disposal sites outside the State of Delaware, the contractor must provide written approval from the State Historic Preservation Office of each respective state.

A project's disposal operation will not commence until the DE SHPO has notified the DelDOT District Engineer that the site location(s) is approved for use.



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The use of the disposal site will not result in discharge of materials into US Army Corps of Engineers or DNREC jurisdictional wetlands or waters. It is the responsibility of the contractor to provide any site surveys or wetland delineations needed to preclude wetland encroachment.

The contractor will be responsible for all sediment and erosion control measures and subsequent approvals for the disposal site(s) operations.

It is the contractor's responsibility to obtain all other appropriate Federal, State, or local approvals required by law for the disposal site(s).

15. All construction debris, excavated material, brush, rocks and refuse incidental to such work shall be placed above the influence of surface waters and appropriately contained at all times to prevent its entry into surface water or wetlands. All such material shall be reused, removed or properly disposed. .

16. Disturbance of wetlands and/or aquatic vegetation adjacent to the permitted construction by burning, cutting, herbicide treatments, heavy equipment or other methods is prohibited.

17. Erosion and sediment control measures shall be implemented in accordance with the specifications and criteria in the Delaware Erosion and Sediment Control Handbook (1989) so as to minimize entry and dispersal of sediment and other contaminants in surface waters.

18. Construction shall be conducted so as not to violate the State Delaware Department of Natural Resources and Environmental Control, "Surface Water Quality Standards" as issued or amended.

**BID PROPOSAL FORMS**

CONTRACT T200809003.01

FEDERAL AID PROJECT IM-N056(35)



DELAWARE DEPARTMENT OF TRANSPORTATION  
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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS

SECTION 0001 ROAD

0010	201000 CLEARING AND GRUBBING	LUMP		LUMP		
0020	202000 EXCAVATION AND EMBANKMENT	CY	314000.000			
0030	202505 SETTLEMENT PLATFORM	EACH	18.000			
0040	202514 PIEZOMETER	EACH	4.000			
0050	202518 SETTLEMENT MONUMENT	EACH	57.000			
0060	202555 SUBSOIL TILLAGE	SY	2700.000			
0070	207000 EXCAVATION AND BACKFILL FOR STRUCTURES	CY	3415.000			
0090	208000 EXCAVATION AND BACKFILLING FOR PIPE TRENCHES	CY	9249.000			
0100	208500 FLOWABLE FILL	CY	160.000			
0110	209001 BORROW, TYPE A	CY	3325.000			

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			DOLLARS	CTS	DOLLARS	CTS
0120	209002 BORROW, TYPE B	5250.000 CY				
0130	209006 BORROW, TYPE F	86300.000 CY				
0140	210000 FURNISHING BORROW TYPE "C" FOR PIPE, UTILITY TRENCH, AND STRUCTURE BACKFILL	5722.000 CY				
0150	211000 REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LUMP	LUMP			
0160	211002 REMOVAL OF STRUCTURES AND OBSTRUCTIONS (GUARDRAIL)	11500.000 LF				
0170	211004 REMOVAL OF STRUCTURES AND OBSTRUCTIONS (PIPE)	1065.000 LF				
0180	211521 ABANDONMENT OF WELLS	41.000 EACH				
0190	211523 REMOVAL OF P.C.C. BARRIER	7140.000 LF				
0200	212000 UNDERCUT EXCAVATION	2500.000 CY				
0210	212001 UNDERCUT EXCAVATION, PATCHING	50.000 CY				

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			DOLLARS	CTS	DOLLARS	CTS
0220	250000 SEDIMENT REMOVAL	1656.000 CY				
0230	251001 REINFORCED SILT FENCE	25635.000 LF				
0240	252000 INLET SEDIMENT CONTROL, DRAINAGE INLET	622.000 EACH				
0250	254000 STONE CHECK DAM	240.000 TON				
0260	255000 SEDIMENT TRAP	119.000 CY				
0270	257000 RIPRAP DITCH	55.000 CY				
0280	258000 TEMPORARY SWALE, TYPE A-1	3500.000 LF				
0290	261000 TEMPORARY SLOPE DRAIN, 12"	50.000 LF				
0300	263000 SUMP PIT, TYPE 1	2.000 EACH				
0310	268000 STABILIZED CONSTRUCTION ENTRANCE	1400.000 TON				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0320	270000 PORTABLE SEDIMENT TANK	3.000 EACH				
0325	271000 STORMWATER MANAGEMENT POND	750.000 CY	15.00000		11250.00	
0330	302007 GRADED AGGREGATE BASE COURSE, TYPE B	40085.000 CY				
0340	302008 GRADED AGGREGATE BASE COURSE, TYPE B, PATCHING	414.000 CY				
0350	302012 DELAWARE NO. 57 STONE	364.000 TON				
0360	401654 SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 70-22	15813.000 TON				
0370	401660 SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 76-22	12161.000 TON				
0380	401663 SUPERPAVE, BITUMINOUS CONCRETE BASECOURSE, 160 GYRATIONS, PG 64-22	36591.000 TON				
0390	401665 SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 64-22, PATCHING	79.000 TON				
0400	401666 SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 64-22, PATCHING	236.000 TON				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0410	401667 SUPERPAVE, BITUMINOUS CONCRETE BASECOURSE, 160 GYRATIONS, PG 64-22 PATCHING	423.000 TON				
0420	401668 SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 64-22, WEDGE	1415.000 TON				
0430	401669 SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 64-22, WEDGE	60.000 TON				
0440	401708 SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 70-22, (NON-CARBONATE STONE)	15404.000 TON				
0450	401711 SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 76-22, (NON-CARBONATE STONE)	12865.000 TON				
0460	501006 PORTLAND CEMENT CONCRETE PAVEMENT, 12"	57497.000 SY				
0470	601502 TEMPORARY PROTECTIVE SHIELD	LUMP	LUMP			
0480	602579 DRILLING HOLES AND INSTALLING DOWELS	240.000 EACH				
0490	602580 PARTIAL REMOVAL OF P.C.C. MASONRY	14.000 CY				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0500	602717 REHABILITATION OF CONCRETE STRUCTURES, PIERS AND ABUTMENTS	141.000 CF				
0510	602772 MECHANICALLY STABILIZED EARTH WALLS	LUMP	LUMP			
0520	602773 PCC MASONRY FOR MECHANICALLY STABILIZED EARTH WALLS	LUMP	LUMP			
0530	602774 PCC MASONRY FOR LIGHT POLE FOUNDATIONS	304.000 CY				
0540	602785 P.C.C. MASONRY, SUBSTRUCTURE, 6000 PSI	252.000 CY				
0550	602786 P.C.C. MASONRY, SUBSTRUCTURES, 8000 PSI	472.000 CY				
0560	602787 POST TENSIONING PIER CAP, BONDED SYSTEM	LUMP	LUMP			
0570	605002 STEEL STRUCTURES	LUMP	LUMP			
0580	605500 CANTILEVER SIGN SUPPORTS AND FOUNDATION	LUMP	LUMP			
0590	605511 PREFABRICATED EXPANSION JOINT SYSTEM, 3"	240.000 LF				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0600	605512 PREFABRICATED EXPANSION JOINT SYSTEM, 4"	72.000 LF				
0610	605513 PREFABRICATED EXPANSION JOINT SYSTEM, 5"	182.000 LF				
0620	605523 BOX TRUSS TYPE OVERHEAD SIGN SUPPORT AND FOUNDATION	LUMP		LUMP		
0630	605581 ELASTOMERIC BRIDGE BEARING PAD	6.000 EACH				
0640	605658 STRIP SEAL EXPANSION JOINT, 2"	31.000 LF				
0650	605750 NON-GUIDED POT BEARING AT ABUTMENT	LUMP		LUMP		
0660	605751 GUIDED POT BEARING AT ABUTMENT	LUMP		LUMP		
0670	605752 NON-GUIDED POT BEARING AT PIER	LUMP		LUMP		
0680	605753 GUIDED POT BEARING AT PIER	LUMP		LUMP		
0690	605754 FIXED POT BEARING AT PIER	LUMP		LUMP		

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0700	605757 HIGH PERFORMANCE STEEL	LUMP	LUMP			
0710	612021 REINFORCED CONCRETE PIPE, 15", CLASS IV	4027.000 LF				
0720	612022 REINFORCED CONCRETE PIPE, 18", CLASS IV	7993.000 LF				
0730	612023 REINFORCED CONCRETE PIPE, 24", CLASS IV	3811.000 LF				
0740	612025 REINFORCED CONCRETE PIPE, 30", CLASS IV	2430.000 LF				
0750	612027 REINFORCED CONCRETE PIPE, 42", CLASS IV	2920.000 LF				
0760	612028 REINFORCED CONCRETE PIPE, 48", CLASS IV	288.000 LF				
0770	612030 REINFORCED CONCRETE PIPE, 18", CLASS V	492.000 LF				
0780	612033 REINFORCED CONCRETE PIPE, 21", CLASS IV	17.000 LF				
0790	612034 REINFORCED CONCRETE PIPE, 36", CLASS IV	1896.000 LF				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
0800	612529 PIPE VIDEO INSPECTION	24800.000 LF				
0810	612535 CLEANING DRAINAGE PIPE, 15"-24" DIA	229.000 LF				
0820	612536 CLEANING DRAINAGE PIPE, GREATER THAN 24" DIA	339.000 LF				
0830	612537 HEAVY CLEANING OF DRAINAGE PIPE	50.000 HOUR				
0840	614003 GALVANIZED CORRUGATED STEEL PIPE, 18", 16 GAGE, 2 2/3" X 1/2" CORRUGATION	304.000 LF				
0860	614605 STEEL CASING PIPE, 12"	75.000 LF				
0870	617003 REINFORCED CONCRETE FLARED END SECTION, 18"	1.000 EACH				
0880	617011 REINFORCED CONCRETE FLARED END SECTION, 48"	1.000 EACH				
0890	617515 HEADWALL	4.000 EACH				
0900	618540 FURNISH STEEL PIPE PILES, 24"	3885.000 LF				

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			DOLLARS	CTS	DOLLARS	CTS
0910	618541 FURNISH STEEL PIPE PILES, 30"	580.000 LF				
0920	618542 FURNISH STEEL PIPE PILES, 36"	9069.000 LF				
0930	618543 FURNISH STEEL PIPE TEST PILES, 24"	1075.000 LF				
0940	618544 FURNISH STEEL PIPE TEST PILES, 30"	83.000 LF				
0950	618545 FURNISH STEEL PIPE TEST PILES, 36"	1232.000 LF				
0960	618546 INSTALL STEEL PIPE PILES, 24"	3885.000 LF				
0970	618547 INSTALL STEEL PIPE PILES, 30"	580.000 LF				
0980	618548 INSTALL STEEL PIPE PILES, 36"	9069.000 LF				
0990	618549 INSTALL STEEL PIPE TEST PILES, 24"	1075.000 LF				
1000	618550 INSTALL STEEL PIPE TEST PILES, 30"	83.000 LF				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1010	618551 INSTALL STEEL PIPE TEST PILES, 36"	1232.000 LF				
1020	619501 PRODUCTION PILE RESTRIKE	60.000 EACH	500.00000		30000.00	
1030	619502 TEST PILE RESTRIKE	28.000 EADY	1000.00000		28000.00	
1040	619519 DYNAMIC PILE TESTING BY CONTRACTOR	70.000 EACH				
1050	619539 SIGNAL MATCHING ANALYSIS BY CONTRACTOR	70.000 EACH				
1060	623002 PRESTRESSED REINFORCED CONCRETE MEMBERS, BOX-BEAMS		LUMP	LUMP		
1070	701010 PORTLAND CEMENT CONCRETE CURB, TYPE 1	701.000 LF				
1080	701020 INTEGRAL PORTLAND CEMENT CONCRETE CURB AND GUTTER, TYPE 1	440.000 LF				
1090	701023 INTEGRAL PORTLAND CEMENT CONCRETE CURB AND GUTTER, TYPE 4	1029.000 LF				
1100	701026 PORTLAND CEMENT CONCRETE MONOLITHIC MEDIAN	65.000 LF				

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			DOLLARS	CTS	DOLLARS	CTS
1110	708051 DRAINAGE INLET, 34" X 24"	42.000 EACH				
1120	708052 DRAINAGE INLET, 48" X 30"	15.000 EACH				
1130	708053 DRAINAGE INLET, 48" X 48"	10.000 EACH				
1140	708057 DRAINAGE INLET, 72" X 24"	60.000 EACH				
1150	708058 DRAINAGE INLET, 72" X 48"	53.000 EACH				
1160	708059 DRAINAGE INLET, 72" X 72"	8.000 EACH				
1170	708107 MANHOLE, ROUND	4.000 EACH				
1180	708111 MANHOLE, 48" X 30"	32.000 EACH				
1190	708112 MANHOLE, 48" X 48"	1.000 EACH				
1200	708113 MANHOLE, 66" X 30"	3.000 EACH				

CANNOT BE  
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BIDDING



DELAWARE DEPARTMENT OF TRANSPORTATION  
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All figures must be typewritten.

CONTRACTOR : \_\_\_\_\_

LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1210	708115 MANHOLE, 66" X 66"	1.000 EACH				
1220	708500 REPLACING CATCH BASIN GRATES	5.000 EACH				
1230	708504 REPLACING CATCH BASIN FRAMES	5.000 EACH				
1240	708512 DRAINAGE INLET, SPECIAL I	1.000 EACH				
1250	708513 DRAINAGE INLET, SPECIAL II	8.000 EACH				
1260	708515 DRAINAGE INLET, SPECIAL IV	2.000 EACH				
1270	708516 DRAINAGE INLET, SPECIAL V	1.000 EACH				
1280	708517 DRAINAGE INLET, SPECIAL VI	2.000 EACH				
1290	708518 DRAINAGE INLET, SPECIAL VII	2.000 EACH				
1300	708537 REMOVE CATCH BASIN	14.000 EACH				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1310	708579 ABANDON EXISTING MANHOLE	32.000 EACH				
1320	708582 MANHOLE, SPECIAL I	1.000 EACH				
1330	708583 PERSONAL GRATE FOR PIPE INLET	2.000 EACH				
1340	708596 MANHOLE, SPECIAL II	1.000 EACH				
1350	708597 MANHOLE, SPECIAL III	1.000 EACH				
1360	708653 DRAINAGE INLET, SPECIAL VIII	1.000 EACH				
1370	708654 DRAINAGE INLET, SPECIAL IX	2.000 EACH				
1380	708655 DRAINAGE INLET, SPECIAL X	2.000 EACH				
1390	708656 DRAINAGE INLET, SPECIAL XI	1.000 EACH				
1400	710001 ADJUSTING AND REPAIRING EXISTING DRAINAGE INLET	4.000 EACH				

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			DOLLARS	CTS	DOLLARS	CTS
1410	710002 ADJUSTING AND REPAIRING EXISTING MANHOLE	2.000 EACH				
1420	712006 RIPRAP, R-5	584.000 SY				
1430	712007 RIPRAP, R-6	480.000 SY				
1440	712531 CHANNEL BED FILL	29.000 CY				
1450	713003 GEOTEXTILES, RIPRAP	672.000 SY				
1460	715001 PERFORATED PIPE UNDERDRAINS, 6"	49552.000 LF				
1470	715500 UNDERDRAIN OUTLET PIPE, 6"	1146.000 LF				
1480	715506 TEMPORARY DRAINAGE PIPE, 24"	1960.000 LF				
1490	715507 TEMPORARY DRAINAGE PIPE, 36"	30.000 LF				
1500	720010 TREATED WOOD BLOCK	380.000 EACH				

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			DOLLARS	CTS	DOLLARS	CTS
1510	720050 GALVANIZED STEEL BEAM GUARDRAIL, TYPE 1-31	9075.000 LF				
1520	720051 GALVANIZED STEEL BEAM GUARDRAIL, TYPE 2-31	250.000 LF				
1530	720506 RELOCATING PORTABLE P.C.C. SAFETY BARRIER	16425.000 LF				
1550	720517 IMPACT ATTENUATOR, TYPE I	22.000 EACH				
1560	720532 INSTALL PORTABLE IMPACT ATTENUATOR	14.000 EACH				
1570	720534 FURNISH PORTABLE IMPACT ATTENUATOR	16.000 EACH				
1580	720539 RELOCATE PORTABLE IMPACT ATTENUATOR	26.000 EACH				
1590	720544 REFLECTORS, WHITE, CONCRETE	339.000 EACH				
1600	720545 REFLECTORS, YELLOW, CONCRETE	396.000 EACH				
1610	720552 REFLECTOR PANELS	459.000 EACH				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1620	720567 FURNISH AND MAINTAIN PORTABLE P.C.C. SAFETY BARRIER	21089.000 LF				
1630	720585 GUARDRAIL END TREATMENT ATTENUATOR, TYPE 1-31	18.000 EACH				
1640	720612 IMPACT ATTENUATOR, SPECIAL	5.000 EACH				
1650	720651 PCC SAFETY BARRIER PERMANENT, DOUBLE FACE BIFURCATED TYPE I	6549.000 LF				
1660	720652 PCC SAFETY BARRIER PERMANENT, DOUBLE FACED BIFURCATED TYPE 2	616.000 LF				
1670	720654 PCC SAFETY BARRIER PERMANENT, SINGLE FACE, MODIFIED TYPE I	2891.000 LF				
1680	720655 PCC SAFETY BARRIER PERMANENT, SINGLE FACE, MODIFIED, TYPE 2	20380.000 LF				
1690	720656 PCC SAFETY BARRIER PERMANENT, SINGLE FACE, MODIFIED, TYPE 3	170.000 LF				
1700	720657 PCC SAFETY BARRIER PERMANENT, SINGLE FACE, MODIFIED, TYPE 4	199.000 LF				

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			DOLLARS	CTS	DOLLARS	CTS
1710	720658 PCC SAFETY BARRIER PERMANENT, SINGLE FACE, MODIFIED TYPE 5	72.000 LF				
1720	725001 GUARDRAIL TO BARRIER CONNECTION (EXIT TYPE 31)	7.000 EACH				
1730	725002 GUARDRAIL TO BARRIER CONNECTION, APPROACH TYPE 1-31	4.000 EACH				
1740	726001 END ANCHORAGE 31	20.000 EACH				
1750	727014 CONSTRUCTION SAFETY FENCE	7000.000 LF				
1760	732002 TOPSOIL, 6" DEPTH	135908.000 SY				
1770	733002 TOPSOILING, 6" DEPTH	10900.000 SY				
1780	734013 PERMANENT GRASS SEEDING, DRY GROUND	146608.000 SY				
1790	734015 PERMANENT GRASS SEEDING, WET GROUND	361.000 SY				
1800	734017 TEMPORARY GRASS SEEDING, DRY GROUND	649329.000 SY				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1810	735006 MULCHING, STRAW	649329.000 SY				
1815	734018 TEMPORARY GRASS SEEDING, WET GROUND	610.000 SY				
1820	735533 SOIL RETENTION BLANKET MULCH, TYPE 3	53600.000 SY				
1830	735534 SOIL RETENTION BLANKET MULCH, TYPE 4	79500.000 SY				
1840	735535 SOIL RETENTION BLANKET MULCH, TYPE 5	14398.000 SY				
1850	735536 SOIL RETENTION BLANKET MULCH, TYPE 6	143.000 SY				
1860	736502 MOWING	792.000 ACRE				
1870	737527 INTERCHANGE TREE PLANTING	LUMP	LUMP			
1880	743003 ARROWPANELS, TYPE C	8423.000 EADY				
1890	743004 FURNISH AND MAINTAIN PORTABLE CHANGEABLE MESSAGE SIGN	866.000 EADY				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
1900	743005 FURNISH AND MAINTAIN PORTABLE LIGHT ASSEMBLY	2067.000 EADY				
1910	743006 PLASTIC DRUMS	526330.000 EADY				
1920	743007 TRAFFIC OFFICERS	24000.000 HOUR	75.00000		1800000.00	
1930	743050 FLAGGER, NEW CASTLE COUNTY, STATE	1197.000 HOUR	41.67000		49878.99	
1940	743062 FLAGGER, NEW CASTLE COUNTY, STATE, OVERTIME	243.000 HOUR	60.42000		14682.06	
1950	743501 WARNING LIGHTS , TYPE B	11091.000 EADY				
1960	743504 WARNING SIGNS	802.000 EACH				
1970	743507 TEMPORARY BARRICADE, TYPE III	329.000 LFDY				
1980	743524 TEMPORARY BARRICADES, TYPE III	91.000 EACH				
1990	743525 TEMPORARY WARNING SIGNS	29249.000 EADY				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
2000	743537 FURNISH AND MAINTAIN TRUCK-MOUNTED ATTENUATOR, TYPE II	1518.000 EACH				
2010	744505 ADJUST OR REPAIR EXISTING CONDUIT JUNCTION WELL	2.000 EACH				
2020	744506 CONDUIT JUNCTION WELL, TYPE 7, 36" X 60" PRECAST POLYMER CONCRETE	11.000 EACH				
2030	744520 CONDUIT JUNCTION WELL, TYPE 1, 20" X 20" PRECAST CONCRETE	76.000 EACH				
2040	744523 CONDUIT JUNCTION WELL, TYPE 4, 20" X 42" 1/2" PRECAST CONCRETE	38.000 EACH				
2050	744525 REMOVAL OF EXISTING JUNCTION WELL	34.000 EACH				
2060	744529 P.C.C. BARRIER JUNCTION WELL	4.000 EACH				
2070	745521 SUPPLY OF 4" SDR-13.5 HDPE CONDUIT	1577.000 LF				
2080	745524 SUPPLY OF 4" SCHEDULE 80 PVC CONDUIT	13575.000 LF				
2090	745526 SUPPLY OF 3" GALVANIZED STEEL CONDUIT	19290.000 LF				

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			DOLLARS	CTS	DOLLARS	CTS
2100	745527 SUPPLY OF 2 1/2" GALVANIZED STEEL CONDUIT LF	1595.000				
2110	745528 SUPPLY OF 2" GALVANIZED STEEL CONDUIT LF	5165.000				
2120	745529 SUPPLY OF 1 1/2" GALVANIZED STEEL CONDUIT LF	290.000				
2130	745530 SUPPLY OF 1" GALVANIZED STEEL CONDUIT LF	1065.000				
2140	745531 SUPPLY OF 3/4" GALVANIZED STEEL CONDUIT LF	350.000				
2150	745537 SUPPLY OF 3/4" FLEXIBLE METALLIC LIQUIDTIGHT CONDUIT LF	105.000				
2160	745538 SUPPLY OF 1 1/2" FLEXIBLE METALLIC-LIQUIDTIGHT CONDUIT LF	555.000				
2170	745542 INSTALLATION OF CONDUIT UNDER EXISTING PAVEMENT-DIRECTIONAL BORE LF	3272.000				
2180	745544 INSTALLATION OF CONDUIT IN UNPAVED TRENCH LF	16295.000				
2190	745546 INSTALLATION OF CONDUIT ON STRUCTURE LF	555.000				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
2200	745547 INSTALLATION OF ADDITIONAL CONDUITS IN TRENCH OR OPEN CUT PAVEMENT	1990.000 LF				
2210	745549 INSTALLATION OF BRIDGE-MOUNTED CONDUIT FROM WORK AREA ABOVE BRIDGE DECK	1525.000 LF				
2230	746511 CABLES, 1/#4 AWG	7370.000 LF				
2240	746512 CABLES, 1/#6 AWG	38490.000 LF				
2250	746513 CABLES, 1/#8 AWG	40321.000 LF				
2260	746514 CABLES, 1/#10 AWG	770.000 LF				
2270	746515 INSULATED GROUND CABLES, 1/#6	9042.000 LF				
2280	746518 ALUMINUM LIGHTING STANDARD WITH SINGLE DAVIT ARM, 35' POLE	32.000 EACH				
2290	746519 ALUMINUM LIGHTING STANDARD WITH SINGLE DAVIT ARM, 40' POLE	24.000 EACH				
2300	746527 CABLES, 1/#2 AWG	4752.000 LF				

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			DOLLARS	CTS	DOLLARS	CTS
2320	746537 RELOCATING EXISTING LIGHT STANDARDS	2.000 EACH				
2330	746552 FURNISH AND MAINTAIN TEMPORARY LIGHTING	LUMP	LUMP			
2340	746564 INSULATED GROUND CABLES, 1/#4	1795.000 LF				
2350	746577 INSULATED GROUND CABLE, 1/#8	11055.000 LF				
2360	746592 REPLACE/ADAPT EXISTING TRANSFORMER BASE	2.000 EACH				
2370	746594 LUMINAIRE (HPS), 250 WATT	4.000 EACH				
2380	746596 JUNCTION BOX ON STRUCTURE	9.000 EACH				
2390	746598 INSULATED GROUND CABLE , 1/#2	1717.000 LF				
2400	746605 INSULATED GROUND CABLE, 1/#10	386.000 LF				
2410	746620 RELOCATION OF EXISTING LIGHTING TOWER	1.000 EACH				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
2420	746621 LIGHTING TOWER AND INSTALLATION	7.000 EACH				
2430	746622 CABLES, 1/#4/0 AWG	340.000 LF				
2440	746653 ELECTRICAL TESTING	LUMP	LUMP			
2450	746716 ELECTRIC SERVICE ON PEDESTAL	2.000 EACH				
2480	746774 SUPPLY AND INSTALLATION OF LOOP DETECTOR WIRE	1210.000 LF				
2490	746787 REMOVAL OF CABLE FROM CONDUIT OR POLE	1300.000 LF				
2500	746811 INSTALLATION OR REMOVAL OF LIGHTINGPOLE W/ MAST ARM	32.000 EACH				
2510	746816 REMOVAL OF LUMINAIRE	36.000 EACH				
2520	746830 REMOVAL OF CONCRETE POLE BASES AND CABINET FOUNDATIONS	19.000 CY				
2530	746847 POLE BASE, TYPE 3	8.000 EACH				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
2540	746876 UNDERPASS LIGHT FIXTURE	12.000 EACH				
2550	747504 INSTALLATION OR REMOVAL OF POLE OR POST MOUNTED CABINET	4.000 EACH				
2560	747506 CABINET BASE	8.000 EACH				
2570	747509 LIGHTING CONTROL CENTER - 200A, 277/480V	2.000 EACH				
2580	748015 PERMANENT PAVEMENT STRIPING, SYMBOL/LEGEND ALKYD-THERMOPLAST IC	582.000 SF				
2590	748020 TEMPORARY MARKINGS, PAINT, 6"	52939.000 LF				
2600	748027 PERMANENT PAVEMENT STRIPING, ALKYD-THERMOPLASTIC, 12"	570.000 LF				
2610	748502 RAISED/RECESSED PAVEMENT MARKER	1582.000 EACH				
2620	748506 PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, 4"	12440.000 LF				
2630	748507 PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, 6"	146137.000 LF				

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			DOLLARS	CTS	DOLLARS	CTS
2640	748508 PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, 8"	340.000 LF				
2650	748509 PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, 12"	22410.000 LF				
2660	748526 TEMPORARY MARKINGS, TAPE, 6"	4950.000 LF				
2670	748530 REMOVAL OF PAVEMENT STRIPING	15125.000 SF				
2680	748539 PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 12"	360.000 LF				
2690	748540 PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 16"	100.000 LF				
2700	748547 RETROREFLECTIVE PREFORMED PATTERNED CONTRAST MARKINGS, 9"	390.000 LF				
2710	748557 PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 3"	4200.000 LF				
2720	749500 SIGN PANEL	23224.000 SF				
2730	749511 INSTALLATION OR REMOVAL OF SIGN ON ROADSIDE I-BEAM STRUCTURE	280.000 SF				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
2740	749514 INSTALLATION OF SIGN OVERLAY OVER 16 S.F.	192.000 EACH				
2750	749516 REINFORCED CONCRETE SIGN FOUNDATION, W-6	1.000 EACH				
2760	749519 REINFORCED CONCRETE SIGN FOUNDATION, W-12	2.000 EACH				
2770	749521 SUPPLY OF BREAKAWAY I-BEAM SIGN POSTS, W-6	16.000 LF				
2780	749524 SUPPLY OF BREAKAWAY I-BEAM SIGN POSTS, W-12	46.000 LF				
2790	749550 INSTALLATION OF BREAKAWAY I-BEAM SIGN POSTS	3.000 EACH				
2800	749559 SUPPLY OF JERSEY BARRIER MOUNTED I-BEAM	3.000 EACH				
2810	749560 INSTALLATION OF JERSEY BARRIER MOUNTED I-BEAM	3.000 EACH				
2820	749561 INSTALLATION OF SIGN ON JERSEY BARRIER MOUNTED I-BEAM	485.000 SF				
2830	749687 INSTALLATION OR REMOVAL OF TRAFFIC SIGN(S) ON SINGLE SIGN POST	160.000 EACH				

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LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		BID AMOUNT	
			DOLLARS	CTS	DOLLARS	CTS
2840	758000 REMOVAL OF EXISTING PORTLAND CEMENT CONCRETE PAVEMENT, CURB, SIDEWALK, ETC.	17730.000 SY				
2850	759501 FIELD OFFICE, SPECIAL	42.000 EAMO				
2860	760504 RUMBLE STRIPS, HOT MIX	125000.000 LF				
2870	760507 PROFILE MILLING, HOT-MIX	91464.000 SYIN				
2880	762001 SAW CUTTING, HOT MIX	18308.000 LF				
2890	762002 SAW CUTTING, CONCRETE, FULL DEPTH	1540.000 LF				
2900	763000 INITIAL EXPENSE		LUMP	LUMP		
2910	763500 MAINTENANCE OF TRAFFIC		LUMP	LUMP		
2920	763501 CONSTRUCTION ENGINEERING		LUMP	LUMP		
2930	763503 TRAINEE	1080.000 HOUR		0.80000		864.00

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			DOLLARS	CTS	DOLLARS	CTS
2940	763508 PROJECT CONTROL SYSTEM DEVELOPMENT PLAN	LUMP	LUMP			
2950	763509 CPM SCHEDULE UPDATES AND/OR REVISED UPDATES	42.000 EAMO				
2960	602007 PORTLAND CEMENT CONCRETE MASONRY, PIER ABOVE FOOTING, CLASS A	1003.000 CY				
2970	602011 PORTLAND CEMENT CONCRETE MASONRY, SUBSTRUCTURE, CLASS A	2514.000 CY				
2980	602013 PORTLAND CEMENT CONCRETE MASONRY, SUPERSTRUCTURE, CLASS D	4286.000 CY				
2990	602014 PORTLAND CEMENT CONCRETE MASONRY, APPROACH SLAB, CLASS D	591.000 CY				
3000	602015 PORTLAND CEMENT CONCRETE MASONRY, ABUTMENT ABOVE FOOTING, CLASS A	803.000 CY				
3010	602017 PORTLAND CEMENT CONCRETE MASONRY, PARAPET, CLASS A	2440.000 CY				
3020	603000 BAR REINFORCEMENT	491000.000 LB				
3030	604000 BAR REINFORCEMENT, EPOXY COATED	2521000.000 LB				

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			DOLLARS	CTS	DOLLARS	CTS
3040	712005 RIPRAP, R-4	7310.000				
		SY				
3050	720529 P.C.C. SAFETY BARRIER PERMANENT, SINGLE FACE	17167.000				
		LF				
3060	746852 POLE BASE, TYPE 6	10.000				
		EACH				
3070	748535 PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 4"	180.000				
		LF				
	SECTION 0001 TOTAL					
	ITEMS TOTAL					

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**SPECIAL BIDDING PROCEDURE  
T200809003.01**

**THE BELOW FORM MUST BE COMPLETED AND SUBMITTED WITH THE BID**

Contractor: \_\_\_\_\_

The dollar amount for all work to be performed  
under the proposal.

Part A = \_\_\_\_\_  
(Total Bid Amount of Section 0001)

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BIDDING**

Total number of calendar days (includes Weather Days as calculated  
from Table 1 under item 763564 - Special Bidding Procedures)

\_\_\_\_\_

Number of calendar days above multiplied by \$35,000.00

Part B = \$ \_\_\_\_\_

Price for comparison of bids - TOTAL

\$ \_\_\_\_\_  
TOTAL OF "A" ABOVE, PLUS "B" ABOVE



# **BREAKOUT SHEETS**

THE FOLLOWING SHEETS MUST BE COMPLETED AND RETURNED WITH THE PROPOSAL AT THE TIME OF BID. FAILURE TO COMPLETE THE BREAKOUT SHEETS AS REQUIRED WILL RESULT IN THE BID BEING DECLARED NON-RESPONSIVE AND THE BID WILL NOT BE CONSIDERED. BREAKOUT SHEETS MUST BE COMPLETED REGARDLESS OF WHETHER BIDDING BY ELECTRONIC MEANS OR TYPEWRITTEN HARD COPY.

## **NOTICE:**

**DO NOT ENTER A ZERO UNIT PRICE ON ANY BREAKOUT SHEET. ENTRY OF A ZERO UNIT PRICE WILL RESULT IN THE BID BEING DECLARED NON-RESPONSIVE AND THE BID WILL NOT BE CONSIDERED.**



**SECTION 1** **BREAKOUT SHEET - 2** **CONTRACT NO. T200809003**  
**ITEM 602772 - MECHANICALLY STABILIZED EARTH WALLS**

ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	1	LS	Wall 1 MSE Wall	\$	\$
2	1	LS	Wall 2 MSE Wall	\$	\$
3	1	LS	Wall 3 MSE Wall	\$	\$
4	1	LS	Wall 4 MSE Wall	\$	\$
5	1	LS	Wall 5 MSE Wall	\$	\$
6	1	LS	Wall 6 MSE Wall	\$	\$
7	1	LS	Wall 7 MSE Wall	\$	\$
8	1	LS	Wall 8 MSE Wall	\$	\$
9	1	LS	Wall 9 MSE Wall	\$	\$
10	1	LS	Wall 10 MSE Wall	\$	\$

CANNOT BE USED FOR BIDDING



SECTION 1		BREAKOUT SHEET - 2A		CONTRACT NO. T200809003	
ITEM 602772 - MECHANICALLY STABILIZED EARTH WALLS					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
11	1	LS	Wall 12 MSE Wall	\$	\$
12	1	LS	Wall 13 MSE Wall	\$	\$
13	1	LS	Wall 14 MSE Wall	\$	\$
14	1	LS	Wall 15 MSE Wall	\$	\$
15	1	LS	Wall 16 MSE Wall	\$	\$
16	1	LS	MSE Wall at S1	\$	\$
17	1	LS	MSE Wall at S2	\$	\$
18	1	LS	MSE Wall at S3	\$	\$
19	1	LS	MSE Wall at S4	\$	\$
20	1	LS	MSE Wall at S5	\$	\$
21	1	LS	MSE Wall at S6	\$	\$
TOTAL ITEM 602772 - MECHANICALLY STABILIZED EARTH WALLS				\$	_____
(LUMP SUM BID PRICE FOR ITEM 602772)					



**SECTION 1** **BREAKOUT SHEET 3** **CONTRACT NO. T200809003**  
**ITEM 602773 - P.C.C. MASONRY FOR MECHANICALLY STABILIZED EARTH WALLS**

ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	23	CY	Wall 4 Concrete	\$	\$
2	1	CY	Wall 5 Concrete	\$	\$
3	15	CY	Wall 6 Concrete	\$	\$
4	33	CY	Wall 8 Concrete	\$	\$
5	8	CY	Wall 16 Concrete	\$	\$
6	5	CY	Wall S1 Concrete	\$	\$
7	4	CY	Wall S2 Concrete	\$	\$
8	4	CY	Wall S3 Concrete	\$	\$
9	3	CY	Wall S4 Concrete	\$	\$
10	4	CY	Wall S5 Concrete	\$	\$
11	3	CY	Wall S6 Concrete	\$	\$
TOTAL ITEM 602773 - P.C.C MASONRY FOR MECHANICALLY STABILIZED EARTH WALLS				\$	
				(LUMP SUM BID PRICE FOR ITEM 602773)	

CANNOT BE USED FOR BIDDING



SECTION 1		BREAKOUT SHEET - 4		CONTRACT NO. T200809003	
ITEM 602787 - POST TENSIONING PIER CAPS, BONDED SYSTEM					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	3	Each	Bride S1	\$	\$
2	1	Each	Bride S2	\$	\$
3	1	Each	Bride S3	\$	\$
4	1	Each	Bride S4	\$	\$
5	2	Each	Bride S6	\$	\$
TOTAL ITEM 602787 - POST TENSIONING PIER CAPS, BONDED SYSTEM				\$	
				(LUMP SUM BID PRICE FOR ITEM 602787)	



SECTION 1		BREAKOUT SHEET - 5		CONTRACT NO. T200809003	
ITEM 605002 - STEEL STRUCTURES					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	1,672,000	LB	Bridge S1	\$ _____	\$ _____
2	885,000	LB	Bridge S2	\$ _____	\$ _____
3	903,000	LB	Bridge S3	\$ _____	\$ _____
4	419,000	LB	Bridge S4	\$ _____	\$ _____
5	988,000	LB	Bridge S5	\$ _____	\$ _____
6	1,416,978	LB	Bridge S6	\$ _____	\$ _____
7	972	LB	Bridge S9	\$ _____	\$ _____
TOTAL ITEM 605002- STEEL STRUCTURES				\$ _____	
(LUMP SUM BID PRICE FOR ITEM 605002)					







SECTION 1		BREAKOUT SHEET - 6		CONTRACT NO. T200809003	
ITEM 605500 - CANTILEVER SIGN SUPPORTS AND FOUNDATIONS					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
11	29	CY	C-5 Concrete Foundation, Class A	\$ _____	\$
12	15	LF	C-5 5ft Dia. Concrete Caisson, Class A	\$	\$
13	35	LF	C-6 Cantilever Sign Structure	\$	\$
14	21	CY	C-6 Concrete Foundation, Class A	\$	\$
15	15	LF	C-6 5ft Dia. Concrete Caisson, Class A	\$	\$
TOTAL ITEM 605500 - CANTILEVER SIGN SUPPORTS AND FOUNDATIONS - \$ _____					
(LUMP SUM BID PRICE FOR ITEM 605500)					



**SECTION 1** **BREAKOUT SHEET - 7** **CONTRACT NO. T200809003**  
**ITEM 605523 - BOX TRUSS TYPE OVERHEAD SIGN SUPPORTS AND FOUNDATIONS**

ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	84	LF	OH-1 Overhead Sign Structure	\$	\$
2	52	CY	OH-1 Concrete Foundation, Class A	\$	\$
3	80	LF	OH-1 4ft Dia. Concrete Caisson, Class A	\$	\$
4	80	LF	OH-2 Overhead Sign Structure	\$	\$
5	54	CY	OH-2 Concrete Foundation, Class A	\$	\$
6	80	LF	OH-2 4ft Dia. Concrete Caisson, Class A	\$	\$
7	74.5	LF	OH-3 Overhead Sign Structure	\$	\$
8	52	CY	OH-3 Concrete Foundation, Class A	\$	\$
9	80	LF	OH-3 4ft Dia. Concrete Caisson, Class A	\$	\$
10	113	LF	OH-5 Overhead Sign Structure	\$	\$



**SECTION 1** **BREAKOUT SHEET - 7** **CONTRACT NO. T200809003**  
**ITEM 605523 - BOX TRUSS TYPE OVERHEAD SIGN SUPPORTS AND FOUNDATIONS**

ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
11	52	CY	OH-5 Concrete Foundation, Class A	\$	\$
12	80	LF	OH-5 4ft Dia. Concrete Caisson, Class A	\$	\$
13	50	LF	OH-6 Overhead Sign Structure	\$	\$
14	54	CY	OH-6 Concrete Foundation, Class A	\$	\$
15	80	LF	OH-6 4ft Dia. Concrete Caisson, Class A	\$	\$
16	64	LF	OH-7 Overhead Sign Structure	\$	\$
17	52	CY	OH-7 Concrete Foundation, Class A	\$	\$
18	80	LF	OH-7 4ft Dia. Concrete Caisson, Class A	\$	\$
19	55	LF	OH-8 Overhead Sign Structure	\$	\$
20	90	CY	OH-8 Concrete Foundation, Class A	\$	\$



**SECTION 1** **BREAKOUT SHEET - 7** **CONTRACT NO. T200809003**  
**ITEM 605523 - BOX TRUSS TYPE OVERHEAD SIGN SUPPORTS AND FOUNDATIONS**

ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
21	160	LF	OH-8 4ft Dia. Concrete Caisson, Class A	\$	\$
22	60	LF	OH-9 Overhead Sign Structure	\$	\$
23	56	CY	OH-9 Concrete Foundation, Class A	\$	\$
24	80	LF	OH-9 4ft Dia. Concrete Caisson, Class A	\$	\$
25	66	LF	OH-10 Overhead Sign Structure	\$	\$
26	52	CY	OH-10 Concrete Foundation, Class A	\$	\$
27	80	LF	OH-10 4ft Dia. Concrete Caisson, Class A	\$	\$
28	112	LF	OH-11 Overhead Sign Structure	\$	\$
29	52	CY	OH-11 Concrete Foundation, Class A	\$	\$
30	80	LF	OH-11 4ft Dia. Concrete Caisson, Class A	\$	\$



**SECTION 1** **BREAKOUT SHEET - 7** **CONTRACT NO. T200809003**  
**ITEM 605523 - BOX TRUSS TYPE OVERHEAD SIGN SUPPORTS AND FOUNDATIONS**

ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
31	100	LF	OH-12 Overhead Sign Structure	\$	\$
32	52	CY	OH-12 Concrete Foundation, Class A	\$	\$
33	80	LF	OH-12 4ft Dia. Concrete Caisson, Class A	\$	\$
34	84.5	LF	OH-13 Overhead Sign Structure	\$	\$
35	52	CY	OH-13 Concrete Foundation, Class A	\$	\$
36	80	LF	OH-13 4ft Dia. Concrete Caisson, Class A	\$	\$
37	60	LF	OH-14 Overhead Sign Structure	\$	\$
38	52	CY	OH-14 Concrete Foundation, Class A	\$	\$
39	80	LF	OH-14 4ft Dia. Concrete Caisson, Class A	\$	\$
40	64	LF	OH-15 Overhead Sign Structure	\$	\$



**SECTION 1** **BREAKOUT SHEET - 7** **CONTRACT NO. T200809003**  
**ITEM 605523 - BOX TRUSS TYPE OVERHEAD SIGN SUPPORTS AND FOUNDATIONS**

ITEM NO.	UOM	APPROX. QTY.	DESCRIPTION	UNIT PRICE	AMOUNT
41	52	CY	OH-15 Concrete Foundation, Class A	\$	\$
42	80	LF	OH-15 4ft Dia. Concrete Caisson, Class A	\$	\$
43	67	LF	OH-16 Overhead Sign Structure	\$	\$
44	52	CY	OH-16 Concrete Foundation, Class A	\$	\$
45	80	LF	OH-16 4ft Dia. Concrete Caisson, Class A	\$	\$
46	74	LF	OH-17 Overhead Sign Structure	\$	\$
47	52	CY	OH-17 Concrete Foundation, Class A	\$	\$
48	80	LF	OH-17 4ft Dia. Concrete Caisson, Class A	\$	\$
49	197	LF	OH-18 Overhead Sign Structure	\$	\$
50	94	CY	OH-18 Concrete Foundation, Class A	\$	\$



**SECTION 1** **BREAKOUT SHEET - 7** **CONTRACT NO. T200809003**  
**ITEM 605523 - BOX TRUSS TYPE OVERHEAD SIGN SUPPORTS AND FOUNDATIONS**

ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
51	100	LF	OH-18 5ft Dia. Concrete Caisson, Class A	\$	\$
52	185	LF	OH-19 Overhead Sign Structure	\$	\$
53	154	CY	OH-19 Concrete Foundation, Class A	\$	\$
54	100	LF	OH-19 5ft Dia. Concrete Caisson, Class A	\$	\$
55	213	LF	OH-20 Overhead Sign Structure	\$	\$
56	94	CY	OH-20 Concrete Foundation, Class A	\$	\$
57	100	LF	OH-20 5ft Dia. Concrete Caisson, Class A	\$	\$
58	116	LF	OH-21 Overhead Sign Structure	\$	\$
59	52	CY	OH-21 Concrete Foundation, Class A	\$	\$
60	80	LF	OH-21 4ft Dia. Concrete Caisson, Class A	\$	\$

TOTAL ITEM 605523 - BOX TRUSS TYPE OVERHEAD SIGN SUPPORTS AND FOUNDATIONS \$ \_\_\_\_\_  
(LUMP SUM BID PRICE FOR ITEM 605523)



SECTION 1		BREAKOUT SHEET - 8		CONTRACT NO. T200809003	
ITEM 605750 - NON-GUIDED POT BEARING AT ABUTMENT					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	4	Each	Bridge S1	\$ _____	\$ _____
2	4	Each	Bridge S2	\$ _____	\$ _____
3	4	Each	Bridge S3	\$ _____	\$ _____
4	4	Each	Bridge S4	\$ _____	\$ _____
5	4	Each	Bridge S5	\$ _____	\$ _____
6	4	Each	Bridge S6	\$ _____	\$ _____
TOTAL ITEM 605750 - NON-GUIDED POT BEARING AT ABUTMENT \$				(LUMP SUM BID PRICE FOR ITEM 605750)	



SECTION 1		BREAKOUT SHEET - 9		CONTRACT NO. T200809003	
ITEM 605751 - GUIDED POT BEARING AT ABUTMENT					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	8	Each	Bridge S1	\$ _____	\$ _____
2	6	Each	Bridge S2	\$ _____	\$ _____
3	6	Each	Bridge S3	\$ _____	\$ _____
4	4	Each	Bridge S4	\$ _____	\$ _____
5	4	Each	Bridge S5	\$ _____	\$ _____
6	4	Each	Bridge S6	\$ _____	\$ _____
TOTAL ITEM 605751 - GUIDED POT BEARING AT ABUTMENT				\$ _____	\$ _____
(LUMP SUM BID PRICE FOR ITEM 605751)					



**CANNOT BE  
USED FOR  
BIDDING**

SECTION 1		BREAKOUT SHEET - 10		CONTRACT NO. T200809003	
ITEM 605752 - NON-GUIDED POT BEARING AT PIER					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	4	Each	Bridge S2	\$ _____	\$ _____
2	4	Each	Bridge S5	\$ _____	\$ _____
TOTAL ITEM 605752 - NON- GUIDED POT BEARING AT PIER				\$ _____	
(LUMP SUM BID PRICE FOR ITEM 605752)					



SECTION 1		BREAKOUT SHEET - 11		CONTRACT NO. T200809003	
ITEM 605753 - GUIDED POT BEARING AT PIER					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	4	Each	Bridge S1	\$	\$
2	6	Each	Bridge S2	\$	\$
3	4	Each	Bridge S5	\$	\$
4	4	Each	Bridge S6	\$	\$
TOTAL ITEM 605753 - GUIDED POT BEARING AT PIER				\$	\$
(LUMP SUM BID PRICE FOR ITEM 605753)					







CANNOT BE

SECTION 1		BREAKOUT SHEET - 13		CONTRACT NO. T200809003	
ITEM 605757 - HIGH PERFORMANCE STEEL					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	732,000	LB	Bridge S1	\$	\$
2	182,000	LB	Bridge S6	\$	\$
TOTAL ITEM 605757 - HIGH PERFORMANCE STEEL				\$	
(LUMP SUM BID PRICE FOR ITEM 605757)					

USED FOR  
BIDDING



**SECTION 1** **BREAKOUT SHEET - 15** **CONTRACT NO. T200809003**  
**ITEM 737527 - INTERCHANGE PLANTING**

ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
1	31	EA	Acer rubrum (Red maple) 4-5' ht	\$	\$
2	31	EA	Liquidambar styraciflua (Sweetgum) 4-5' ht	\$	\$
3	30	EA	Liriodendron tulipifera (Tuliptree) 4-5' ht	\$	\$
4	32	EA	Quercus alba (White Oak) 4-5' ht	\$	\$
5	32	EA	Quercus rubra (Northern Red Oak) 4-5' ht	\$	\$
6	31	EA	Sassafras albidum (Sassafras) 4-5' ht	\$	\$
7	32	EA	Amelanchier canadensis (Shadbush serviceberry) 4-5' ht	\$	\$
8	33	EA	Cercis canadensis (Eastern redbud) 4-5' ht	\$	\$
9	32	EA	Lindera benzoin (Spicebush) 18-24" ht	\$	\$
10	31	EA	Viburnum acerfolium (Mapleleaf viburnum) 18-24" ht	\$	\$



**SECTION 1** **BREAKOUT SHEET - 15** **CONTRACT NO. T200809003**  
**ITEM 737527 - INTERCHANGE TREE PLANTING**

ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
11	31	EA	Viburnum dentatum (Southern arrowwood) 18-24" ht	\$	\$
12	32	EA	Viburnum prunifolium (Black Haw) 18-24" ht	\$	\$
13	1	EA	Ulmus americana 'Princeton' (American Elm)/2.5' cal	\$	\$
14	4	EA	Cercis canadensis 'Forest Pansy' (forest Pansy Eastern Redbud)/8-10' ht	\$	\$
15	2	EA	Crataegus viridis 'Winter King' (Winter King Hawthorn)/ 6-8' ht	\$	\$
16	3	EA	Picea abies (Norway Spruce)/ 8-9' ht	\$	\$
17	72	EA	Rhus aromatica 'low-grow' (Sweet Sumac)/ 12-24" ht	\$	\$
18	20	EA	Viburnum dentatum (Arrowwood Viburnum)/ 30-36" ht	\$	\$
19	20	EA	Ilex glabra 'Shamrock' (Shamrock Inkberry)/ 24-30" ht	\$	\$
20	154	EA	Panicum virgatum 'Shennandoah' (Switchgrass)/ 2 gal	\$	\$

TOTAL ITEM 737527 - INTERCHANGE TREE PLANTING \$ \_\_\_\_\_  
(LUMP SUM BID PRICE FOR ITEM 737527)



# "ATTENTION"

## TO BIDDERS

This Bid Proposal includes breakout sheets. The breakout sheets **CANNOT BE USED FOR BIDDING** MUST ACCOMPANY the bid proposal at the time of bid. Failure to return completed breakout sheets WILL RESULT in the bid proposal being declared non-responsive and REJECTED as irregular.

DO NOT ENTER ZERO UNIT PRICES



**CANNOT BE  
FORM SHEETS**

THE FOLLOWING SHEETS MUST BE COMPLETED AND RETURNED WITHIN 10 CALENDAR DAYS BY THE APPARENT LOW BIDDER. FAILURE TO COMPLETE THE FORM SHEETS AS REQUIRED WILL RESULT IN THE BID BEING DECLARED NON-RESPONSIVE AND THE BID WILL NOT BE CONSIDERED. FORM SHEETS MUST BE COMPLETED REGARDLESS OF WHETHER BIDDING BY ELECTRONIC MEANS OR TYPEWRITTEN HARD COPY.

**USED FOR  
BIDDING**

Contract No. T2008090030.01

Addendum No. 4  
May 12, 2011

SECTION 1		FORM - 1 for Item 720532		CONTRACT NO. T200809003	
ITEM 720532 - INSTALL PORTABLE IMPACT ATTENUATOR					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
				\$	\$
				\$	\$
				\$	\$
				\$	\$
				\$	\$
TOTAL MUST EQUAL BID PRICE FOR ITEM 720532 - INSTALL PORTABLE IMPACT ATTENUATOR				\$	
				(BID PRICE FOR ITEM 720532)	

Contract No. T200809003.01

Addendum No. 4  
May 12, 2011

SECTION 1		FORM - 2 for Item 720534		CONTRACT NO. T200809003	
ITEM 720534 - FURNISH PORTABLE IMPACT ATTENUATOR					
ITEM NO.	APPROX. QTY.	UOM	DESCRIPTION	UNIT PRICE	AMOUNT
				\$	\$
				\$	\$
				\$	\$
				\$	\$
				\$	\$
TOTAL MUST EQUAL BID PRICE FOR ITEM 720534 - FURNISH PORTABLE IMPACT ATTENUATOR				\$	_____
				(BID PRICE FOR ITEM 720534)	



**Diesel Fuel Cost Price Adjustment Option**

The Bidder is required to submit this form within 10 calendar day of the bid opening.

OPTION-IN

Checking here selects the option to participate in the 763626 - Diesel Fuel Cost Price Adjustment.

OPTION-OUT

Checking here declines the option to participate in the 763626 - Diesel Fuel Cost Price Adjustment.

The undersigned hereby certifies that he/she is authorized to make this Option on behalf of the bidder in compliance with the special provision 763626 - Diesel Fuel Cost Price Adjustment.

Sealed and dated this \_\_\_\_\_ day of \_\_\_\_\_ in the year of our Lord two thousand and \_\_\_\_\_ ( 20\_\_ ).

\_\_\_\_\_  
Name of Bidder (Organization)  
Corporate Seal By: \_\_\_\_\_  
Authorized Signature

Attest \_\_\_\_\_  
Title

SWORN TO AND SUBSCRIBED BEFORE ME this \_\_\_ day of \_\_\_\_\_, 20\_\_.

Notary Seal \_\_\_\_\_  
BIDDING  
Notary



**CERTIFICATION**

Contract No. T200809003.01  
Federal Aid Project No. IM-N056(35)

The undersigned bidder, \_\_\_\_\_ whose address is \_\_\_\_\_  
\_\_\_\_\_ and telephone number is \_\_\_\_\_  
hereby certifies the following:

I/We have carefully examined the location of the proposed work, the proposed plans and specifications, and will be bound, upon award of this contract by the Department of Transportation, to execute in accordance with such award, a contract with necessary surety bond, of which contract this proposal and said plans and specifications shall be a part, to provide all necessary machinery, tools, labor and other means of construction, and to do all the work and to furnish all the materials necessary to perform and complete the said contract within the time and as required in accordance with the requirements of the Department of Transportation, and at the unit prices for the various items as listed on the preceding pages.

**Bidder's Certification Statement [US DOT Suspension and Debarment Regulation (49 CFR 29)]:**

**NOTICE:** All contractors who hold prime contracts (Federal Aid) with DelDOT are advised that the prime contractor and subcontractors are required to submit to DelDOT a signed and notary attested copy of the Bidder Certification Statement for each and every subcontract that will be utilized by the prime contractor. This Certification **must** be filed with DelDOT prior to written approval being granted for each and every subcontractor. Copies of the Certification Form are available from the appropriate District Construction Office.

Under penalty of perjury under the laws of the United States, that I/We, or any person associated therewith in the capacity of (owner, partner, director, officer, principal, investigator, project director, manager, auditor, or any position involving the administration federal funds):

- a. am/are not currently under suspension, debarment, voluntary exclusion, or determination of ineligibility by any federal agency;
- b. have not been suspended, debarred, voluntarily excluded or determined ineligible by any federal agency within the past 3 years;
- c. do not have a proposed debarment pending; and,
- d. have not been indicted, convicted, or had a civil judgement rendered against (it) by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past 3 years.

Exceptions will not necessarily result in denial of award, but will be considered in determining bidder responsibility. For any exception noted, indicate below to whom it applies, initiating agency, and dates of action. Providing false information may result in criminal prosecution or administrative sanctions.

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(Insert Exceptions)

**DBE Program Assurance:**

**NOTICE:** In accordance with 49 CFR Part 26 the undersigned, a legally authorized representative of the bidder listed below, must complete this assurance.

By its signature affixed hereto, assures the Department that it will attain DBE participation as indicated:

**Disadvantaged Business Enterprise \_\_\_\_\_ percent** (blank to be filled in by bidder)

The foregoing quantities are considered to be approximate only and are given as the basis for comparison of bids. The Department of Transportation may increase or decrease the amount of any item or portion of the work as may be deemed necessary or expedient. Any such increase or decrease in the quantity for any item will not be regarded as a sufficient ground for an increase or decrease in the unit prices, nor in the time allowed for the completion of the work, except as provided in the contract.

Accompanying this proposal is a surety bond or a security of the bidder assigned to the Department of Transportation, for at least ten (10) percentum of total amount of the proposal, which deposit is to be forfeited as liquidated damages in case this proposal is accepted, and the undersigned shall fail to execute a contract with necessary bond, when required, for the performance of said contract with the Department of Transportation, under the conditions of this proposal, within twenty (20) days after date of official notice of the award of the contract as provided in the requirement and specifications hereto attached; otherwise said deposit is to be returned to the undersigned.

I/We are licensed, or have initiated the license application as required by Section 2502, Chapter 25, Title 30, of the Delaware Code.

By submission of this proposal, each person signing on behalf of the bidder, certifies as to its own organization, under penalty of perjury, that to the best of each signer's knowledge and belief:

1. The prices in this proposal have been arrived at independently without collusion, consultation, communication, or Agreement with any other bidder or with any competitor for the purpose of restricting competition.
2. Unless required by law, the prices which have been quoted in this proposal have not been knowingly disclosed and will not knowingly be disclosed by the bidder, directly or indirectly, to any other bidder or competitor prior to the opening of proposals.
3. No attempt has been made or will be made by the bidder to induce any other person, partnership, or corporation to submit or not to submit a proposal for the purpose of restricting competition.

I/We acknowledge receipt and incorporation of addenda to this proposal as follows:

No.	Date	No.	Date	No.	Date	No.	Date	No.	Date
<p>FAILURE TO ACKNOWLEDGE RECEIPT OF <u>ALL</u> ADDENDA <u>AND</u> FINAL QUESTIONS AND ANSWERS WILL RESULT IN THE BID BEING DECLARED NON-RESPONSIVE.</p>									

**MUST INSERT DATE OF FINAL QUESTIONS AND ANSWERS ON WEBSITE:** \_\_\_\_\_



Sealed and dated this \_\_\_\_\_ day of \_\_\_\_\_ in the year of our Lord two thousand and \_\_\_\_\_ (20\_\_\_\_).

\_\_\_\_\_  
Name of Bidder (Organization)

Corporate  
Seal

By:

\_\_\_\_\_  
Authorized Signature

Attest \_\_\_\_\_

\_\_\_\_\_  
Title

SWORN TO AND SUBSCRIBED BEFORE ME this \_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_.

Notary  
Seal

\_\_\_\_\_  
Notary

**BID BOND**

TO ACCOMPANY PROPOSAL  
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: \_\_\_\_\_  
of \_\_\_\_\_ in the County of \_\_\_\_\_ and State of \_\_\_\_\_  
as **Principal**, and \_\_\_\_\_ of \_\_\_\_\_ in the  
County of \_\_\_\_\_ and State of \_\_\_\_\_ as **Surety**, legally authorized to do business in the  
State of Delaware ("**State**"), are held and firmly unto the **State** in the sum of \_\_\_\_\_  
Dollars (\$ \_\_\_\_\_), or \_\_\_\_\_ percent not to exceed \_\_\_\_\_  
Dollars (\$ \_\_\_\_\_) of amount of bid on  
Contract No. T200809003.01, to be paid to the **State** for the use and benefit of its Department of  
Transportation ("**DelDOT**") for which payment well and truly to be made, we do bind ourselves, our and  
each of our heirs, executors, administrators, and successors, jointly and severally for and in the whole firmly  
by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bounden **Principal**  
who has submitted to the **DelDOT** a certain proposal to enter into this contract for the furnishing of certain  
materiel and/or services within the **State**, shall be awarded this Contract, and if said **Principal** shall well and  
truly enter into and execute this Contract as may be required by the terms of this Contract and approved by  
the **DelDOT**, this Contract to be entered into within twenty days after the date of official notice of the award  
thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and  
remain in full force and virtue.

Sealed with \_\_\_\_\_ seal and dated this \_\_\_\_\_ day of \_\_\_\_\_ in the year of our Lord two  
thousand and \_\_\_\_\_ (20\_\_\_\_).

SEALED, AND DELIVERED IN THE  
presence of

\_\_\_\_\_  
Name of Bidder (Organization)

Corporate  
Seal

By: \_\_\_\_\_  
Authorized Signature

Attest \_\_\_\_\_

\_\_\_\_\_  
Title

\_\_\_\_\_  
Name of **Surety**

Witness: \_\_\_\_\_

By: \_\_\_\_\_

\_\_\_\_\_  
Title

