# STATE OF DELAWARE

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# DEPARTMENT OF TRANSPORTATION

# BID PROPOSAL

for

# CONTRACT T201606301.01

## PAVEMENT AND REHABILITATION, SUSSEX COUNTY, OPEN-END, FY2016 - FY2018

SUSSEX COUNTY

ADVERTISEMENT DATE: June 8, 2015

COMPLETION TIME: 1,095 Calendar Days

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

Bids will be received in the Bidder's Room at the Delaware Department of Transportation's Administration Building, 800 Bay Road, Dover, Delaware until 2:00 P.M. local time **June 30, 2015**

**Contract No.T201606301.01**

**PAVEMENT AND REHABILITATION, SUSSEX COUNTY, OPEN-END, FY2016 - FY2018**
SUSSEX COUNTY

## GENERAL DESCRIPTION

### LOCATION

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

### DESCRIPTION

The improvements consist of furnishing all labor and materials for Pavement and Rehabilitation, Sussex County, Open-End, FY2016 - FY2018, and other incidental construction in accordance with the location, notes and details shown on the plans and as directed by the Engineer.

### COMPLETION TIME

All work on this contract must be complete within 1,095 Calendar Days. It is the Department's intent to issue a Notice to Proceed such that work starts on or about August 17, 2015.

### PROSPECTIVE BIDDERS NOTES:

1. BIDDERS MUST BE REGISTERED with DelDOT and request a cd of the official plans and specifications in order to submit a bid. Contact DelDOT at dot-ask@state.de.us, or (302) 760-2031.
2. QUESTIONS regarding this project are to be e-mailed to dot-ask@state.de.us no less than six business days prior to the proposal opening date in order to receive a response. Please include T201606301.01 in the subject line. Responses to inquiries are posted on-line at http://www.bids.delaware.gov.
3. This project incorporates the electronic bidding system **Expedite**, **version 5.9a**. Bidders will find the installation file on the plan holders bid file disk. The installation file and instructions are also available on DelDOT's Website at: http://www.deldot.gov/information/business/bids/const_proj_bid_info.shtml.
4. Each proposal must be accompanied by a deposit of either surety bond or security for a sum equal to at least 10% of the bid.
5. No retainage will be withheld on this contract.
6. The Department's External Complaint Procedure can be viewed on DelDOT's Website at; http://www.deldot.gov/information/business/, or you may request a copy by calling (302) 760-2555.

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7. **SPECIFICATIONS**: New Supplemental Specifications to the August 2001 Standard Specifications were issued November 24, 2014 and apply to this project. They can be viewed here. The Department is currently updating the August 2001 Specifications for Road and Bridge Construction. Through this update, some Divisions were renumbered and some new ones were created and added. The ***Specifications Note*** document is for the use by the bidders to reference the new numbers to the past numbers used for bidding purposes on previous Department contracts.
8. **PLEASE NOTE** the requirements of special provision 'Changes to Project Documents During Advertisement' have moved to Supplemental Specifications, the special provision is no longer needed.
9. It is anticipated that all work will occur within DelDOT's right of way. Should the need occur to trespass onto railroad property, including the highway-rail crossing; it will be the responsibility of the project manager to contact the railroad chief engineer and obtain written authorization before entering.

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

| **English Code** | English Description | Multiply By | Metric Code | Metric Description | Suggested CEC Metric Code |
|---|---|---|---|---|---|
| ACRE | Acre | 0.4047 | ha | Hectare | HECTARE |
| BAG | Bag | N/A | Bag | Bag | BAG |
| C.F. | Cubic Foot | 0.02832 | $m^3$ | Cubic Meter | M3 |
| C.Y. | Cubic Yard | 0.7646 | $m^3$ | 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 | $m^3$ | Cubic Meter | M3 |
| MGAL | Thousand Gallons | 3.785 | kL | Kiloliter | KL |
| MILE | Mile | 1.609 | km | Kilometer | KM |
| S.F. | Square Foot | 0.0929 | $m^2$ | Square Meter | M2 |
| S.Y. | Square Yard | 0.8361 | $m^2$ | Square Meter | M2 |
| SY-IN | Square Yard-Inch | 0.8495 | $m^2$-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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# GENERAL NOTICES

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.

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."

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:
>
> 1. The contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex or national 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.

2. 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.

CONTRACTOR / SUBCONTRACTOR LICENSE: 29 DEL. C. §6967:
(b) No agency shall accept a proposal for a public works contract unless such contractor has provided a proper and current copy of its occupational and/or business license, as required by Title 30, to such agency.

(c) Any contractor that enters a public works contract must provide to the agency to which it is contracting, within 30 days of entering such public works contract, copies of all occupational and business licenses of subcontractors and/or independent contractors that will perform work for such public works contract. However, if a subcontractor or independent contractor is hired or contracted more than 20 days after the contractor entered the public works contract the occupational or business license of such subcontractor or independent contractor shall be provided to the agency within 10 days of being contracted or hired.

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 of 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 fourth 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.

RIGHT TO AUDIT

The Department shall have the right to audit the books and records of the contractor or any subcontractor under this contract or subcontract to the extent that the books and records relate to the performance of the contract or subcontract. The books and records shall be maintained by the contractor for a period of 3 years from the date of final payment under the prime contract and by the subcontractor for a period of 3 years from the date of final payment under the subcontract (*29 Del.C. §6930*)

**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.

REQUIREMENT BY DEPARTMENT OF LABOR FOR SWORN PAYROLL INFORMATION

Title 29 Del.C. §6960 stipulates;

(b) Every contract based upon these specifications shall contain a stipulation 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. The specifications shall further stipulate 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.

(c) Every contract based upon these specifications shall contain a stipulation that sworn payroll information, as required by the Department of Labor, be furnished weekly. The Department of Labor shall keep and maintain the sworn payroll information for a period of 6 months from the last day of the work week covered by the payroll.

Bidders are specifically directed to note the Department of Labor's prevailing wage 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."

Contractor may contact:

Department of Labor
Division of Industrial Affairs
4425 No. Market Street
Wilmington, DE 19802
Telephone (302) 761-8200

STATE OF 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 13, 2015

| CLASSIFICATION | NEW CASTLE | KENT | SUSSEX |
|---|---|---|---|
| BRICKLAYERS | 49.39 | 49.39 | 14.51 |
| CARPENTERS | 42.55 | 51.86 | 41.22 |
| CEMENT FINISHERS | 31.06 | 30.92 | 19.65 |
| ELECTRICAL LINE WORKERS | 22.50 | 22.50 | 21.25 |
| ELECTRICIANS | 63.60 | 63.60 | 63.60 |
| IRON WORKERS | 42.20 | 23.87 | 25.35 |
| LABORERS | 31.10 | 34.12 | 37.75 |
| MILLWRIGHTS | 16.11 | 15.63 | 13.49 |
| PAINTERS | 48.84 | 48.84 | 48.84 |
| PILEDRIVERS | 66.42 | 23.75 | 26.95 |
| POWER EQUIPMENT OPERATORS | 39.15 | 32.92 | 29.04 |
| SHEET METAL WORKERS | 22.75 | 20.31 | 18.40 |
| TRUCK DRIVERS | 32.31 | 20.65 | 25.55 |

CERTIFIED: 6/1/15 BY: _____
ADMINISTRATOR, OFFICE OF LABOR LAW ENFORCEMENT

NOTE: THESE RATES ARE PROMULGATED AND ENFORCED PURSUANT TO THE PREVAILING WAGE REGULATIONS ADOPTED BY THE DEPARTMENT OF LABOR ON APRIL 3, 1992.

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.

NON-REGISTERED APPRENTICES MUST BE PAID THE MECHANIC'S RATE.

**PROJECT: T201606301.01 Pavement and Rehabilitation, Open End, FY2016-FY2018, Sussex County**

# 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

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.**

# 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

**NOTE**:

**PLEASE NOTE** revised Supplemental Specifications to the August 2001 Standard Specifications were issued November 24, 2014 and apply to this project. They can be viewed here and at www.deldot.gov.

**SPECIFICATIONS**: The Department is currently updating the August 2001 Specifications for Road and Bridge Construction. Through this update, some Divisions were renumbered and some new ones were created and added. The ***Specifications Note*** document is for the use by the bidders to reference the new numbers to the past numbers used for bidding purposes on previous Department contracts.

## 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 link for the posting is http://www.deldot.gov/information/business/bids/asphalt_cement_english.shtml.

The Project Asphalt Cement Base Price will be the Delaware Posted Asphalt Cement Price in effect on the date of advertisement.

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 using the weight of eligible asphalt that is shown on the QA/QC pay sheets as a percentage for the delivered material.

If the mix was not inspected and no QA/QC pay sheet was generated, then the asphalt percentage will be obtained from the job mix formula for that mix ID.

The asphalt percentage eligible for cost adjustment shall only be the virgin asphalt cement added to the mix.

There shall be no separate payment per ton cost of asphalt cement. That cost shall be included in the various unit prices bid per 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 per ton for the project will be the Delaware Posted Asphalt Cement Price in effect on the date of project advertisement.

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 or more of hot-mix bid quantity in case of Sections 401, 402 and 403; and 15,000 gallons or more in case of Sections 304, 404 and 405.

5/05/15

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

### .01 Description

This item shall govern the Quality Assurance Testing for supplying bituminous asphalt plant materials and constructing bituminous asphalt pavements and the calculation for incentives and disincentives for materials and construction. The Engineer will evaluate all materials and construction for acceptance. The procedures for acceptance are described in this Section. 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 bituminous asphalt. Payment to the Contractor for the bituminous asphalt item(s) will be based on the Contract price per ton and the pay adjustments described in this specification.

### .02 Bituminous Concrete Production – Quality Acceptance

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

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 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.

Supply and capture samples, as directed by the Engineer under the purview of the Engineer from delivery trucks before the trucks leave the production plant. Hand samples to the Engineer to be marked accordingly. 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. The Contractor may visually inspect the specified delivery load during sampling and elect to reject the load. If the contractor elects to reject the specified delivery truck, each subsequent load will be inspected until a visually acceptable load is produced for acceptance testing. All visually rejected loads shall not be sent to a Department project.

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. Samples not retrieved in accordance with the Contractor's QC plan will be deemed unacceptable and may be a basis for rejection of material produced. Parallel tests or dispute resolution tests will only be performed on material captured at the same time and location as the acceptance test sample. Parallel test samples or Dispute Resolution samples will be created by splitting a large sample or obtaining multiple samples that equally represent the material. The Engineer will perform all splitting and handling of material after it is obtained by the Contractor.

The Contractor may retain dispute resolution samples or perform parallel tests with the Engineer on any acceptance sample.

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$^{th}$ 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 sublot basis. The size for each sublot shall be 100 to 500 tons and testing for the sub lots will be completed on a daily basis. For each sublot, 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 and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
- AASHTO T166, Method C (Rapid Method) - Bulk Specific Gravity of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface Dry Specimens
- AASHTO T308 - Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method
- AASHTO T30 - Mechanical Analysis of Extracted Aggregate
- AASHTO T209 - Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt (HMA)
- ASTM D7227 - Standard Practice for Rapid Drying of Compacted Asphalt Specimens using Vacuum Drying Apparatus

**(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 based on daily production.

Notify the Engineer of any locations within that road segment that may not be suitable to achieve minimum (93%) compaction due to existing conditions prior to paving the road segment. 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 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 **.02 Acceptance Plan**

**(a) Material Production - B 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 1.0 feet from the newly placed longitudinal joint and 50 feet from a new transverse joint.

Cut one six (6) inch diameter core through the full lift depth at the exact location marked by the Engineer. Cores submitted that are not from the location designated by the Engineer will not be tested and will be paid at zero pay.

Notify the Engineer prior to starting paving operations with approximate 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 mark core locations within 24 hours of notification. 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.

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

Commence coring of the pavement after the pavement has cooled to a temperature of 140°F or less. Cut each core with care in order to prevent damaging the core. Damaged cores will not be tested. Label each core with contract number, date of construction, and number XX of XX upon removal from the roadway Place cores in a 6-inch diameter plastic concrete cylinder mold or approved substitute for protection. Separate cores in the same cylinder mold with paper. Attach a completed QC test record for the represented area with the corresponding cores. The Engineer will also complete a test record for areas tested for the QA report and provide to Materials & Research. Deliver the cores to the Engineer for testing, processing, and report distribution at the end of each production day.

Repair core holes per Appendix A, Repairing Core Holes in Bituminous 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) – Bulk Specific Gravity of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface Dry Specimens
- AASHTO T209 - Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt
- ASTM D7227 - Standard Practice for Rapid Drying of Compacted Asphalt Specimens using Vacuum Drying Apparatus

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.

**.03 Payment and Pay Adjustment Factors.**

The Engineer will determine pay adjustments for the bituminous asphalt item(s) in accordance with this specification. The Engineer will determine a pay adjustment factor for the material produced and a pay adjustment factor for the pavement construction. Pay adjustments for material and construction will be calculated independently. When the pay adjustment calculation for either material or construction falls to zero payment per tables 4, 5, or 5a, the maximum pay adjustment for the other factor will not exceed 100.

Pay Adjustment factors will only be calculated on in place material. Removed material will not be used in payment adjustment calculations.

Material Production Pay Adjustments will be calculated based upon 70% of the contract unit price and calculated according to section .03(a) of this specification. Pavement construction Pay Adjustments will be calculated based upon 30% of the contract unit price and calculated according to section .03(b) of this specification.

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

Calculate the material pay adjustment by evaluating the production material based on the following parameters:

**Table 2 - Material Parameter Weight Factors**

| Material Parameter | Single Test Tolerance (+/-) | Weight Factor |
|---|---|---|
| Asphalt Content | 0.4 | 0.30 |
| #8 Sieve (>=19.0 mm) | 7.0 | 0.30 |
| #8 Sieve (<=12.5 mm) | 5.0 | 0.30 |
| #200 Sieve (0.075mm Sieve) | 2.0 | 0.30 |
| Air Voids (4.0% Target) | 2.0 | 0.10 |

Using the JMF target value, the single test tolerance (from Table 2), 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 = ((JMF target) + (single test tolerance) - (mean value)) / (standard deviation).
3. For each parameter, calculate the Lower Quality Index (QL):
   QL = ((mean value) - (JMF target) + (single test tolerance)) / (standard deviation).
4. For each parameter, locate the values for the Upper Payment Limit (PU) and the Lower Payment Limit (PL) from Table 3 - 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 2 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. When all properties of a single test are within the single test tolerance of Table 2, Pay Adjustment factors shall be determined by Column B. When any property of a single test is outside of the Single Test Tolerance parameters defined in Table 2, the Material Pay Adjustment factor shall be determined by Column C.

9. For each lot, determine the final material price adjustment:

Final Material Pay Adjustment =
(Lot Quantity) x (Item Bid Price) x (Pay Adjustment Factor) x 70%. This final pay calculation will be paid to the cent.

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. When the PWL of any material parameter in Table 2 is below 60, the Engineer may require the removal and replacement of the material at no additional cost to the Department. Test results on removed material shall not be used in calculation of future PWL calculations for Mixture ID.

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 outside of the allowable single test tolerance for any Materials criteria in Table 2, 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. The pay factors for the out of tolerance sample lot will be calculated using column C of table 4.

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. After the Contractor has made appropriate changes, the Contractor will visually inspect each produced load. The first visually acceptable load will be sampled and 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.

**Table 3 – Quality Level Analysis by the Standard Deviation Method**

| PU or PL | QU and QL for "n" Samples | | | | | | |
|---|---|---|---|---|---|---|---|
| | n = 3 | n = 4 | n = 5 | n = 6 | n = 7 | n = 8 | n = 9 |
| 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 |
| 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 |

**Table 3 – Quality Level Analysis by the Standard Deviation Method**

| PU or PL | QU and QL for "n" Samples | | | | | | |
|---|---|---|---|---|---|---|---|
| | n = 3 | n = 4 | n = 5 | n = 6 | n = 7 | n = 8 | n = 9 |
| 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 |

**Table 4 - PWL Pay Adjustment Factors**

| PWL | Pay Adjustment Factor (%) Column B | Pay Adjustment Factor (%) Column C |
|---|---|---|
| 100 | +5 | 0 |
| 99 | +4 | -1 |
| 98 | +3 | -2 |
| 97 | +2 | -3 |
| 96 | +1 | -4 |
| 95 | 0 | -5 |

| | | |
|---|---|---|
| 94 | -1 | -6 |
| 93 | -2 | -7 |
| 92 | -3 | -8 |
| 91 | -4 | -9 |
| PWL<91 | PWL - 100 | 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. .

1. Calculate the core bulk specific gravity values from the sublot tests values, to the nearest 0.001 unit. Obtain the Theoretical maximum Specific Gravity values from the corresponding laboratory sublot tests.
2. Calculate the Degree of Compaction:

   Degree of Compaction =

   ((Core Bulk Specific Gravity) / (Theoretical Maximum Specific Gravity)) x 100% recorded to the nearest 0.1%.
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 and recorded to the nearest 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:

   Construction Pay adjustment = (Lot Quantity) x (Bid Price) x (Pay Adjustment Factor) x 30%.

**Table 5: Compaction Price Adjustment Highway Locations**

| Degree of Compaction (%) | Range | Pay Adjustment Factor (%) |
|---|---|---|
| >= 97.0 | >= 96.75 | -100* |
| 96.5 | 96.26 – 96.74 | -5 |
| 96.0 | 95.75 – 96.25 | -3 |
| 95.5 | 95.26 – 95.74 | -2 |
| 95.0 | 94.75 – 95.25 | 0 |
| 94.5 | 94.26 – 94.74 | 0 |
| 94.0 | 93.75 – 94.25 | 1 |
| 93.5 | 93.26 – 93.74 | 3 |

| | | |
|---|---|---|
| 93.0 | 92.75 – 93.25 | 5 |
| 92.5 | 92.26 – 92.74 | 3 |
| 92.0 | 91.75 – 92.25 | 0 |
| 91.5 | 91.26 – 91.74 | 0 |
| 91.0 | 90.75 – 91.25 | -5 |
| 90.5 | 90.26 – 90.74 | -15 |
| 90.0 | 89.75 – 90.25 | -20 |
| 89.5 | 89.26 – 89.74 | -25 |
| 89.0 | 88.75 – 89.25 | -30 |
| 88.5 | 88.26 – 88.74 | -50 |
| =<88.0 | =<88.25 | -100* |

* or remove and replace it at Engineer's discretion

| **Table 5A: Compaction Price Adjustment Other[1] Locations** | | |
|---|---|---|
| Degree of Compaction | Range | Pay Adjustment Factor (%) |
| >= 97.0 | >= 96.75 | -100* |
| 96.5 | 96.26 – 96.74 | -5 |
| 96.0 | 95.75 – 96.25 | -3 |
| 95.5 | 95.26 – 95.74 | -2 |
| 95.0 | 94.75 – 95.25 | 0 |
| 94.5 | 94.26 – 94.74 | 0 |
| 94.0 | 93.75 – 94.25 | 0 |
| 93.5 | 93.26 – 93.74 | 1 |
| 93.0 | 92.75 – 93.25 | 3 |
| 92.5 | 92.26 – 92.74 | 1 |
| 92.0 | 91.75 – 92.25 | 0 |
| 91.5 | 91.26 – 91.74 | 0 |
| 91.0 | 90.75 – 91.25 | 0 |
| 90.5 | 90.26 – 90.74 | 0 |
| 90.0 | 89.75 – 90.25 | 0 |
| 89.5 | 89.26 – 89.74 | 0 |
| 89.0 | 88.75 – 89.25 | -1 |
| 88.5 | 88.26 – 88.74 | -3 |
| 88.0 | 87.75 – 88.25 | -5 |

| | | |
|---|---|---|
| 87.5 | 87.26 – 87.74 | -10 |
| 87.0 | 86.75 – 87.25 | -15 |
| 86.5 | 86.26 – 86.74 | -20 |
| 86.0 | 85.75 – 86.25 | -25 |
| 85.5 | 85.26 – 85.74 | -30 |
| 85.0 | 84.75 – 85.25 | -40 |
| 84.5 | 84.26 – 84.74 | -50 |
| =< 84.0 | =<84.25 | -100* |

* or remove and replace at Engineer's discretion

[1] 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.

**.04 Dispute Resolution.**

Disputes or questions about any test result shall be brought to the attention of the Contractor and the Engineer within two operational days of reported test results. 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.

Third party resolution testing can be performed at either 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 properly captured, labeled, and stored, as described in the second paragraph of the section of these specifications titled **.02 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. The Contractor may request up to two dispute resolution samples be tested per calendar year without charge. Any additional Dispute Resolution samples run at the Contractors request where the results substantiate the acceptance test result will be assessed a fee of $125. Any additional Dispute Resolution samples that substantiate the Contractors test result will not be assessed the 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.

## Appendix A - Repairing Core Holes in Bituminous Asphalt Pavement

**Description.**

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

**Materials and Equipment.**

The following material shall be available to complete this work:

- Patch Material - 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 - mechanical (electrical, pneumatic, or gasoline driven) tamping device with a flat, circular tamping face smaller than 6 inches in diameter.

**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 and compact with mechanical tamping device. 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.

**Appenidx 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 Bituminous 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:

| Existing Material | Structural Coefficient |
|---|---|
| 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:

| | |
|---|---|
| Existing HMA | 2 * 0.32 = 0.64 |
| GABC | 7 * 0.14 = 0.98 |
| | 1.62 |

For the Type C lift the calculation would be:

| | |
|---|---|
| Newly Placed B | 2.25 * 0.4 = 0.90 |
| Existing HMA | 2 * 0.32 = 0.64 |
| GABC | 7* 0.14 = 0.98 |
| | 2.52 |

11/3/14

# 401752 – SAFETY EDGE FOR ROADWAY PAVEMENT

**Description:**

This work consists of the construction of safety edge(s) along bituminous concrete pavement or P.C.C. pavement in accordance with the details and notes on the Plans and as directed by the Engineer.

**Construction Methods:**

The safety edge shall not be constructed adjacent to curb or in front of guardrail sections.

In bituminous concrete pavement sections, prior to the construction of the safety edge, the fill or in situ material at the edge of pavement shall be compacted so that it is level with the top of the pavement, prior to the final surface overlay.

In bituminous concrete pavement sections, the contractor shall attach a device to the screed of the paver unit that confines the material at the end of the gate and extrudes the asphalt material in such a way that results in a compacted wedge shape pavement edge of 32 degrees (+/- 2 degrees). Contact shall be maintained between the device and the road shoulder surface. The device shall be manufactured so that it can be easily adjusted to transition at cross roads, driveways and obstructions without stopping the paver unit. The device's shape shall constrain the asphalt and cause compaction, as well as increase the density of the extruded profile.

In bituminous concrete pavement sections, the Transtech Shoulder Wedge Maker, Carlson Safety Edge End Gate or an approved equal shall be used to produce the safety edge. Contact information for these wedge shape compaction devices is listed below:

Transtech Systems, Inc.
1594 State Street
Schenectady, NY 12304
1-800-724-6306
www.transtechsys.com

or

Carlson Paving Products
18425 50th Ave. E
Tacoma, WA 98446
1-253-278-9426
www.carlsonpavingproducts.com

or an approved equal.

In P.C.C. pavement sections, the paver screed shall be modified to provide a chamfer at the end of the P.C.C. pavement in accordance with the details and notes on the Plans, or as directed by the Engineer.

**Method of Measurement:**

Safety Edge will not be measured for payment.

**Basis of Payment:**

The cost associated with the construction of safety edge(s), including but not limited to the wedge device, preparation and compaction of the fill or in situ material, and placement of the safety edge in accordance with the Plans and Details shall be incidental to the bituminous concrete pavement or P.C.C. pavement item being placed.

10/15/2013

**401800 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 115 GYRATIONS, PG 64-22 (CARBONATE STONE)**
**401801 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 64-22 (CARBONATE STONE)**
**401802 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 205 GYRATIONS, PG 64-22 (CARBONATE STONE)**

**401803 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 115 GYRATIONS, PG 70-22 (CARBONATE STONE)**
**401804 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 70-22 (CARBONATE STONE)**
**401805 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 205 GYRATIONS, PG 70-22 (CARBONATE STONE)**

**401806 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 115 GYRATIONS, PG 76-22 (CARBONATE STONE)**
**401807 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 76-22 (CARBONATE STONE)**
**401808 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 205 GYRATIONS, PG 76-22 (CARBONATE STONE)**

**401809 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 115 GYRATIONS, PG 64-22**
**401810 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 160 GYRATIONS, PG 64-22**
**401811 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 205 GYRATIONS, PG 64-22**

**401812 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 115 GYRATIONS, PG 70-22**
**401813 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 160 GYRATIONS, PG 70-22**
**401814 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 205 GYRATIONS, PG 70-22**

**401815 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 115 GYRATIONS, PG 76-22**
**401816 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 160 GYRATIONS, PG 76-22**
**401817 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 205 GYRATIONS, PG 76-22**

**401818 - BITUMINOUS CONCRETE, SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 115 GYRATIONS, PG 64-22**
**401819 - BITUMINOUS CONCRETE, SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 160 GYRATIONS, PG 64-22**
**401820 - BITUMINOUS CONCRETE, SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 205 GYRATIONS, PG 64-22**

**401821 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 64-22, PATCHING**
**401822 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 160 GYRATIONS, PG 64-22, PATCHING**
**401823 - BITUMINOUS CONCRETE, SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 160 GYRATIONS, PG 64-22, PATCHING**
**401824 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG-64-22, WEDGE**
**401825 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE B, 160 GYRATIONS, PG-64-22, WEDGE**

**401826 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 115 GYRATIONS, PG 64-22, (NON-CARBONATE STONE)**
**401827 -BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 64-22, (NON-CARBONATE STONE)**
**401828 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 205 GYRATIONS, PG 64-22, (NON-CARBONATE STONE)**

**401829 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 115 GYRATIONS, PG 70-22, (NON-CARBONATE STONE)**
**401830 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 70-22, (NON-CARBONATE STONE)**
**401831 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 205 GYRATIONS, PG 70-22, (NON-CARBONATE STONE)**

**401832 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 115 GYRATIONS, PG 76-22, (NON-CARBONATE STONE)**
**401833 -BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 76-22, (NON-CARBONATE STONE)**
**401834 - BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 205 GYRATIONS, PG 76-22, (NON-CARBONATE STONE)**

**401835 - THIN BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 115 GYRATIONS, PG 64-22**
**401836 - THIN BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 64-22**
**401837 - THIN BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 115 GYRATIONS, PG 70-22**
**401838 - THIN BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 70-22**
**401839 - THIN BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 115 GYRATIONS, PG 76-22**
**401840 - THIN BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 76-22**

**.01 Description:**

This specification shall govern the production and construction of bituminous concrete pavement. 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.

Payment for bituminous concrete shall be in accordance with item 401699. 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. Payment adjustment factors will be calculated in accordance with the latest version of item 401699.

Bituminous concrete may be produced by one or a combination of several technologies involving asphalt foaming processes and equipment or additives that facilitate the reduction of the temperature at which the mix can be placed and satisfactorily compacted thereby permitting the mix to be produced at reduced temperatures.

**.02 Materials:**

Use materials conforming to standard specifications 823.

Materials for 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. If the Contractor proposes to use a combination of materials that are not covered by this Specification, the mix design shall be submitted and reviewed by the Engineer 30 calendar days prior to use.

a) **Asphalt Binder:**

Meet the requirements of Superpave performance-grade asphalt binder, as referenced in the Plans, according to M 320 [1], Table 1 and tested according to AASHTO R29 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 - 2.20 kPa[1] |
| RTFO DSR, G*/sin (δ) | T 315 | >/= 2.20 kPa |

| TEST Procedure | AASHTO REFERENCE | SPECIFICATION LIMITS |
|---|---|---|
| PAV DSR, G*/ sin (δ) | T 315 | </=5000 kPa |
| BBR Creep Stiffness, S | T 313 | </= 300.0 kPa |
| BBR m-value | T 313 | >/=0.300 |

Note 1: The exception to M 320 is that the original DSR shall be 1.00 to 2.20 kPa

Substitution of a higher temperature grade will require prior approval by the Engineer.

The highest low temperature grade virgin binder to be used is -22.

Depending on the level of Recycled materials used, the low temperature properties, per T 313, may be different than stated in M 320 or the previous table.

b) **Recycled Materials:**

**RAP (Recycled Asphalt Pavement):** Bituminous concrete pavement mechanically processed to a homogenous consistency to be recycled through the production plant for use in a new bituminous concrete mixture.

The percentage allowance of recycled materials (recycled asphalt pavement and/or shingles) shall be controlled through the use of the Materials & Research recycled mixture program available through the Materials & Research Section. The program can be used by the Contractor to determine which materials and combinations of materials can be used to meet the specified material on the contract.

If the Contractor proposes to use a combination of materials that are not covered by this program, the mix design shall be submitted and reviewed by the Engineer.

c) **Shingles:**

**RAS (Recycled Asphalt Shingles):** Materials reclaimed from the shingle manufacturing process such as tabs, punch-outs, and damaged new shingles mechanically broken down with 100% passing the ½ in (12.5 mm) sieve. Shipping, handling, and shredding costs are incidental to the price of Superpave item.

Post-consumer shingles or used shingles are not acceptable. Fiberglass-backed and organic felt-backed shingles shall be kept separate. Both materials shall not be used in the same mixture at the same time. All shingles shall be free of all foreign material and moisture.

The use of Recycled Asphalt Shingles will be considered for 115 gyration mix designs upon demonstration by the producer of adequate blending of the binder verified by laboratory testing on plant produced material.

**d) Mineral Aggregate:**

Conform to Section 805 and the following criteria. These criteria apply to the combined aggregate blend.

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

[1]Coarse Aggregate Angularity is tested according to ASTM D5821.
[2]Fine Aggregate Angularity is tested according to AASHTO TP-33.
[3]Clay Content is tested according to AASHTO T176.
[4]Flat and Elongated is tested according to ASTM 4791 with a 5:1 aspect ratio.
[5] 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 |
|---|---|
| **Toughness**, AASHTO T96<br>Percent Loss, Maximum | 40 |
| **Soundness**, AASHTO T104<br>Percent Loss, Maximum for five cycles | 20 |
| **Deleterious Materials**, AASHTO T112<br>Percent, Maximum | 10 |
| **Moisture Sensitivity**, AASHTO T283<br>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 B ALaboratory Method of Predicting Frictional Resistance of Polished Aggregates and Pavement Surfaces.@ RAP shall be assigned a value of 5.0. The Contractor shall supply all polish values to the Engineer upon request.

e) **Mineral Filler:**

Conform to AASHTO M17.

f) **Warm Mix Additives:**

For any WMA technology requiring addition of any material by the producer during production, the following information will be submitted with the proposed JMF for review and approval at least 30 calendar days prior to production:

1. WMA technology and/or additive information.
2. WMA technology manufacturer's recommendation for usage.
3. WMA technology target dosage rate and tolerance envelope. Support tolerance envelope with test data demonstrating acceptable mix production properties conforming to all sections of this specification.
4. WMA technology manufacturer's material safety data sheets (MSDS).
5. Documentation of past WMA technology field application including points of contact.
6. Temperature ranges for mixing and compacting.
7. Laboratory test data, samples, and sources of all mix components, and asphalt binder viscosity-temperature relationships.

Follow the manufacturer's recommendation for incorporating additives and WMA technologies into the mix. Comply with the manufacturer's recommendation regarding receiving, storage, and delivery of additives.

If the producer performs blending of the WMA technology in their tank, a separate Quality Control plan shall be submitted by the producer to the Department for review and approval at least 30 calendar days prior to production.

g) **Anti-stripping additives**

Conform to standard specifications Section 829 and blend with the asphalt cement in accordance with this specification. Incorporate anti-stripping additives when the Tensile Strength Ratio (TSR) as determined in accordance with AASHTO T283 is less than 80 or when specified for use by the Engineer.

**.03 Bituminous Concrete Production – Quality Control**

**(a) Process Control - Material Production Quality Control.**

Submit through 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 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 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.
- Load number of QC samples (1-10 if QA sample is not within trucks 1-10)
- Locations where samples will be obtained and the sampling techniques for each test
- 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 on working day as test results for each sublot 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 401644 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.

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 DelDOT
- Failure to perform materials testing per their approved QC Plan
- Deviating from AASHTO or DelDOT testing procedures.
- Use of any material or the use of a JMF component in a proportion that exceeds the allowable tolerance as specified in section 04(a)(1) of this specification not listed in the JMF.
- Use of the wrong PG graded asphalt.
- Failure to take corrective action per action points in the Contractors approved QC plan.

The following steps will be taken for violations listed above:

1. First offence: Written notice of violation to the Contractor
2. Second offence: Written notice of violation and forfeiture of any bonus (material production or pavement construction) payment eligibility under 401699 section .03 for that production shift.

3. Third offence: Written notice of violation, forfeiture of bonus payment eligibility, and a 5% deduction of payment based upon contract unit price in addition to any calculated pay adjustment factors per 401699 Section 03.
4. Fourth offence: Written notice of violation, forfeiture of bonus payment eligibility, 50% deduction of payment based upon contract unit price in addition to any calculated payment adjustment factor per 401699 Section 03, and immediate suspension of the Contractor until corrective actions are taken. Corrective actions shall be submitted in writing to the Engineer for approval. The Engineer may request a meeting with the Contractor to discuss proposed changes prior to lifting suspension.

Violations of Contractor QC plans shall be kept on record for a period of 1 year from the date of violation at the Central Lab.

**(b) Material Production Test Equipment.**

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.

Facilities for the use of the Engineer and inspectors shall be a minimum of 600 square feet of floor space conditioned to maintain constant temperature of 77F with two windows and a door equipped with functional locks and latches, located such that plant activities are plainly visible from one window of the building. Work space shall be furnished with illumination, tables, chairs, desks, telephone, and water including drinking water, sanitary facilities, fuel, and power necessary to conduct all necessary tests.

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 suspend production. In the case of an equipment malfunction, the Engineer may elect to test the material at another qualified testing laboratory while waiting for repairs to equipment.

Maintain minimum calibration records for the referenced equipment:

- SUPERPAVE$^{R}$ 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.

**(c) Material Production Test Methods**

- AASHTO T312 - Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
- AASHTO T166, Method C (Rapid Method) - Bulk Specific Gravity of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface Dry Specimens
- AASHTO T308 - Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method
- AASHTO T30 - Mechanical Analysis of Extracted Aggregate
- AASHTO T209 - Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt (HMA)
- ASTM D7227 - Standard Practice for Rapid Drying of Compacted Asphalt Specimens using Vacuum Drying Apparatus

**.04 Job Mix Formula (JMF)**

**Mix Design.** Develop and submit a job mix formula for each mixture according to AASHTO R35. Each mix design shall be capable of being produced, placed, and compacted as specified. Assign a unique identification number to each JMF.

a) Development of JMF

**Gradation**: Use the FHWA Superpave 0.45 Power Chart 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 bituminous concrete. Unless otherwise noted in the Plans, the Type C shall meet the 3/8" (9.5 mm) Nominal Maximum Aggregate Size. Type B bituminous concrete 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 Gsb, apparent specific gravity Gsa, 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 Gyratory Compactive (SGC) Effort:**

The Superpave Gyratory 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 Gyratory 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 |
| ≥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) NOMINAL MAX. AGGREGATE (MM) | | | | | VOIDS FILLED WITH ASPHALT (%) |
|---|---|---|---|---|---|---|---|---|---|
| | $N_{INITIAL}$ | $N_{DESIGN}$ | $N_{MAX}$ | 25.0 | 19.0 | 9.5 | 12.5 | 4.75 | |
| 0.3 to < 3 | ≤ 90.5 | - | - | - | - | - | - | - | 65.0 - 78.0 |
| 3 to < 10 | - | - | - | - | - | - | - | - | - |
| 10 < 30 | - | - | - | - | - | - | - | - | - |
| ≤ 30 | ≤ 89.0 | 96.0 | ≤ 98.0 | 12.5 | 13.5 | 15.5 | 14.5 | 16.5 | 65.0 - 75.0[1] |

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 Primary Control Sieve (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 $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.
TABLE 1

| Nominal Maximum Aggregates Size Control Points, Percent Passing | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **25.0 MM** | | **19.0 MM** | | **12.5 MM** | | **9.5 MM** | | **4.75 MM** | |
| **SIEVE SIZE** | **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:**

| Volumeric Property | Superpave Criteria |
|---|---|
| Air Voids ($V_a$) at (%) $N_m$ | 2.0 (min) |
| Air Voids ($V_a$) at $N_{design}$ (%) | 6.0 (max) |
| Voids in Mineral Aggregate (VMA) at $N_{design}$ | |

| Volumeric Property | Superpave Criteria |
|---|---|
| 25.0 mm Bituminous Concrete Base Course | -1.5 |
| 19.0 mm Type B Hot-Mix | +2.0 |
| 12.5 mm Type C Hot-Mix | |
| 9.5 mm Type C Hot-Mix | |
| 4.5 mm Type C Hot-Mix | |

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

Submit for approval to the Engineer the following documentation on Pinepave mixture design software prior to starting production of a new mixture:

1. Job mix formula (JMF) design of the component materials and target characteristic values for each mixture proposed for use. 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 bituminous concrete meeting the specified properties. Recycled Asphalt Pavement (RAP) is one individual aggregate component regardless of fractionation size. Recycled Asphalt Shingles (RAS) is a separate component from RAP.

2. 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.

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

4. 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 $N_{m.}$

5. 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 (kg/m²) at both $N_d$ and $N_m$.

6. 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.

7. 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.

   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.

8. Provide raw material of each JMF so NCAT Ignition Oven calibration correction numbers can be established for the Engineers and Contractors ovens. The Engineer shall provide an ignition oven correction number for each JMF.

**.05 Approval of JMF**

The Engineer will have up to three weeks once the JMF is submitted to review the submitted information.

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: Gmm: + / -0.030 and Gmb: + / - 0.040

a) **Design Evaluation:**

The Engineer may elect to evaluate the proposed JMF and suitability of all materials through laboratory trial batches. 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.

For more expeditious approval, the Contractor may undertake the following steps:

1. Submit the proper documentation on Pinepave mixture design software.
2. Produce the new mixture for a non-Department project. The Engineer will test the material, by taking three series per section 401800 03(c). The mixture will be approved by the Engineer for Department projects if the test results are within the specifications.

A new JMF is required when any of the following conditions occur:

- A change in the source of any of the aggregate component materials
- A change in the proportion of any aggregate component by more than 5.0%
- A change in the aggregate components resulting in a change in percent passing any sieve as identified in Table 1 by more than 5% of the JMF target.
- A change in the target AC content by more than 0.20% from the JMF target to maintain other Volumetric properties of the approved JMF.
- For any mixture that has a 20% or greater failure rate on any combined volumetric criteria.

Although a new JMF is not required, 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. This notification shall include the total change made from the approved JMF proportions, and the effective time of the change. The Engineer will reply to the proposed changes within one operational day and notify the Contractor of the effective date of the changes.

**.06 Construction.**

**(a) Pavement Construction Test Equipment**.

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

**Weather Limitations.**

Place mix only on dry, unfrozen surfaces and only when weather conditions allow for proper production, placement, handling, and compacting.

The following table of ambient temperatures for various binder grades and lift thicknesses for placement with the following parameters:

| Lift Thickness (in) | PG Binder | | |
|---|---|---|---|
| | 76-22 | 70-22 | 64-22 |
| 1.50 | 50°F | 45°F | 40°F |
| 2.00 | 40°F | 38°F | 35°F |
| 3.00 | 32°F | 32°F | 32°F |

- Minimum surface temperature of 32°F and
- Minimum production temperature of 275°F and
- Maximum wind speed of 8 miles per hour

Construction outside of these conditions with WMA technology will be at the discretion of the Engineer.

**Compaction:**

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

Perform Quality Control of pavement compaction by testing in-place pavement density by the following methods.

- ASTM D2950 Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods; the use of other density gauges shall be as per the manufacturer's recommendations.
- AASHTO T166, Method C (Rapid Method) Bulk Specific Gravity of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface Dry Specimens
- ASTM D7227 - Standard Practice for Rapid Drying of Compacted Asphalt Specimens using Vacuum Drying Apparatus

Cores may be cut on the first day of paving or once after the change of a JMF for gauge calibration. The number of cores obtained for calibration purposes shall not exceed the number of QA samples obtained by the Department for payment. The Contractor may use any method to select locations for the Quality Control calibration cores.

Repair all core holes in accordance with 401699 Appendix A.

**Method of Measurement:**

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

**Basis of Payment:**

All work completed under this item shall be considered for full payment and subsequently modified in accordance with the procedures enumerated under 401699.

Material production quality shall be evaluated per item 401699 - Quality Control/Quality Assurance of Bituminous Concrete .03 (a) Material Production - Tests and Evaluations.

Compaction quality shall be evaluated per Item 401699 - Quality Assurance of Bituminous Concrete .03 (b) Pavement Construction - Tests and Evaluations.

10/29/2014

**503001 - PATCHING P.C.C. PAVEMENT, 6' TO 15', TYPE A**
**503002 - PATCHING P.C.C. PAVEMENT, GREATER THAN 15' TO 100', TYPE B**
**503006 - DOWEL BARS**

Section 503 of the Standard Specification is replaced with the following:

**503.01 Description.** This work consists of removing and disposing of existing Portland cement concrete pavement and replacing it with new Portland cement concrete pavement. The Engineer will designate the boundaries of each repair. This work is not intended for repairing newly constructed Portland cement concrete pavement or for repairing continuously reinforced concrete pavement. This work shall be completed after any planned partial depth patching. It shall also be completed before any diamond grinding, and before any overlay.

**Materials**

**503.02 Portland Cement Concrete.** Portland cement concrete shall conform to Class A, Section 812 and have a minimum compressive strength of 2000 psi in six hours as measured by Sure-Cure Mold test cylinders. The Sure-Cure Mold test cylinders and all associated equipment shall be provided by the Contractor. The concrete will be sampled and tested by the Engineer. The Engineer may also use the concrete maturity meter in accordance with AASHTO T325 to determine compressive strength.

This concrete shall also have material present in the mixture to mitigate alkali-silica reactivity (ASR) as per Section 812. The following parameters shall be adhered to by the contractor-submitted mix design for the Portland cement concrete:

| CONCRETE PROPERTY | SPECIFICATION |
|---|---|
| Water/Cementitious Material Ratio | 0.40 (Max.) |
| Air Content (%) | 4 - 7 |
| Slump* | 2 - 5" |
| Synthetic Fibers ** | 1.5 lb/yd³ min. or as per manufacturer's recommendation |

*Slump may be increased up to 8" if a Type F Admixture is utilized. All admixtures utilized in the mixture shall be non-chloride based materials.

** Synthetic fibers shall be alkali resistant polypropylene, polyethylene, or nylon fibers with a minimum length of ½" and meet the requirements of ASTM C1116, Type III.

The Contractor, in order to accomplish 2000 psi compressive strength in six hours, shall establish actual combination of weights and proportion of admixtures as required by the field conditions, ambient temperature, humidity, and wind conditions. If the Contractor, due to unfavorable conditions, is unable to accomplish the desired strength in six hours, they may reschedule to the proper timing for performing the patching work.

**503.03 Load Transfer Device.** Dowel bars shall conform to AASHTO M 227/M 227M grade 65 (grade 450). The entire length of the dowel shall be pre-coated to conform to AASHTO M254. If the slab is less than 10" thick, the dowels shall be 18" long with a diameter of 1 ¼". If the slab is greater than or equal to 10" thick, the dowels shall be 20" long, with a diameter of 1 ½".

Load transfer assemblies shall be fabricated from corrosion-resistant, coated dowel bars conforming to AASHTO M254. Dowel support baskets shall conform to the requirements of Standard Construction Details or details in the Plans.

**503.04 Grout.** Epoxy grout, when used for anchoring the dowels in place, shall conform to AASHTO M235. Concrete grout, when used for anchoring the dowels in place, shall be non-shrink grout conforming to the

Corps of Engineers "Specification for Non-Shrink Grout," CRD-C621. The maximum allowable expansion shall be 0.4 percent. The grout shall have a compressive strength no less than 3000 psi at 24 hours when tested according to ASTM C109. The initial set shall be less than 60 minutes when tested under the Corps of Engineers "Method of Test for Time of Setting of Grout Mixtures," CRD-C82.

**503.05 Joint Sealants.** Hot-poured joint sealant shall conform to the requirements of AASHTO M301 or AASHTO M282.

**503.06 Curing Materials.** Curing materials shall be as follows:

(1) *Liquid Membrane Compounds.* The material shall conform to the requirements of AASHTO M 148, for Type 2, Class A or B white-pigmented liquid curing compound.
(2) *Polyethylene Sheeting.* Polyethylene sheeting shall conform to the requirements of AASHTO M 171.
(3) *Waterproof Paper.* Waterproof paper shall conform to the requirements of AASHTO M 171.
(4) *Water Cure.* The water shall conform to Section 803.

**503.07 Insulating Blankets.** Insulation blankets shall be a minimum of 2" thick of fiberglass, rock wool, or other approved commercial insulation material.

## CONSTRUCTION METHODS

**503.08 Patching Limits.** The areas of old pavement to be patched will be indicated on the Plans, or identified by the Engineer.

The limits of the area where the pavement is to be removed and patched will be painted on the existing pavement by the Engineer.

Patches can be either Type 'A' or Type 'B'. A Type 'A' patch is 15' or less in length. A Type 'B' patch is greater than 15' and less than 100' in length and contains load transfer assemblies spaced at a maximum of 15'.

Pavement replacement greater than 100' in length shall be constructed under **Section 501 Portland Cement Concrete Pavement**.

**503.09 Patching Pavement.** The Engineer will designate the boundaries of the concrete patch. The ends of the patch shall either match or offset by at least 2' the existing joints, any cracks, or patch ends in the immediate adjacent lanes. Transverse boundaries of the concrete patch shall be at least 2' from the existing joint line.

Patch lengths shall be at least 6' and no more than 15' without a load-transfer device. The patch shall be the full width of the existing slab or as noted on the Plans. The patch depth shall be no less than the existing slab.

The entire perimeter of the patch that is adjacent to concrete shall be sawed full depth by a concrete saw equipped with a diamond blade or approved equal of sufficient size to cut the concrete slabs to the required depth along straight and plumb lines. All perimeter cuts shall be plumb and parallel to or normal to the centerline of the roadway. Cutting, removing, and replacing existing hot-mix overlays up to 8" on the concrete shall be considered incidental to this item. Any over cut into the remaining slabs shall be kept to a minimum and shall be sealed (incidental to the sealing of the patch if not overlaid; if overlay is planned, no sealing will be required.). Any existing tie-steel across the patch perimeter line shall be cut. The Contractor may make additional cuts (such as diagonal and slanted cuts) to facilitate the removal of the concrete within the patch boundaries. The additional cuts to facilitate removal shall be incidental to the saw cutting item and will not be measured or paid. Cutting shall not precede the removal operations by more than two days.

The concrete in the repair area shall be removed by the lift-out technique without damaging the remaining concrete slabs or disturbing the base and subgrade. The lift out technique involves drilling holes into the patch to insert lifting hooks, pins, or chains. Improper actions (such as dropping the removed slab on adjacent concrete pavement, damaging the pavement edge due to Contractors methods, or other actions deemed damaging by the Engineer) leading to slab damage, shall be repaired by the Contractor, by an approved method, at no cost to the Department.

When the lift-out technique is not feasible, concrete in the patch area shall be broken by an approved mechanical pavement breaker or jackhammers and removed. The removal of the existing concrete and hot-mix overlay shall be executed with minimal disturbance to the remaining concrete or foundation. Any damage beyond the limits of the patch, caused by the improper actions of the Contractor shall be repaired to the satisfaction of the Engineer at no cost to the Department.

Where the patch is next to the shoulder and removal of the concrete results in a clean, uniform shoulder edge, the Engineer may allow the Contractor to use the shoulder edge as the form for the new concrete. Any portion of the shoulder pavement structure removed or disturbed by the patching operation shall be repaired in kind by the Contractor and the cost shall be incidental to the patching item(s). Saw cutting the joint between the concrete pavement and shoulder may assist in maintaining a clean, uniform shoulder edge. If the adjacent shoulder is concrete, the saw cut will be measured and paid for. If the adjacent shoulder is hot-mix asphalt, no measurement or payment will be made.

**503.10 Patch Preparation.** After removal of the concrete, the repair area shall be cleaned out with hand tools. Particular attention shall be given to existing longitudinal joint areas due to the possibility of loose concrete where the joint cracked away from the plumb line during the original construction. All vertical faces shall be cleaned of loose and deleterious material, prior to the placement of concrete.

Any base or subgrade that is unstable shall be removed to a maximum depth of 6" as directed by the Engineer. No new base material shall be placed; the excavated area will be filled with the concrete when the patch concrete is placed. The excavation is to be paid for under Item 212001 - Undercut, Excavation, Patching, with the replacement material to be concrete SY-IN paid for under Item 503503 - Patching Concrete.

After the old concrete is removed, the patch areas shall be protected from water intrusion when precipitation is forecast.

Dowels shall be placed to provide load transfer at mid-depth ± 1" of the ends of the patch along the transverse joint at 12" ± 1" on-center spacing, at least 6" from the slab edge. The dowel holes shall be drilled parallel to the profile and centerline of the pavement to an embedment depth of half the dowel bar length. The equipment for drilling holes in the face of the remaining concrete slabs must be capable of producing holes of proper size, depth, and angle. The drill must not crack or spall the remaining concrete. A drill support system shall be used to ensure proper hole alignment.

Dowel holes shall be drilled to a diameter of 1 3/4″ for cementitious grout and 1 9/16" for epoxy grout. If the existing concrete breaks during drilling, cut away more concrete or relocate the hole to provide a solid support for the dowel. Fill any unused hole with cement grout or epoxy grout. Any damage caused by the Contractor's technique shall be repaired at no added cost to the Department.

The holes shall be blown clean with compressed air prior to placing the anchoring epoxy or grout material. The anchoring material shall be injected into the back of the hole to provide complete coverage around the dowels without any voids. The dowels, each with a grout retention disk, shall be inserted into the holes with a twisting motion and seated into place by tapping. The disk shall be flush to the face of the existing concrete. The dowels shall be solidly held in proper alignment before placement of the patch concrete.

Dowel placement and joint construction details for contraction joints within the patch area shall conform to the requirements of Standard Construction Details or details in the Plans.

The following are the allowable dowel translations and rotations: Vertical rotation - the difference in depth (vertical position) between the midpoint and the exposed end of the dowel; the allowable tolerance is ¼” of vertical deviation from the true longitudinal axis of the pavement. Horizontal rotation - the difference in lateral position between the midpoint and the exposed end of the dowel; the allowable tolerance is ¼” of horizontal deviation from the true longitudinal axis of the pavement. Longitudinal translation - the longitudinal distance between the exposed end of the dowel and the edge of the patch is 10" with an allowable tolerance of ± 1" .

The dowels at the end of each patch will be paid for under Item 503006-Dowels.

Side forms may be required when the patch is adjacent to a hot mix shoulder and the shoulder is damaged during concrete removal. Bonding of the transverse and longitudinal sides of the patch to the adjacent concrete slabs shall be prevented by an approved bond-breaking material such as a sheet of plastic over the vertical face or a light coating of a wax based curing compound covering the vertical face.

For existing composite pavements (hot-mix over concrete) that will not be overlaid, a 2" lift of hot-mix shall be placed over the concrete after the concrete has reached strength sufficient to allow opening to traffic.

**503.11 Placing Concrete.** Portland cement concrete shall be placed according to the requirements of Subsection 501.07. The concrete shall be deposited directly on the foundation and shall be uniformly distributed and spread over the entire foundation. Each patch area shall be cast in one continuous operation.

**503.12 Consolidating and Finishing Concrete.** The concrete shall be consolidated with an internal vibrator, particularly near the edges, corners, and around the dowels. The vibrator must be capable of visibly affecting the concrete from a distance of 1' from the vibrator head.

Except when a hot-mix surface is required or when an overlay will be placed, the surface of the patch concrete shall be struck off flush with the existing pavement. For patches up to 10' long, the screed shall be placed parallel to the centerline of the roadway. For longer patches, the screed may be placed perpendicular to the centerline of the roadway. The surface of the concrete patch shall be textured to match the surrounding pavement (tining, grooves, etc.), except when an overlay will be placed or diamond grinding will be performed.

The riding surface texture, profile, and cross section of the concrete patches shall meet the following requirements:

When the patch surface will be overlaid with Hot-Mix Asphalt as part of this Contract, the patch shall be broom finished or tined, with the texture applied in a direction perpendicular to the traffic flow. The profile and cross slope shall match the adjacent pavement surface. If the profile in the finished patch area contains excessive surface deviations, the patch is unacceptable. Excessive deviations are surface deviations greater than 1/8" from a reference line between points not greater than 10' apart along the direction of traffic.

When the patch surface will be part of the final surface of the roadway, the patch surface shall be finished to match the texture of the adjacent pavement. The patch surface cross section shall match the preceding and following pavement surfaces. The Engineer may test for excessive deviations with a straightedge, a California-type profilometer, or other surface measuring devices. When tested with a straightedge, excessive deviations are surface deviations greater than 1/8" from a reference line between points not greater than 10' apart along the direction of traffic. When tested with a profilograph, excessive deviations are surface deviations greater than 0.3" above or below a reference line between points not greater than 25' apart along the direction of traffic, when the pavement will not be diamond ground end-to-end after patching. When the pavement will be diamond ground end-to-end after patching, excessive deviations are defined as surface deviations greater than 0.4" above or below a reference line between points not greater than 25' apart along the direction of traffic and less than 0.3" after grinding. The Contractor shall correct unacceptable deviations in the patch areas before starting the end-to-end grinding.

**503.13 Curing and Protecting.** Curing shall conform to the requirements of Subsections 501.11 and 501.12 and the following:

The patch shall be cured and protected with either a liquid membrane curing compound and polyethylene sheeting or wet burlap and polyethylene sheeting.

When liquid membrane curing compound is used, it shall be applied uniformly upon completion of the patch texturing at a rate of 150 $ft^2$/gallon and then covered with polyethylene sheeting.

When burlap/polyethylene sheeting is used, the patch shall be covered with a layer of wet burlap immediately after the concrete has achieved initial set, and the wet burlap shall be covered with a polyethylene sheet. After the curing compound/polyethylene sheeting or burlap/polyethylene sheeting is applied, the patch shall be covered with an approved insulation blanket, and it shall remain in place until the concrete has achieved the design strength. Edges and seams in the insulation shall be secured to prevent penetration of the wind.

**503.14 Joints.** The transverse and longitudinal joints shall be formed or sawed as shown on the Standard Construction Details Transverse joints within the patch area shall be sawed at the proper time to assure proper cracking at the transverse crack. Cleaning and sealing of the joints with hot poured sealant material shall be completed within 5 days after concrete placement if no overlay is planned. The non-repaired transverse joints on each side of the patched area shall also be cleaned and resealed. Joints shall be cleaned by mechanical wire brushing or by light sandblasting. Immediately prior to resealing, the joint groove shall receive a final cleaning with compressed air having a minimum pressure of 90 psi. Repairs to damaged concrete or hot-mix shoulder shall be completed before the patch area is subjected to any traffic loading.

**503.15 Defective Work.** Concrete which fails to reach the full design strength in the specified 6-hours may be considered defective concrete based upon its structural adequacy.

If the concrete is determined to not be structurally adequate by the Engineer, it is considered defective and it shall be removed and replaced at no additional cost to the Department. If the concrete is determined to be structurally adequate by the Engineer and the concrete can remain in place, the Contractor may accept a prorated payment for the below-specified concrete as referenced below. If the Contractor does not wish to accept the prorated payment, the below-specified concrete shall be removed and replaced at no cost to the Department.

**503.16 Method of Measurement.** The quantity of Portland cement concrete pavement patch will be measured as the actual number of square yards of concrete patch placed and accepted. The width of measurement will be the full width from outside of the completed patches as constructed, measured parallel to the transverse saw cuts. The length will be the actual length measured parallel to the centerline of the pavement. The quantity of dowel bars will be measured as the actual number of dowel bars installed and accepted at the ends of each patch. Dowel bars and support assemblies (load transfer assemblies) installed at internal joints in Type B Patches will not be measured but will be considered as incidental to the Contract price per square yard for Item 503002 - Patching P.C.C. Pavement, greater than 15' to 100', Type B.

**503.17 Basis of Payment.** The quantity of Portland cement concrete pavement patch will be paid for at the Contract unit price per square yard . Price and payment will constitute full compensation for furnishing, hauling, and placing all materials, including high-early strength concrete; load transfer assembly, and joint filler (where applicable).; for removing, and disposing of existing concrete; for preparing the foundation; for tooling, finishing, curing, sealing of over cuts in non-overlay areas, and protecting the new concrete; for disposing of excess material; and for all labor, equipment, tools, and incidentals required to complete the work. In addition, the price and applicable payment(s) will be based on Type A or Type B Patches.

*Price Adjustment for Low Strength Concrete.* Prorated payment for concrete as specified in Subsection 503.15 shall be calculated as shown in the following equation:

$$\textit{Prorated Payment} = \frac{\textit{Actual 6-hour Compressive Strength}}{\textit{Specified 6-hour Compressive Strength}} \times (\textit{Quantity of Concrete}^{*}) \times (\textit{Bid Price}^{**})$$

* The quantity for which the low compressive strength results represent.
** Item bid price; not material cost.

**NOTE:**
**If the Engineer directs the Contractor (in writing) to place Portland cement concrete which is in violation to any applicable Specifications, or if any other Department Specification is violated, this Prorated Payment will not be enforced.**

The quantity of dowel bars will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for drilling holes, furnishing and installing grout and dowel bars with grout retention disk and for all labor, equipment, tools, and incidentals required to complete the work. Saw cutting the perimeter of the patch that is adjacent to concrete (including shoulder if applicable) will be measured and paid for under item 762002 - Saw Cutting, Concrete, Full Depth. All other saw cutting, including the joint between the concrete and hot-mix asphalt shoulder, will be incidental to the patching item(s).

Hot-pour sealant, if applicable, will be measure and paid for under item 503501. Any damage caused by the lift-out technique of the Contractor, shall be repaired by the Contractor at no cost to the Department.

## 503501 - CRACK AND JOINT SEALING LESS THAN 3/4" WIDE
## 503502 - CRACK AND JOINT SEALING 3/4" to 1 3/4" WIDE

**Description:**

The item shall consist of cleaning and sealing the existing P.C.C. pavement transverse and longitudinal joints, and pavement cracks in accordance with these specifications, plans, and as directed by the Engineer.

**Materials:**

**Pourable Sealant:** The Sealant shall meet the requirements of ASTM D 6690 (Classification-Type II). The Appendix of that specification shall be considered as part of this specification. Application for approval of joint and crack sealant material by the manufacturer shall be submitted to the Department's Materials and Research Section.

**Backup Material/Bondbreaker:** The backup material/bondbreaker shall be stitched cotton piping cord, polyethylene backer rod, or approved equal material that is compatible with the sealant to be used and capable of withstanding the required sealant application temperature without melting. Back-up material shall be 25% wider than the nominal width of the joints.

The diameter of the backup material/bondbreaker shall be such that when placed in the joint it will support the sealant at its design depth, allowing the sealant to achieve the design shape, prevent the sealant from leaking around and underneath it, and allow the sealant to deform freely when the joint expands and contracts.

The backer rod shall not be stretched during insertion in the joint. When the bottom of the joint opening to be sealed is formed by previously installed expansion joint material (such as at concrete patch locations), a nonreactive adhesive-backed tape shall be inserted in lieu of the backer rod. The tape shall be 1/8 inch (3 mm) wider than the nominal width of the joints.

**Sealant Equipment:** Proper sealing equipment shall be used for the specific material listed in accordance with the manufacturers recommendations. The equipment for hot applied sealing compounds shall be a melting kettle of a double boiler, indirect heating type, using oil as a heat-transfer medium. The kettle shall have an effective mechanically operated agitator and shall be equipped with a positive thermostatic temperature control which shall be checked for calibration before commencing. Overheating shall not be permitted. The hoses and applicator wand shall be insulated. The nozzle of the mechanical device shall be shaped to fit inside the joint and introduce the sealant between the joint faces.

**Construction Methods:**

Removal of existing joint sealant, sawing and/or refacing of joints, cleaning, shape factor dimensions, backup material and sealant installation shall be in accordance with these specifications.

**Existing Sealant Removal:** Any in-place sealant shall be removed from the joint using a vertical cutting edge tool; however, V-shape plow tools will not be permitted. A power driven concrete high pressure water blasting will be permitted.

The sealant shall be removed to the depth required to accommodate any separating and/or backup material used, and to provide the specified depth for the new sealant material to be installed.

**Refacing of Joints:** Joints shall be sawed or refaced using a power driven concrete saw with diamond or abrasive blades to remove all old sealant from the joint faces to expose new clean concrete and, if required, to cut the joint to the width and depth necessary to provide for an effective shape factor in the joint sealant.

**Cleaning Prior to Resealing:** Following all sawing, resawing, or refacing operations, the joint faces and opening shall be thoroughly cleaned by sandblasting followed by an oil-free air jet to remove all cuttings or debris remaining on the faces or in the joint opening. The newly exposed joint faces shall be cleaned by sandblasting. The sandblast joint cleaning operation shall be such that when completed the

concrete joint surface which is to receive the new joint sealant shall be free of all tar and asphalt, all old sealant, all discoloration and stain, as well as any and all other forms of contamination of the pore structure--leaving a clean, dry, newly exposed concrete surface.

Immediately prior to the placement of the backup material and the sealant, the joints shall be cleaned with a compressed air stream of at least 100 psi (690 kPa) measured at the source.

The air compressors used for the purpose described above must be equipped with traps capable of removing moisture and oil from the air. Work shall be stopped when there is oil or moisture in the compressed air. Work shall not resume until suitable adjustments are made and the air stream is found to be free of such contaminants.

Under no conditions will the Contractor be permitted to place the sealant if there is dust, moisture, oil, or any other contaminants on that portion of the concrete which is to receive the joint sealant.

The Contractor shall be responsible for protecting the public from hazard or damage during the sandblasting and joint cleaning operations. Rigidly supported plywood sheeting or other suitable material and method used for this purpose shall be subject to the approval of the Engineer.

During all operations, care shall be taken not to damage the subbase, curbs, shoulders, load transfer devices, or pavement. In the event that such damage occurs, it shall be repaired to the satisfaction of the Engineer at no expense to the State.

**Limits of Joint Preparation:** The work required for the removal of existing joint sealant, widening and/or deepening of the joint openings, if required, refacing of joint faces, and sandblasting of the joint faces should proceed at reasonable production rates. The final stages of joint preparation which includes air pressure cleaning of joints, and placement of separating and/or backup material shall be limited to only that length of joint that can be resealed during a day's production.

**Installation of Pourable Sealant:** A copy of the manufacturer's recommendations pertaining to the heating and application of the sealant shall be submitted to the Engineer prior to the commencement of work and these recommendations shall be adhered to and followed by the Contractor, with such exceptions as this specification may require.

At the start of the day's operations special procedures may be necessary in order to achieve a sealant temperature consistent with this specification. The Contractor shall ascertain from the manufacturer of the apparatus he is using, the procedures necessary and be able to so execute these procedures prior to his commencement of joint sealing operations.

The recommended pouring temperature shall be 10 degrees (5.5 degrees) below the manufacturer's designated Safe Heating Temperature. The allowable variance from the recommended pouring temperature shall be ±10 degrees (±5 degrees).

The first gallon (4 liters) of material to flow out of the applicator wand at the beginning of the day shall be considered spoil and as such be discarded into a container for proper disposal.

The applicator wand shall be returned to the machine and the material recirculated immediately upon the completion of each joint sealing.

Sealant compound shall not be placed unless the face of the joint is completely dry, clean and free of dust, and backup material installed at the required depth to provide a uniform, specified sealant thickness. Manufacturer's recommendations for application temperature shall be followed, however, the atmospheric and pavement temperature shall both be at least 50 degrees F (10 degrees C) but not greater than 90 degrees F (32 degrees C). at the time of application of the sealant. Installation of the sealant shall be such that the in-place sealant shall be well bonded to the concrete and free of voids or entrapped air. The joints shall be uniformly sealed in a neat and workmanlike manner, so that upon completion of the work, the surface of the sealant material shall be 1/4 in. ± 1/16 in (6 mm ± 1.5 mm) below the adjacent pavement surface. The Contractor shall "spot up" or refill all low joints before final acceptance. Any excess material on the surface of the pavement shall be removed and the pavement surface shall be left in a clean condition. Unless otherwise specified, the period of cure shall be in accordance with the manufacturer's recommendations.

Vehicular or heavy equipment traffic shall not be permitted on the pavement in the area of the joints during the curing period. The sealant shall be placed to conform with the dimensions and shape shown on the Plans and as specified herein. Any failure of the sealed joint due to lack of adhesion or cohesion of joint material; improper or unsatisfactory workmanship by the Contractor; or damage by the Contractor's operations or traffic will be cause for rejection. The joint(s) shall be repaired to the Engineer's satisfaction at no additional cost to the Department.

After a joint has been sealed, all excess sealant or other residue on the pavement surface shall be removed. Traffic shall not be permitted over sealed joints until the sealant is tackfree and until debris from traffic does not imbed into the sealant.

**Method of Measurement:**

The quantity of crack and joint sealing will be measured as the actual number of linear feet (meters) of cracks and joints sealed and accepted measured along the crack and/or joint, end to end.

**Basis of Payment:**

The quantity of transverse and longitudinal cracks and joints cleaned and resealed, measured from end-to-end shall be paid for at the Contract unit price per linear foot (meter) for "Crack and Joint Sealing Less than 3/4 in. (19 mm) Wide, and "Crack and Joint Sealing, 3/4 in. to 1 3/4 in. (19 mm to 44 mm) Wide. Price and payment will constitute full compensation for furnishing and placing hot poured joint sealer as specified on the Plans or as directed, backup material, for removal and disposal of existing joint sealer, for all joint resawing and refacing, for sandblast cleaning, airblast cleaning, for all labor, tools, equipment, and incidentals necessary to complete the item.

6/12/14

## 503503 - PATCHING CONCRETE

**Description:**

This item consists of furnishing and placing Portland Cement Concrete, conforming to the requirements of Section 503 of the Standard Specifications and/or as modified herein under this Contract. After removal of the existing P.C.C. pavement, if the base material is unsuitable or washed out, the unsuitable material shall be excavated and the void replaced with the same concrete used in the patch area. This additional depth shall not exceed 6″ (150 mm) from the bottom of the existing P.C.C. Pavement. Excessive moisture remaining after excavation, shall require construction of a pipe underdrain system, when directed by the Engineer and as shown on the Plans. All excavation below the bottom of existing pavement shall be paid for under the item "Undercut Excavation, Patching".

This item may also be used in areas of composite pavements (hot-mix over concrete) if the Contractor elects to pour concrete patch flush with existing hot-mix pavement to eliminate grade differential. This additional depth shall be as directed by the Engineer, but shall not exceed 6" (150 mm) in depth.

**Method of Measurement:**

The quantity of concrete patching will be measured as the actual number of square yards per inch of thickness (square meters per 25 mm of thickness) of additional thickness either above or below the existing concrete pavement. The area measured shall be the square yards (square meter) on the surface of the base course and the depth measured in inches (mm) from either top or bottom of the original P.C.C. pavement as determined from the adjacent pavement. The depth shall be as directed by the Engineer, but shall not exceed 6" (150 mm) in measurement or payment.

**Basis of Payment:**

The quantity of concrete patching will be paid for at the Contract fixed price of $5.65 per square yard per inch of thickness ($6.13 per square meter per 25 mm of thickness). Price and payment will constitute full compensation for furnishing and placing additional depth of concrete as described above, for all labor, tools, equipment, and incidentals to complete the item.

**NOTE**

Also, under the items 503001 - Patching P.C.C. Pavement, 6′ to 20′, Type A and 503000 - Patching P.C.C. Pavement, Greater than 20′ to 100′, Type B (503001 - Patching P.C.C. Pavement, 1.8 m to 6 m, Type A and 503002 - Patching P.C.C. Pavement, Greater than 6 m to 30 m, Type B), the Contractor shall be paid for the additional thickness of concrete actually poured in the field above the thickness specified on the P.C.C. Patching Plans at a fixed rate of $5.65 per square yard per inch of thickness ($6.13 per square meter per 25 mm of thickness).

10/06/06

## 503517 - P.C.C. PATCHING, PARTIAL DEPTH

**Description:**

All the requirements of Section 503 of the Standard Specifications shall be applicable except as modified in this Specification.

This work shall consist of partial depth patching of spalls, potholes, corner breaks or other surface distress in Portland Cement Concrete pavements. The patch area shall be prepared by removal of existing damaged and/or disintegrated concrete from the area indicated on the plans and/or as directed by the Engineer, and patched with materials indicated here or with approved materials.

**Materials and Construction Methods:**

The Contractor shall use rapid set patch materials (Sika Quick 2500 or Master Builders HD50 or Set 45 or Five Star Highway Patch or approved equal), in strict accordance with the manufacturer's recommendations.

1. The patch materials shall be a blend of selected Portland Cements, specially graded aggregates, admixtures for controlling setting time, water reducers for workability, and an accelerator. The mix shall be mechanically mixed on site.

2. The patch materials shall be supplied in a factory-blended bag/container accompanied with the manufacturer's recommendations.

3. The very rapid-setting cement mortar must be placed 1" in depth per lift for horizontal applications.

4. To prepare a very rapid-setting patching material, aggregate shall be added to the mix conforming to ASTM C-33, at a rate recommended by the manufacturer. The aggregate shall be (Delaware No. 8) 3/8" clean, well-graded, saturated surface dry aggregate, approved for use by Materials & Research.

Batch Portland Cement Concrete will not be permitted for partial depth patching.

Partial depth patches shall be constructed at locations shown on the plans and as directed by the Engineer in the field. A saw cut of prescribed depth shall be made around the perimeter of the patch area to provide a vertical face at the edge. Concrete within the parch area shall be broken and removed to a depth required with light (10-20 lbs.) pneumatic tools until sound and clean concrete is exposed. Care must be taken to avoid fracturing the sound concrete below the patch and undercutting or spalling patch boundaries during the jackhammering operation for the removal of the deteriorated concrete.

If a partial depth repair area abuts a working joint or crack which penetrates the full depth of the slab, an insert or other approved bond-breaking medium shall be used to maintain working joints or cracks.

After the patch surface of the existing concrete has been prepared, and just prior to placement of the patch material, it shall be air cleaned.

The rapid set patch material shall achieve a compressive strength of 2,000 psi.

If the Contractor, because of unfavorable ambient temperature, is unable to accomplish the desired strength, he shall reschedule the proper timing for performing the patching work.

For day time projects only, the areas to be patched shall be prepared and poured allowing sufficient time to accomplish 2,000 psi compressive strength before dark. If the specified compressive strength is not attained, flagman, lights, barricades, warning lights, and other traffic control devices required after dark, shall be placed and maintained by the Contractor at his own expense.

All joints with the existing concrete pavement (transverse and longitudinal) shall be tooled or sawed to form a sealant reservoir with the dimensions of 3/4 by 3/4 inch. An approved bond breaking material (such as tape, backer rod, etc.) shall be placed on the bottom of the reservoir prior to placement of the sealant system in order to allow bonding of the system materials to only the vertical surfaces of the concrete in the reservoir.

The patched areas shall not be open to traffic until so permitted by the Engineer.

**Basis of Payment:**

The payment for the item shall be made for at the contract unit price per square yard per inch of depth for "P.C.C. Patching, Partial Depth" of specified depth, which price and payment shall constitute full compensation for furnishing and placing all materials, including admixtures, aggregates, and accelerants, removal and disposal of old concrete pavement, curing, joint sealing, for all labor, tools, equipment, and incidentals necessary to complete the work.

2/28/09

**612519 - CORRUGATED POLYETHYLENE PIPE, TYPE C, 15"**
**612521 - CORRUGATED POLYETHYLENE PIPE, TYPE C, 12"**
**612527 - CORRUGATED POLYETHYLENE PIPE, TYPE C, 18"**
**612528 - CORRUGATED POLYETHYLENE PIPE, TYPE C, 24"**

**Description:**

The item(s) shall consist of furnishing and installing corrugated polyethylene pipe with a corrugated surface both inside and outside in reasonably close conformity with lines and grades indicated on the plans, and as directed by the Engineer.

**Materials:**

Pipes, couplings and fittings shall be made of polyethylene compounds; and shall meet all applicable requirements of AASHTO M294 current edition Type C. The pipes and fittings shall be free of foreign inclusions and visible defects and pipe shall be cut squarely and cleanly so as not to adversely affect joining or connecting. Visible defects such as cracks, creases, unpigmented or nonuniformly pigmented pipe are not permissible in the pipe as furnished.

The pipe as noted below shall have minimum pipe stiffness at five percent deflection when tested in accordance with the requirements of ASTM D-2412:

| Diameter [Inches (mm)] | Pipe Stiffness [psi (KPa)] |
|---|---|
| 12 (300) | 50 (345) |
| 15 (375) | 42 (240) |
| 18 (450) | 40 (276) |
| 24 (600) | 34 (234) |

The fittings shall not reduce or impair the overall integrity or function of the pipe line, and shall include in-line joint fittings, such as couplings and reducers, and branch or complimentary assembly fittings such as tees, wyes, and end caps. These fittings may be installed by various approved methods, such as snap-on, screw-on, and wrap around. Fittings produced by the manufacturer's other than the supplier of the pipe shall not be permitted without the approval of the Engineer.

All fittings shall be within an overall length dimensional tolerance $\pm$ 0.5 inch (13 mm) of the manufacturer's specified dimensions when measured in accordance with AASHTO M-294 and shall not reduce the inside diameter of the pipe being joined by more than 0.5 inch (13 mm).

Reducer fittings shall not reduce the cross-sectional area of the small size.

Couplings shall be corrugated to match the pipe corrugations and shall provide sufficient longitudinal strength to preserve pipe alignment and prevent separation at the joint. Couplings shall be bell and spigot, split collar, or screw-on collar. Split collar couplings shall engage at least two full corrugation on each pipe section and screw on collars shall be in width at least one-half the nominal diameter of the pipe.

Pipe connections shall not separate to create a gap exceeding 3/16 inch (4.8) when measured in a radial direction between pipe and coupling, or between tongue and groove portions of pipe.

The Engineer may demand a manufacturer's certificate signed by the manufacturer's representation stating the product was manufactured, tested and supplied in accordance with all the applicable requirements of AASHTO M-294.

**Construction Methods:**

Pipe shall be installed in accordance with the applicable requirements of Section 614 of the Standard Specifications and notes on the plans. Backfill materials, and placement of the material shall conform to the applicable requirements of Section 208 of the Standard Specifications.

Joint shall be made with split couplings, corrugated to match the pipe corrugations; and shall engage a minimum of two full corrugations for on each pipe section at the joint. A neoprene gasket shall be used with the couplings to provide a soil tight joint.

**Method of Measurement:**

The number of feet of polyethylene pipe to be paid under the item(s) shall be the number of linear feet (meters) of pipe installed in place complete and accepted, measured from end to end of pipe.

**Basis of Payment:**

The number of linear feet of polyethylene pipe measured and as provided above shall be paid for at the contract unit price per Linear Foot (meter) bid for the item "Corrugated Polyethylene Pipe, Type C" of the diameter size(s) required by this contract, which price and payment shall constitute full compensation for furnishing, hauling and installing as described herein and required at the site, cribbing, shoring, and sheeting, for all labor, tools, equipment and necessary incidentals to complete the work.

For round pipe under 24" (600 mm) nominal inside diameter, the excavation (excluding rock), backfill, and backfilling will be included in the price for this work. For pipe of nominal inside diameter or horizontal dimension of 24" (600 mm) and over, payment for excavation and backfill will be in accordance with Section 208. Furnishing of Borrow Type C for pipe of nominal inside diameter or horizontal dimension of 24" (600 mm) and over, will be paid for under Section 210.

Payment for excavation and replacement of unsuitable material encountered below the flow line of pipe will be provided for under Section 208.

1/3/2012

## 705505 - RESET STONE/BRICK SIDEWALK AND/OR STONE/BRICK ROADWAY

**Description:**

This work consists of removing and resetting the existing stone/brick sidewalk and/or roadway in accordance with details, notes on the Plans and as directed by the Engineer.

**Materials and Construction Method:**

The stone/brick blocks from the existing sidewalks and/or roadway shall be removed, cleaned and stored for later use. Sand and/or mortar required for setting the stones/bricks shall comply with the applicable requirements of Section 610 of the Standard Specifications.

The installation pattern and spacing of stones/bricks shall match the existing sidewalk and/or roadway setting, unless otherwise specified on the Plans. The stones/bricks shall be set on an approved compacted foundation with 2" (50 mm) of sand over it. Joint filler material (sand or mortar) shall be compatible with the original sidewalk and/or roadway.

After completion of stone/brick setting, the sidewalk and/or roadway surface area shall be thoroughly cleaned of mortar and/or as applicable to the contract.

**Method of Measurement:**

The quantity of stone/brick sidewalk and/or roadway reset will be measured as the number of square feet (square meters) measured at the surface of the sidewalk and/or roadway, reset and accepted.

**Basis of Payment:**

The quantity of stone/brick sidewalk and/or roadway reset will be paid for at the Contract unit price per square foot (square meter). Price and payment will constitute full compensation for removal, storage and cleaning of stones/bricks, furnishing all materials, resetting and cleaning the sidewalk and/or roadway, disposal of discarded materials, for all labor, tools, equipment, and all necessary incidentals to complete the work. The cost of providing replacement stone/brick for those which are damaged is incidental to this item.

3/5/05

## 705530 – TRIANGULAR CHANNELIZING ISLANDS

**Description:**

Furnish all materials to construct Triangular Channelizing Island(s) on a prepared foundation as shown on the details in Plans, at the location(s) shown on the Plans, and/or as directed by the Engineer.

**Materials:**

Provide materials as specified in:

| | |
|---|---|
| Graded Aggregate Base Course | Section 302 |
| Bituminous Pavement | Section 401 |
| Bituminous Patching | Section 406 |
| Portland Cement Concrete | Section 812, Class B |
| Expansion Joint Material | Subsection 808.06 |
| Curing Compound | Subsection 812.02 (i) |
| Delineator | As Submitted and approved by Engineer |

General: Submit all proposed sources of materials to Materials and Research Section in accordance with Subsection 106.01.

**Construction Methods:**

A. Construction of Triangular Channelizing Island(s)

1. Sawcut existing bituminous concrete pavement or PCC pavement, if applicable;
   a. For bituminous concrete pavements, sawcut 2' minimum from the proposed face of curb of the island to allow enough room to achieve compaction for hot-mix patching;
   b. For PCC pavement, sawcut at the proposed face of curb.

2. Remove bituminous concrete pavement or PCC pavement and dispose of in accordance with Subsection 106.09 and/or permits, if applicable;

3. Prepare the foundation for the curb in accordance with Subsections 701.05;

4. Place Graded Aggregate Base Course (GABC) for curb installation at the location and depths shown on the plans in accordance with Section 302;

5. Layout and pour PCC Curb Type II in accordance with Section 701 unless otherwise specified on the plans or directed by the Engineer;
   a. Finish curb in accordance with Subsection 701.11;
   b. Cure curb in accordance with Subsection 701.13;
   c. Backfill curb in accordance with Subsection 701.14 after removal of forms, or upon completion of slip-form operation;

6. Prepare the foundation for the sidewalk in accordance with Subsection 705.05;

7. Place concrete for sidewalk at depth(s) shown on plans in accordance with Section 705;
   a. Install 4" PVC sleeve for signs at locations shown on plans;

8. Construct Curb Ramps, if applicable, in accordance with the requirements of the Standard Construction Details, any modifications on the plans and to all the applicable requirements of Section(s) 302 and 705 of the Standard Specifications.

9. Furnish and install Sidewalk Surface Detectable Warning System, if applicable, in accordance with the requirements of the Standard Construction Details and to all the applicable requirements of Section 705.

10. Perform bituminous concrete patching in accordance with Section 406 and/or PCC patching in accordance with Section 503, if applicable, as shown on plans or otherwise match existing pavement structure;

11. Furnish and install Delineator(s) on the leading ends/corners of the island(s).

**Method of Measurement:**

The quantity of Triangular Channelizing Island(s) will be measured as the number of square foot (square meter), from face of curb to face of curb, of Triangular Channelizing Island(s) installed and accepted.

Sidewalk Surface Detectable Warning System will be measured and paid for under Item No. 705007.

**Basis of Payment:**

The quantity of Triangular Channelizing Island(s) will be paid for at the Contract unit price per square foot (square meter). Price and payment constitutes full compensation for sawcutting hot-mix, sawcutting concrete full depth, removal and disposal of existing materials, foundation preparation, furnishing and placing all materials including but not limited to; GABC, concrete for curb and sidewalk, expansion joint material, the construction of curb ramps within the limits of the island, bituminous pavement and/or PCC pavement patching, for furnishing and installing delineator(s) and for all labor, tools, and incidentals necessary to complete the work.

No additional payment will be made under other contract items for work necessary to construct the island except Item No. 705007 - Sidewalk Surface Detectable Warning System.

**Note:** The curb and sidewalk components are not to be placed monolithically unless otherwise directed by the Plans or the Engineer.

10/25/2013

# 727502 - ADJUSTING EXISTING MONUMENT BOX

**Description:**

This work consists of adjusting the existing monument box in accordance with notes and details shown on the Plans and/or as directed by the Engineer.

**Materials and Construction Methods:**

Portland cement concrete for the item shall be Class B, and shall conform to the requirements of Section 812 of the Standard Specifications.

The monument box shall be raised and adjusted in accordance with the details shown on the Plans, and curing of the P.C. concrete shall be done in accordance with the applicable requirements of Section 501 of the Standard Specifications.

**Method of Measurement:**

The quantity of monument boxes adjusted will be measured as the actual number of each adjusted and accepted.

**Basis of Payment:**

The quantity of monument boxes adjusted will be paid for at the Contract unit price per each. Price and payment shall constitute full compensation for furnishing all materials including concrete, excavation and backfill, disposal of discarded materials, adjusting the monument box, for all labor, equipment, and incidentals necessary to complete the item.

11/8/01

**744500 - CONDUIT JUNCTION WELL, TYPE 6, PRECAST POLYMER CONCRETE**
**744506 - CONDUIT JUNCTION WELL, TYPE 7, PRECAST POLYMER CONCRETE**
**744507 - CONDUIT JUNCTION WELL, TYPE 8, PRECAST POLYMER CONCRETE**
**744508 - CONDUIT JUNCTION WELL, TYPE 9, PRECAST POLYMER CONCRETE**
**744509 - CONDUIT JUNCTION WELL, TYPE 10, PRECAST POLYMER CONCRETE**
**744520 - CONDUIT JUNCTION WELL, TYPE 1, PRECAST CONCRETE**
**744523 - CONDUIT JUNCTION WELL, TYPE 4, PRECAST CONCRETE**
**744524 - CONDUIT JUNCTION WELL, TYPE 5, PRECAST CONCRETE**
**744530 - CONDUIT JUNCTION WELL, TYPE 11, PRECAST CONCRETE/POLYMER LID-FRAME**
**744531 - CONDUIT JUNCTION WELL, TYPE 14, PRECAST CONCRETE/POLYMER LID-FRAME**
**744532 - CONDUIT JUNCTION WELL, TYPE 15, PRECAST CONCRETE/POLYMER LID-FRAME**

**Description:**

This work consists of supplying, constructing and installing conduit junction wells as shown on the applicable Plan Sheets or Standard Construction details

**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.

All required hardware and wire for Bonding and Grounding as shown on the Standard Construction or applicable Plan details.

Types 6, 7, 8 and 10 are precast polymer concrete stackable boxes with no base.

Precast polymer concrete is reinforced by heavy-weave fiberglass with a compressive strength of 9,000-15,000 psi, impact energy of 30-72 ft. lbs. and a tensile strength of 800-1,100 psi. 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. over a 10" 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).

Types 11, 14, and 15 are precast polymer frame and lids installed on a precast concrete base. Precast polymer concrete frame and lids shall be the heavy-duty nonconductive type with a design load of 15,000 lbs. over a 10" square. The coefficient of friction should be greater than 0.5. The precast polymer concrete lid logo shall bear the inscription "DelDOT ELECTRIC"(Types 11, 14, and 15)

**Construction Methods:**

The conduit junction well shall conform to the dimensions shown on the Standard Construction or applicable Plan Details, 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, pedestrian curb ramps, 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 applicable plan sheets or Standard Construction Details. A stone base shall be built for all types of junction wells. Grounding and bonding of the units shall be performed as shown on the plans or Standard Construction details.

**Method of Measurement:**

The quantity of junction wells shall be the actual number of conduit junction wells by type, that are supplied, constructed, complete in place, and accepted, including cast iron frames and lids with grounding lugs, precast polymer concrete frame and covers, or precast polymer concrete covers, stone base, bonding, grounding, and splicing if required. 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 or applicable Plan 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, backfilling, and stone base. Price and payment will constitute full compensation for all labor, equipment, tools, and incidentals required to complete the work.

2/29/12

# 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

**744533 - FURNISH & INSTALL FRAME AND LID FOR JUNCTION WELL, TYPE 1**
**744534 - FURNISH & INSTALL FRAME AND LID FOR JUNCTION WELL, TYPE 4**
**744535 - FURNISH & INSTALL FRAME AND LID FOR JUNCTION WELL, TYPE 5**
**744536 - FURNISH & INSTALL PRECAST POLYMER COVER FOR JUNCTION WELL, TYPE 6**
**744537 - FURNISH & INSTALL PRECAST POLYMER COVER FOR JUNCTION WELL, TYPE 7**
**744538 - FURNISH & INSTALL PRECAST POLYMER COVER FOR JUNCTION WELL, TYPE 8**
**744539 - FURNISH & INSTALL PRECAST POLYMER COVER FOR JUNCTION WELL, TYPE 9**
**744540 - FURNISH & INSTALL PRECAST POLYMER COVER FOR JUNCTION WELL, TYPE 10**
**744541 - FURNISH & INSTALL FRAME AND LID FOR JUNCTION WELL, TYPE 11**
**744542 - FURNISH & INSTALL FRAME AND LID FOR JUNCTION WELL, TYPE 14**
**744543 - FURNISH & INSTALL FRAME AND LID FOR JUNCTION WELL, TYPE 15**

**Description:**

This work consists of furnishing and installing cast iron frames and lids or precast polymer concrete covers for existing junction wells only. The item shall not be used when furnishing new junction wells as the frames and lids are included in the price for the new units. The frames and lids are as shown on the Standard Construction or applicable Plan Details. The work includes furnishing and installing all required materials and hardware to properly ground the unit, including wire and splicing if required and as shown on the Standard Construction or applicable Plan Details.

**Materials:**

Castings for frames, lids, and ½" dia. x 1 ¼" grounding lugs shall conform to Section 708.05 of the Standard Specifications and Standard Construction Details or applicable Plan Details.

Precast polymer concrete covers shall be reinforced by heavy-weave fiberglass. All precast polymer concrete covers shall be the heavy-duty type with a design load of 15,000 lbs. over a 10" square and a coefficient of friction greater than 0.5. The precast polymer concrete cover logo shall bear the inscription "DelDOT Traffic" for Types 6, 8, and 10 and "DelDOT Traffic Fiber Optics" for Type 7. The precast polymer concrete cover Type 11, 14, and 15 logo shall bear the inscription "DelDOT ELECTRIC".

Material for Grounding, bonding, and all related hardware and wire (including splicing if required) shall be as shown on the Standard Construction or applicable Plan Details.

**Method of Measurement:**

The quantity of spare frames and lids or precast polymer concrete covers shall be the actual number of frames and lids or precast polymer concrete covers by type furnished, installed, bonded, grounded and accepted.

**Basis of Payment:**

The item 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.

2/29/12

# 744544 – 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 applicable Plans, the Standard Construction Details, and as directed by the Engineer. If Bonding and Grounding of the unit is required, that work will be paid for under "Bonding and Grounding Existing Junction Well".

**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 resetting existing 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.

2/29/12

**745601 – FURNISH & INSTALL UP TO 3" FLEXIBLE METALLIC-LIQUIDTIGHT CONDUIT**
**745602 - FURNISH & INSTALL UP TO 4" SCHEDULE 80 HDPE CONDUIT (BORE)**
**745603 - FURNISH & INSTALL UP TO 4" SCHEDULE 80 PVC CONDUIT (OPEN CUT)**
**745604 - FURNISH & INSTALL UP TO 4" SCHEDULE 80 PVC CONDUIT (TRENCH)**
**745605 - FURNISH & INSTALL UP TO 4" SCHEDULE 80 PVC CONDUIT (ON STRUCTURE)**
**745606 - FURNISH & INSTALL UP TO 4" GALVANIZED STEEL CONDUIT (TRENCH)**
**745607 - FURNISH & INSTALL UP TO 4" GALVANIZED STEEL CONDUIT (BORE)**
**745608 - FURNISH & INSTALL UP TO 4" GALVANIZED STEEL CONDUIT (OPEN CUT)**
**745609 - FURNISH & INSTALL UP TO 4" GALVANIZED STEEL CONDUIT (ON STRUCTURE)**
**745610 - FURNISH & INSTALL UP TO 4" NONMETALLIC POLE RISER SHIELD**

**Description:**

Furnish and install HDPE, PVC, or Galvanized steel conduits of any size less than or equal to 4 inches in diameter (3 inches or less for Flexible Metallic Liquidtight Conduit) as described below.

**Materials:**

All conduits shall be UL listed.

**HDPE Conduit -** 4" or less diameter, high density polyethylene (HDPE) schedule 80, smooth wall conduit with permanently pre-lubricated lining, meeting ASTM D2447, ASTM D3035 and NEMA TC7 specifications.

**PVC Conduit -** 4" or less diameter, schedule 80 rigid polyvinyl chloride (PVC) conduit, meeting Commercial Standard CS-272-65 (PVC), ASTM D-1785 and U.C. Standard 651 specifications.

**Galvanized Steel Conduit -** 4" or less diameter, rigid galvanized steel conduit meeting National Electric Code 2002, Article 344.

**Nonmetallic Pole Riser Shield** – 4" diameter or less nonmetallic pole riser shield with belled ends meeting NEMA TC-19 specifications.

**Flexible Metallic-Liquidtight Conduit** – meets National Electric Code 2002, Article 350

**Weatherhead for galvanized or PVC conduit –** material shall match the adjoining conduit

**Insulated grounding bushing with knockouts** - meet or exceed UL 514 B

**Condulets for conduit sizes -** material shall match the adjoining conduit

**Anchors -** A 307, Galvanized per A 153

**One hole conduit hangers -** Steel City Series 6H or 6H-B, CADDY CD3B Rigid Conduit Hanger, or approved equal

**End caps -** material shall match the adjoining conduit

**LONG sweep sections for conduit sizes -** material shall match the adjoining conduit, and shall be manufactured 90 degree sweeping bends.

**Construction Methods:**

**General Installation Requirements -** 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 600 feet for fiber optic conduit or no more than 300 feet for copper in conduit, or as directed by the Engineer. If bends are required during installation, they must be manufactured 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 and a maximum cover of 48 inches.

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 metallic 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 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 inside a junction well. See Standard Construction Details or applicable Plan Details for typical methods of termination.

All underground conduits shall be marked in the ground with a metallic warning tape. The marking tape shall be buried directly above the conduit run that it identifies, at a depth of approximately 12 inches below final grade. The tape identifying ALL conduits shall be at least 6 inches wide, and have a minimum thickness of 3 mils and 500 percent elongation.

The color of the metallic 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, 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 shall be installed in each conduit for future use. In instances where the Contractor installs the cable, the fish wire may be eliminated.

All PVC and HDPE conduits shall have a continuous metallic trace wire installed for the entire length of the conduit run for all fiber installations.

**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". The size of a bore shall not exceed the outside diameter of the conduit by more than 1 inch. If it does, cement grout shall be pumped into the void. **Only HDPE and/or Galvanized Steel conduit may be installed by Directional Bore methods.**

**Installation Of Conduit Under Existing Pavement, Open Cut -**

Installation by sawcutting the full pavement depth and removing the existing pavement with an excavator or by hand methods, shall be used only for conduits not less than 1-1/2" diameter. The Engineer must first approve all open cutting of roadways. The width and length of open cut and patch restoration materials shall be as shown on the plan details. The Contractor shall be responsible for the removal of all cut pavement and surplus excavation, and for the replacement and correction of any damaged pavement outside the sawcut limits after the conduit(s) are installed. Asphalt pavement, concrete, base course, sawcutting, and/or borrow from an outside source as required to restore the roadway will be paid for separately under their respective bid items.

**Installation Of Conduit Under Existing Pavement, 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 be removed either by the use of an approved sod cutter and then replaced, or 6 inches 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. Sodding and/or topsoil from an outside source if required will be paid for separately under their respective bid items. Seeding is considered incidental to the conduit item.

**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 apart. Any 90-degree turns in the conduit run shall be accomplished by placing the proper size and type manufactured sweeping bends for the application needed.

**Installation of Nonmetallic Riser Shield or Flexible Metallic Liquidtight Conduit -**

Riser Shield and/or Flexible Metallic Liquidtight Conduit installed on wood poles, metal poles, structures, and/or mast arms shall be installed in a straight line. The conduit, when attached to poles, shall be attached with 2-hole straps spaced not more than 36 inches apart with the top-most strap being 12 inches from the weatherhead and the lower-most being 12 inches from the condulet. A weatherhead matching the diameter of the conduit shall be installed on the upper end of the conduit. A condulet of the same size as the conduit being installed, but not smaller than 2 inches shall be placed 48 inches above finished grade. Install two, 2-hole straps of the proper size, evenly spaced below the condulet. Nonmetallic pole risers (U-guard) shall be installed on 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 or metallic liquidtight conduit is not the same size as the conduit, an adapter shall be used at no additional cost to the Department. The nonmetallic pole riser or metallic liquidtight conduit shall be attached to the pole with 1/4" x 1-1/2" galvanized lag bolts with washers. Lag bolts will be used every 36 inches on BOTH sides of the nonmetallic pole riser or liquidtight conduit, and in the top most and bottom most set of slots. Flexible metallic liquidtight conduit shown on the plans to be installed on mast arms or on metal structure shall also include stainless steel banding placed at a maximum of 5 feet intervals.

**Method of Measurement:**

The quantity of conduit or riser shield installed as specified, shall be measured as the number of linear feet of each conduit or riser shield installed as specified, complete in place, and accepted.

The length of each conduit installed under existing pavement by a directional bore or by open cutting the pavement shall be measured along the path of the bore or open cut, from the point that cannot be trenched to the point that trenching can resume.
The length of any conduit that is reduced or divided (with a junction well or conduit body) shall be measured as part of the larger conduit.

**Basis of Payment:**

The quantity of conduit or riser shield will be paid for at the Contract unit price per linear foot. Price and payment shall include full compensation for furnishing all conduit and/or riser shield materials, equipment, labor, and incidentals necessary to complete the item.

For conduit installed by Directional Bore, the linear foot payment also includes excavation and backfilling for Bore Equipment, placing the conduit, caps if required, and all other requirements and incidentals listed in the body of this specification.

For conduit installed by Open Cutting existing pavement, the linear foot payment also includes excavating, backfilling, placing the conduit, disposal of excess materials, and all other requirements and incidentals listed in the body of this specification.

For conduit installed in an Unpaved Trench, the linear foot payment also includes excavating, removal of sod if required, backfilling, placing the conduit, disposal of excess materials, replacing excavated on-site sod if required, seeding if required, and all other requirements and incidentals listed in the body of this specification. Sod and/or topsoil furnished from an outside source, will be paid for separately.

For conduit installed on a structure, the linear foot payment also includes furnishing and installing anchors and hangers, removal of excess materials, and all other requirements and incidentals listed in the body of this specification.

For riser shield or flexible metallic conduit installed on poles, mast arms, or structures the linear foot payment also includes furnishing and installing straps, weatherhead, condulet, lag bolts and washers, any other required mounting hardware, and all other requirements and incidentals listed in the body of this specification.

2/29/12

# 746614 - POLE BASE EXTENSION

**Description:**

This work consists of furnishing and installing all materials necessary to increase the vertical dimension of the pole base. The extension shall consist of reinforced concrete to a depth in accordance with the notes and details on the Plans and as directed by the Engineer.

**Materials:**

The concrete for pole base extensions shall conform to Section 812, Class B of the Standard Specifications.

Bar reinforcement shall meet the requirements of Section 603 Grade 60 of the Standard Specifications.

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.

All applicable requirements of Section 746 of the Standard Specifications shall govern and be supplemented by notes and details on the plans.

**Construction Methods:**

Where pole bases are required to extend to a depth greater than that given on Standard Construction Details, they shall be extended as directed by the Engineer.

Reinforcing bars shall be extended in a pattern that complies with the Standard Drawings and matches the pattern of the pole base being extended using continuous vertical bars and is in accordance with Section 603.07 of the Standard Specifications.

The pole base extension shall include a longer length ground rod so that a minimum of 8 feet (2.5 m) of rod is driven into undisturbed earth and 8 inches (200 m) is above the final grade of the pole base.

**Method of Measurement:**

The quantity of pole base extension will be measured by the cubic feet (cubic meters) of concrete required to increase the vertical dimension from the standard depth to the increased depth. The volume will be measured by multiplying the vertical increase in depth by the cross-sectional area of the standard pole base. Reinforcement bars, excavation and backfilling will be incidental to this item and included in the unit price bid.

**Basis of Payment:**

The quantity of pole base extensions will be paid for at the Contract unit price per cubic foot (cubic meter) of pole base extension. Price and payment will constitute full compensation for furnishing and placing all materials including bar reinforcement, ground rod as required, excavation, and backfilling; and for all labor, equipment, tools, and incidentals required to complete the work.

01/15/03

**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 base 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 with Borrow Type C and tamped on all sides in continuous, horizontal layers not to exceed 68 inches (200150 mm) in depth, loose measurement.

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. Concrete, excavation and backfilling around the base, ground rods, and the two conduit sweeps in the base are included in this item.

Furnishing Borrow Type C backfill material will be measured and paid for separately by the cubic yard (cubic meter).

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:**

Borrow Type C will be paid for under Section 210. No payment for Borrow Type C backfill material placed outside of the vertical plans located 18" (450 mm) outside of the neat line perimeter of the vertical face of the pole base foundation.

Any increase in the vertical dimension required herein shall be paid for separately under Item 746614, Pole Base Extension; another item of this contract.

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 including concrete, ground rods, and 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.

3/1/12

## 746883 - PARTIAL 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.

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.

02/03/03

## 746924 - FURNISH & INSTALL LOOP WIRE 1-CONDUCTOR #14 AWG ENCASED IN ¼" FLEXIBLE TUBING IN A LOOP SAWCUT

**Description:**

Sawcut and seal existing pavement, furnish and install loop detector wire, aluminum shielded "home-run" cable, as shown on the Plans.

**Materials:**

1. **1-conductor #14 AWG Cable in ¼" Flexible Tubing -** shall consist of cable preinstalled in a polyethylene (PE) plastic duct meeting IMSA 51-5. Cable shall be rated for 600 volts. The cable shall have a temperature tolerance range of at least - 65 to + 176 degrees Fahrenheit. The conductor is AWG #14 stranded copper. Outside diameter of the cable is 0.25 inches. Referred to as "loop wire"

2. **2-conductor #14 AWG Aluminum Shielded Cable –** see specifications for furnish and install cable. Referred to as "home-run cable".

3. **Flexible embedding sealer** - 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 Industry11 1 for asphalt pavement, or approved equal. A sealer accelerant or retarder may be added per the manufacturers specifications.

4. **Backer Rod -** 5/8" closed cell foam

5. **Tape –** Vinyl electrical tape shall have a PVC base with rubber based pressure sensitive adhesive. The tape shall be a minimum 7 mils thick and be UL listed and marked per UL Standard 510 as flame retardant and cold resistant. It shall be compatible with synthetic cable insulations, jackets and splicing compounds and rated for wire and cable splices up to 600-volts.

6. For splices in Junction Well (see plan detail):

   a. Dual Wall Heat Shrink Tubing – Heat-shrink tubing shall be medium or heavy wall thickness, irradiated polyolefin tubing containing an adhesive mastic inner wall. Minimum wall thickness prior to contraction shall be 40 mils. When heated, the inner wall shall melt and fill all crevices and interstices of the object being covered while the outer wall shrinks to form a waterproof insulation. Each end of the heat-shrink tube or the open end of the end cap of heat-shrink tubing shall, after contraction, overlap the conductor insulation at least one and one-half inches. Heat-shrink tubing shall conform to the requirements in UL Standard 468D and ANSI C119.1, for extruded insulated tubing at 600 V.

   b. Soldering iron with Rosin Core solder

   c. Splicing Kit- In-line barrel type design, resin encapsulating compound kit with UL486 rating. Suitable for use in wet or direct buried locations. Resin encapsulating compounds shall be acceptable for use at 16 degrees C.

**Construction Methods:**

**Loop Wire Installation:**

The pavement saw cut shall be 5/8" wide and up to 3½" deep. It shall be "wet-cut" in the directions and sizes specified on the Plans, 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 prior to sealing. 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"). A 5/8" backer rod will be placed into the bottom of the saw cut as needed to secure the wiring within the saw cut. 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.

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 and finished flush with the pavement. Drilled holes in the pavement shall also be sealed.

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 Plan Details). Wires shall be parallel, twisted a minimum of 5 wraps per foot, and taped every 12" to 18" from the end of the saw cut to a junction well up to the splice. The loop detector wire shall be installed between the end of the saw cut and junction well through a penetration created by a 1 ½" rotary drill as directed by the Engineer.

The loop detector wire shall be continuous and without splices from the junction well, through the saw cuts and conduit.

**Home-run Wire Installation -** refer to furnish and install cable specifications and conduit installation specifications. Refer to plans for details.

**Splicing** – splices between the loop detector wire and home-run cable shall be done in accordance with the plan details.

Conductors to be soldered shall be placed side by side with the exposed copper aligned. The copper shall then be twisted clockwise with pliers until a good mechanical connection is affected. The splice shall be coated with flux, heated with a soldering iron, and rosin core soldered in a manner that minimizes insulation damage. After each soldered connection is completed, it shall be properly insulated with heat shrink tubing.

After the electrical and mechanical connection is completed and before the splicing kit is applied, a test shall be made by the Contractor to ensure that all circuits are complete. An approved splice kit shall be installed as per manufacturer's instructions. A continuity test will be performed at the cabinet by the Department technician after the splicing kit is applied. The Department will be notified of the test results. If the continuity test fails the Contractor shall remake the splice and/or loop at his own expense.

If a splice is found to be faulty within 90 calendar days of installation, it shall be the Contractor's responsibility to remake the splice at his own expense.

**Method of Measurement:**

The quantity of loop detector wire to be measured under this item shall be the number of linear feet of sawcut in which loop detector wire is installed, sealed, tested, and accepted.
Sealer, sealer accelerant or retarder shall be incidental to this item.

Loop detector wire routed through the rotary drill penetration is considered incidental to the cost of the loop installation.

Conduit and associated home-run cable between the junction well and cabinet will be measured and paid for under their respective items, separate from this specification.

Splicing of the loop detector wire to a home-run cable in a junction well shall be incidental to the cost of the loop wire.

**Basis of Payment:**

The quantity of loop detector wire supplied and installed will be paid for at the Contract unit price per linear foot, determined by measuring the footage of sawcut described above. Price and payment shall constitute full compensation for "wet"-sawcutting, furnishing and placing all materials including loop detector wire, backer rod, sealer, and for all labor, equipment, tools, splicing in the junction well, and incidentals necessary to complete this item.

The price bid per linear foot of sawcut with Loop Wire shall include drilling required for installation, concrete and pavement patching, sealing the conduit ends, internal bushings shown on the plans, and all incidentals necessary to complete the item.

7/18/14

# 747514 - CABINET BASE TYPE F
# 747515 - CABINET BASE TYPE M
# 747516 - CABINET BASE TYPE P
# 747517 - CABINET BASE TYPE R

**Description:**

This work consists of constructing cabinet base Type F, M, P and R in accordance with the Standard Construction Details or applicable Plan Details and at locations as directed by plans or the Engineer.

**Materials:**

Class B Concrete
3/4" x 10' sectional copperclad steel ground rods
5/8" Zinc plated or Stainless Steel Drop-in Anchors manufactured by Hilti Systems, Concrete Fastening Systems, or approved equal
5/8" x 1-1/2" galvanized hex bolts
3/4" acorn type ground clamps
PVC conduit sweeps

**Construction Methods:**

The base shall conform to the dimensions as indicated in the cabinet base detail on the Standard Construction Details or applicable Plan Sheets. A concrete collar is only required when installed in earth areas or as directed by the engineer. 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 between conduits and the ground rods.

A minimum of 8 foot of the ground rods must be driven into undisturbed soil through the 2 inch 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.

All conduit sweeps extending into the cabinet base as shown on the Plans or Standard Details as applicable shall be included in the price for each cabinet base..

**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 concrete, ground rods, labor, equipment, tools, conduit sweeps, and incidentals required to complete the work as shown on the standard details or applicable plan sheets.

10/9/2012

## 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:

The followings models have been tested and approved by the Department and shall be used:

1. Ennis Paint - Stimsonite Model 101LPCR with Model C40 reflective pavement markers.
2. Ray-O-Lite Model 300 Snowplowable 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.

Placement shall be in accordance with the DE MUTCD.

**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.

07/26/2011

**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"**
**748548 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, WHITE/YELLOW, 5"**
**748549 -PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, WHITE/YELLOW, 10"**
**748557 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 3"**
**748559 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 5"**
**748568 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 9"**
**748569 - PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, BLACK, 14"**

**Description:**

This work consists of striping layout,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:

**% BY WEIGHT**

| | **WHITE:** | **YELLOW:** |
|---|---|---|
| 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% $TiO_2$ (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 ± 5°F. (23 ± 3°C).

a. Color. The white epoxy composition when applied at a minimum wet film thickness of 20$\pm$1 mils (500 µm) 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 µm) 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 µm) 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±1 mils (500 or 625 um) 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 polyterrafluorethylene (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,[1] 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.S. Standard Sieve | % Retained | % Passing |
|---|---|---|
| #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.S. Standard Sieve | % Retained | % Passing |
|---|---|---|
| #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: | Component | Percent By Weight |
|---|---|---|
| | 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:

| Sieve Size | Percent Retained |
|---|---|
| #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.

| | |
|---|---|
| Hardness: | The black aggregate hardness shall be 6.5-7 on Moh's Mineral Scale. |
| Porosity: | The black aggregate porosity shall be less than two (2) percent. |
| Moisture Content: | 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 -White Edge lines on Portland cement concrete pavements shall have a 3 inch black contrast line running parallel to the white edge line. The contrast line shall be to the inside or travel lane side of the edge line. The black contrast marking is to be applied with a single drop of graded black aggregate. Once it has cured sufficiently so as not to track, the reflectorized white line is to be applied along side of the contrast line and the two lines shall adjoin each other.

Dotted Line: All dotted 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 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 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 LTL-X 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 3", 4", 5", 6", 8", 9", 10", 12", 14", 16" (75 mm, 100 mm, 125 mm, 150 mm, 200 mm, 225 mm, 250 mm, 300 mm, 350 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 striping layout, 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.

8/7/2013

# 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, 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 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.

5/21/2013

**748541 - PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, 4”**
**748542 - PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, 6"**
**748543 - PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, 8"**
**748544 - PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, 12”**
**748545 - PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, 16"**
**748546 - PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, SYMBOL/LEGEND**
**748553 - PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, BIKE SYMBOL**
**748554 - PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, PEDESTRIAN SYMBOL**
**748555 - PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, HANDICAP SYMBOL**

**Description:**

This work consists of furnishing and installing preformed retroreflective thermoplastic pavement marking with a preapplied Federal Specification Type IV glass bead coating throughout its entire cross section on bituminous asphalt pavement at the locations and in accordance with the patterns on the Plans, or as directed by the Engineer.

The preformed retroreflective markings shall conform to the size and dimensions as shown in the Federal “Standard Highway Signs” book found at: http://mutcd.fhwa.dot.gov/SHSe/pavement.pdf as referred to in the Delaware Manual on Uniform Traffic Control Devices, Part 3, Markings.

**Materials:**

**General:** Only materials listed on the Department’s Approved Pavement Markings Material List will be used for this item. The preformed retroreflective markings shall be fusible to bituminous asphalt pavement by means of the normal heat of a propane type of torch. Adhesives, primers or sealers are not necessary prior to the preformed retroreflective markings application on bituminous asphalt pavement.

The preformed retroreflective markings shall conform to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics and be capable of fusing to itself and previously applied worn hydrocarbon and/or alkyd thermoplastic pavement markings.

The preformed retroreflective markings shall be capable of application on bituminous asphalt pavement wearing courses during the paving operation in accordance with the manufacturer's instructions. After application the markings shall be immediately ready for traffic. The preformed retroreflective markings shall be suitable for use for one year after the date of receipt when stored in accordance with the manufacturer's recommendations.

The preformed retroreflective thermoplastic markings shall not be brittle and must be sufficiently cohesive and flexible at temperatures exceeding 50ºF (10ºC) for one person to carry without the danger of fracturing the material prior to application.

**Composition:** The retroreflective pliant rosin ester thermoplastic pavement markings shall consist of a homogeneous mixture of high quality polymeric thermoplastic binders, pigments, fillers and glass beads. The thermoplastic material must conform to AASHTO M249-79(86) with the exception of the relevant differences due to the material being preformed, and identified herein.

Intermix Glass Beads: The preformed retroreflective material shall contain a minimum of 30% glass spheres which shall conform to AASHTO M247-81 Type 1. Glass spheres shall have a minimum of 80% true spheres overall.

Top Beads: To provide the required retroreflectivity, the preapplied factory top coating of glass beads shall be a combination of both Federal Spec. Type IV and AASHTO M247-81 Type I beads. Federal Spec. Type IV beads shall be evenly disbursed across the entire surface of the product at a minimum rate of 4 lb. (1.8 kg) per 100 $ft^2$ (9.3 $m^2$) and the AASHTO at 3 lb.(1.4 kg) per 100 $ft^2$ (9.3 $m^2$). In combination, the total glass bead coverage shall be 7-8 lb. (3.2-3.6 kg) per 100 $ft^2$ (9.3 $m^2$). The AASHTO M247-81 Type I beads shall have a minimum of 80% true spheres overall and the Federal Spec. Type IV beads shall be 80% true spheres on the 12 and 14 sieves and shall be no less than 75% true spheres on the remaining sieves.

**Retroreflectivity:** 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. Testing will be done using a Delta LTL 2000 Retrometer (30 meter geometry). The required minimum initial reflectivity reading in millicandellas shall be:

White 300
Yellow 200
Blue 200

**Skid Resistance:** The surface of the preformed retroreflective thermoplastic markings shall provide a pre-appled minimum skid resistance value of 45-51 BPN and a post-applied minimum skid resistance value of 45-55 BPN when tested according to ASTM E303-74.

**Thickness:** The thickness of the supplied material shall have a minimum average thickness of .090" (90 mils) for all Longitudinal lines and a thickness of .125" (125 mils) for all transverse lines and symbols/legends.

**Tensile Strength and Elongation:** The preformed retroreflective thermoplastic material shall have a minimum tensile strength of 150 lb. per square inch (1054 kg per square mm) of cross section, at .002" (2.28 mil) thickness, when tested according to ASTM D638-76 except that a sample 6" by 1" (150 mm by 25 mm) shall be tested at a temperature between 70ºF and 80ºF (21ºC and 27ºC) using a jaw speed of 10" to 12" (250 mm to 300 mm) per minute. The sample shall have a maximum elongation of 20% at break when tested by this method.

**Flexibility:** The preformed retroreflective thermoplastic marking material shall have flexibility at 50ºF such that when a 1" by 6" (25 mm by 150 mm) sample is bent through an arc of 90 degrees at a uniform rate in 10 seconds (9 degrees per second) over a 1" (25 mm) mandrel, no cracking occurs in the test sample. The sample must be conditioned prior to testing at 50ºF±2 degrees (10ºC) for a minimum of four hours. At least two specimens tested must meet the flexibility requirements at 50ºF (10ºC) for a passing result.

**Environmental Resistance:** The applied markings shall be resistance to deterioration due to exposure to sunlight, water, oil, diesel fuels, gasoline, pavement oil content, salt and adverse weather conditions.

**Effective Performance Life:** When properly applied, in accordance with manufacturer's instructions, the preformed retroreflective pavement markings shall be neat and durable. The markings shall remain skid resistant and show no lifting, shrinkage, tearing, roll back or other signs of poor adhesion for a period of one winter season.

**Oil/grease Resistant Test:** The preformed retroreflective thermoplastic material shall not dissolve or smear after rubbing a small amount of motor oil on a small piece of the thermoplastic material for two minutes.

**Bond Strength:** The material shall exhibit a bond strength to Portland Cement Concrete (PCC) equal or exceed 180 psi when tested at room temperature (73.4±3ºF) (23ºC) in accordance to ASTM Standard Test Method for Bond Strength of thermoplastic marking Material D4796-88. Place a coarse brick in a 400ºF (204ºC)

oven for 5 minutes. Prepare a 4 square inch test specimen. Place the test specimen on the brick and further heat in the 400ºF (204ºC) oven for 15 minutes. The test specimen is then allowed to cool to room temperature and prepared for testing.

**Low Temperature Cracking (Stress) Resistance for Extended Period:** The material shall be tested according to AASHTO T250 Section 7 with Section 7.2.3 modified for and extended cold temperature 15 degrees ±3ºF (-9.4±2ºC) exposure period 72 hours. Any cracking shall constitute failure of the material for PCC road surfaces.

**Impact Resistance (Gardner Falling Weight):** A 2" by 7.5" (50 by 190 mm) specimen shall be applied on a course concrete brick. Using a Gardner Impact Tester, a 2 lb (.91 kg) weight is dropped from a height of 80" (2032 mm). The specimen when tested at room temperature 73.4±3ºF (23ºC) should show no sign of cracking. (Test procedure is in accordance with ASTM D5420-93).

**Packaging:** The flexible preformed retroreflective thermoplastic marking materials, for use as transverse or longitudinal markings as well as legends, arrows and symbols shall be available in flat form material or in rolls. Flat material shall be supplied in maximum of 4' (1.2 m) lengths up to 2' (.6 m) in width. The material shall be packed in suitable cartons clearly labeled for ease of identifying the contents.

**Construction Methods:**

The markings shall be applied in strict accordance with the manufacturer's recommendations on clean and dry surfaces. Marking configurations shall be in accordance with the "Delaware Manual on Uniform Traffic Control Devices, Part 3, Markings."

The preformed retroreflective thermoplastic material shall be fusible to the pavement by means of a propane torch recommended by the manufacturer. Preheating the surface to remove any latent moisture will be done just prior to the placement and installation of the Symbol/ Legend.

No markings shall be placed when the ambient temperature is below 40ºF (4ºC). The material shall be kept in a location above 55ºF (13ºC) until just before application.

The supplier shall provide technical services as may be required.

**Method of Measurement:**

The quantity of pavement striping (748541-748545) will be measured by the number of linear feet (linear meters) of 4”, 6”, 8”, 12”, or 16” pavement striping line placed and accepted. The quantity of symbol/ legend (748546) will be measured by the number of square feet (meters) of symbol/legend placed and accepted. The quantity of bike symbol, pedestrian symbol, and handicap symbol (748551-748553) will be measured as each placed and accepted. The dimensions for the symbol/legends are as follows:

Bike Rider with Helmet shall be 3’ X 5’.
Pedestrian shall be 4’ X 8’.
Handicap Symbol shall be 40” X 40”.

**Basis of Payment:**

The quantity of pavement striping payment will be paid for at the Contract unit price per linear foot (linear meter) for 4”, 6”, 8”, 12” and 16” (100 mm, 150 mm, 200 mm, 300 mm, and 400 mm) line. The quantity of symbol/legend will be paid for at the Contract unit price per square foot (meter). The quantity of bike symbol, pedestrian symbol, and handicap symbol will be paid for at the Contract unit price per each. 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.

**Warranty:**

The Contractor shall warrant to the Department that the installed retroreflective preformed thermoplastic pavement markings are free of defects, as hereafter defined, for a period of one winter season 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 be warranted against failure due to blistering, excessive cracking, bleeding, staining, discoloration, oil content of the pavement materials, smearing and spreading under heat, deterioration due to contact with grease deposits, oil, diesel fuel, or gasoline drippings, chipping, spalling, poor adhesion to the pavement materials, vehicular damage, and wear from normal maintenance activities including snow plowing.

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 by the Department unless weather limitations prevent the corrective work. Should the contractor not commence work within the period stated in the notice, 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 responsibility of the contractor. These costs shall include, but are not limited to, removal, material, maintenance of traffic, etc.

2/28/09

## 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 or other type of pole 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.

A single sign totaling more than 9 square feet, or with any dimension, length or width, greater than or equal to 48 inches 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 Delaware MUTCD or as directed by the Engineer. The Contractor shall be responsible for obtaining all necessary utility clearances before the signs may be installed. Signs and plaques shall be mounted no lower than the minimum mounting height specified in the Delaware MUTCD. Signs and plaques shall be mounted no higher than one foot above the minimum mounting height specified in the Delaware MUTCD. Any excess sign post protruding above the top of the top sign shall be cut off and removed. For sign removals, the sign posts shall have all nuts, bolts, and other connectors removed. The disturbed ground shall be graded and backfilled accordingly. The Contractor is responsible for disposal of all signing material removed from the project

**Method of Measurement:**

The number of single sign installations or removals will be measured as the actual number of signs 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 Delaware MUTCD or signs installed in the incorrect location shall be moved at no additional cost to the Department.

5/28/2013

## 749688 - INSTALLATION OF 4" DIAMETER HOLE, LESS THAN OR EQUAL TO 6" IN DEPTH
## 749689 - INSTALLATION OF 4" DIAMETER HOLE, GREATER THAN 6" IN DEPTH

**Description:**

This work consists of boring a hole 4" in diameter averaging 6" in depth into bituminous concrete or P.C.C. surfaces for installing single or multiple sign posts at the locations indicated on the Plans or as directed by an Engineer.

**Materials:**

The Contractor shall provide the equipment necessary to bore a 4" hole into paved surfaces, while maintaining the stability of the surrounding paved or P.C.C. surfaces. The depth of the bored hole shall be to the top of the subbase material.

**Construction Methods:**

The holes shall be bored into pavement or P.C.C. islands, medians, or sidewalk using a mechanical hole borer for such work or other methods approved by the Engineer. The hole shall be 4" in diameter. Holes bigger or smaller than 4" shall be corrected at the Contractor's expense.

**Method of Measurement:**

The number of 4" holes in diameter bored will be measured as the actual number of holes bored and accepted.

**Basis of Payment:**

The quantity of holes bored as required above will be paid for at the Contract unit price per each. Price and payment will constitute full compensation for boring holes at the required depth, and for all labor, equipment, tools, and incidentals required to complete the work.

**Note:**

The cost for installing holes and PVC sleeves for sign posts in newly constructed P.C.C. islands, medians, or sidewalks shall be incidental to the P.C.C. item.

3/23/09

## 749690 - INSTALLATION OR REMOVAL OF TRAFFIC SIGN ON MULTIPLE SIGN POSTS

**Description:**

This work consists of installing or removing traffic sign(s) on multiple sign posts at the locations indicated on the Plans or as directed by the Engineer. This specification also includes installation of posts in holes installed under other items.

A single sign totaling more than 9 square feet, or with any dimension, length or width, greater than 48 inches shall be mounted on two (2) posts. Signs with a length greater than or equal to 78 inches shall be mounted on three (3) 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 Delaware MUTCD or as directed by the Engineer. The Contractor shall be responsible for obtaining all necessary utility clearances before the signs may be installed. Signs and plaques shall be mounted no lower than the minimum mounting height specified in the Delaware MUTCD. Signs and plaques shall be mounted no higher than one foot above the minimum mounting height specified in the Delaware MUTCD. Any excess sign post protruding above the top of the top sign shall be cut off and removed. For sign removals, the sign posts shall have all nuts, bolts, and other connectors removed For sign removals, the sign posts shall have all nuts, bolts, and other connectors removed. The disturbed ground shall be graded and backfilled accordingly. The Contractor is responsible for disposal of all signing material removed from the project..

**Method of Measurement:**

The number of sign installations or removals will be measured as the total square foot of the sign(s) installed or removed and accepted.

**Basis of Payment:**

The quantity of sign installations or removals will be paid for at the Contract unit price per square foot. 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 accordance with the Delaware MUTCD or signs installed in the incorrect location shall be moved at no additional cost to the Department.

5/28/2013

## 760502 - PAVEMENT MILLING, TAPER CUT

**Description:**

This work consists of furnishing a pavement milling machine and milling or planing the existing bituminous concrete pavement to the average depths and widths in accordance with the locations, notes on the Plans and as directed by the Engineer.

The pavement milling machine shall be one with a proven record for use in milling/planing hot-mix pavement. The Contractor shall reuse, salvage, or dispose of the milled material as indicated on the Plans.

**Construction Methods:**

Milling and/or planing shall consist of one pass with a specified depth at one edge (face of the curb) and 0 depth at the other edge, or in cases where excessive crown is being removed, the required number of passes to mill a specified depth at the existing road centerline and 0 depth at the edges. The depth shall be as shown on the Plans or as directed by the Engineer.

**Method of Measurement:**

The quantity of taper cut milling will be measured in square yards per inch of depth (square meters per 25 mm of depth). The average depth shall be determined by either measuring the actual depth removed at face of the curb and dividing by two or measuring the actual depth removed at road centerline and dividing by two, whichever case is applicable.

**Basis of Payment:**

The quantity of taper cut milling will be paid for at the Contract unit price per square yard per inch of depth (square meter per 25 mm of depth). Price and payment will constitute full compensation for furnishing milling machine with operator and milling/planing the roadway, removal and disposal or salvaging the milled material and for transporting, as indicated on the Plans, for all labor, equipment, tools, and necessary incidentals to complete the work.

10/25/01

## 760507 - PROFILE MILLING, BITUMINOUS CONCRETE
## 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 ±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 ±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.

10/25/13

**763544 - ROAD LOCATION MOBILIZATION, ZONE 1**
**763545 - ROAD LOCATION MOBILIZATION, ZONE 2**
**763546 - ROAD LOCATION MOBILIZATION, ZONE 3**
**763547 - ROAD LOCATION MOBILIZATION, ZONE 4**
**763548 - ROAD LOCATION MOBILIZATION, ZONE 5**
**763549 - ROAD LOCATION MOBILIZATION, ZONE 6**
**763550 - ROAD LOCATION MOBILIZATION, ZONE 7**
**763551 - ROAD LOCATION MOBILIZATION, ZONE 8**
**763552 - ROAD LOCATION MOBILIZATION, ZONE 9**
**763553 - ROAD LOCATION MOBILIZATION, ZONE 10**
**763554 - ROAD LOCATION MOBILIZATION, ZONE 11**
**763555 - ROAD LOCATION MOBILIZATION, ZONE 12**
**763556 - ROAD LOCATION MOBILIZATION, ZONE 13**
**763557 - ROAD LOCATION MOBILIZATION, ZONE 14**
**763558 - ROAD LOCATION MOBILIZATION, ZONE 15**
**763559 - ROAD LOCATION MOBILIZATION, ZONE 16**
**763560 - ROAD LOCATION MOBILIZATION, ZONE 17**
**763561 - ROAD LOCATION MOBILIZATION, ZONE 18**
**763562 - ROAD LOCATION MOBILIZATION, ZONE 19**

**Description:**

This Pay Item consists of compensating the Contractor for each re-mobilization of all equipment and accessories between work locations.

This Pay Item for Road Location Mobilization is only payable for work related to patching and associated material removal operations. Mobilization for all other work shall be incidental to their respective pay items.

**Method of Measurement:**

"One mobilization fee shall be paid for each move into a mobilization zone, which shall cover all locations within that mobilization zone, and all work orders issued within that zone. A separate mobilization fee **will not** be paid for each individual location. No mobilization fee will be paid if a new work order is issued while work on a previous work order is ongoing in that zone. A separate mobilization fee will only be paid if the Contractor is directed by the Department to move from the mobilization zone in which he is presently working, or inclement weather causes a substantial delay in work. A substantial delay due to inclement weather shall be defined as fourteen or more calendar days. Payment of any mobilization fees shall be agreed upon between the Contractor and the Department, in writing, prior to commencement of work.

**Basis of Payment:**

The number of Road Location Mobilizations shall be paid at the Contract unit price per each. Price and payment shall constitute full compensation for all material, labor, equipment, tools and incidentals required to complete the work.

8/6/12

**763605 – TEMPORARY TRAFFIC CONTROL - TWO LANE, TWO-WAY WITH SHOULDER CLOSURE (TA-3)**
**763606 – TEMPORARY TRAFFIC CONTROL - TWO LANE, TWO-WAY WITH LANE CLOSURE (TA-10)**
**763607 – TEMPORARY TRAFFIC CONTROL - MULTILANE DIVIDED HIGHWAY WITH SHOULDER CLOSURE (TA-3A)**
**763608 – TEMPORARY TRAFFIC CONTROL - MULTILANE DIVIDED HIGHWAY WITH LANE CLOSURE (TA-33)**
**763609 – TEMPORARY TRAFFIC CONTROL - INTERSTATES AND FREEWAYS, SHOULDER CLOSURE (TA-5A)**
**763664 – TEMPORARY TRAFFIC CONTROL - TWO LANE, TWO-WAY WITH SHOULDER CLOSURE, MOBILE OPERATION (TA-4)**
**763665 – TEMPORARY TRAFFIC CONTROL - TWO LANE, TWO-WAY WITH LANE CLOSURE, MOBILE OPERATION (TA-17)**
**763666 – TEMPORARY TRAFFIC CONTROL - MULTILANE DIVIDED HIGHWAY WITH SHOULDER CLOSURE, MOBILE OPERATION (TA-4A)**
**763667 – TEMPORARY TRAFFIC CONTROL - MULTILANE DIVIDED HIGHWAY WITH LANE CLOSURE, MOBILE OPERATION (TA-35)**
**763668 – TEMPORARY TRAFFIC CONTROL - MULTILANE DIVIDED HIGHWAY WITH DOUBLE LANE CLOSURE (TA-37)**
**763669 – TEMPORARY TRAFFIC CONTROL - MULTILANE DIVIDED HIGHWAY WITH DOUBLE LANE CLOSURE, MOBILE OPERATION (TA-35A)**
**763670 – TEMPORARY TRAFFIC CONTROL - WORK IN THE VICINITY OF AN EXIT RAMP ON A MULTILANE DIVIDED HIGHWAY (TA-42)**
**763671 – TEMPORARY TRAFFIC CONTROL - WORK IN THE VICINITY OF AN ENTRANCE RAMP ON A MULTILANE DIVIDED HIGHWAY (TA-44)**
**763672 – TEMPORARY TRAFFIC CONTROL - PARTIAL EXIT RAMP CLOSURE (TA-43)**
**763673 – TEMPORARY TRAFFIC CONTROL - SURVEYING ALONG A TWO-LANE ROAD (TA-16)**
**763674 – TEMPORARY TRAFFIC CONTROL - DETOUR FOR A CLOSED STREET (TA-20)**

**Description:**

This work shall consist of all work performed by the Contractor to maintain vehicular, bicycle and pedestrian traffic through the location's work zone, 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 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 Manual on Uniform Traffic Control Devices (MUTCD)," hereafter referred to as the "DE MUTCD", including all revisions as of the date of advertisement of this Contract.

The Department reserves the right to stop the Contractor's operations, if in the opinion of the Engineer, the Contractor's operations are not in compliance with the Delaware MUTCD or the Contractor's operations are unsafe and present a hazard to road users or workers.

Prior to the beginning of any work in a particular location, the Contractor shall first place temporary traffic control devices so as to effectively close that area to the passage of unauthorized vehicles, pedestrians or bicycles, and protect the work and personnel until the area is ready for public use.

The safety measures outlined herein and in the DE MUTCD shall be considered as elementary only, and not necessarily sufficient in every instance to guarantee the protection of the traveling public. The final responsibility for the installation of adequate safety precautions, and for the protection of the traveling public, and its own personnel shall rest with the Contractor.

**Schedule and Construction Control:**

A temporary traffic control plan and construction schedule shall be required for all operations affecting the flow of traffic on all roadways where work is to be performed. The temporary traffic control plan shall be submitted to the engineer seven days in advance of the proposed work for approval. The plan must show all methods and devices the Contractor proposes for temporary traffic control. The Contractor shall plan the work such that no lanes of traffic are closed from Friday 3PM until Monday 9AM, with the exception of any weekend work to be allowed on Saturday and Sunday with prior approval from the Engineer. The contractor shall plan his work such that no lane closure occurs without approval during the following periods:

1. December 24 through December 27 (Christmas Day)
2. December 31 through January 3 (New Years Day)
3. Friday prior to Easter through Easter Sunday
4. Thursday prior to Memorial Day through the Tuesday following Memorial Day
5. Dover International Speedway Race Weekends (Thursday prior to the race event through the day after the race event)
6. July 3 through July 5 (Independence Day)
7. Thursday prior to Labor Day through the Tuesday following Labor Day
8. Wednesday prior to Thanksgiving Day through Monday following Thanksgiving Day.
9. Exceptions to these restrictions can be made on a case by case basis with the approval of the Traffic Engineer and Chief Engineer.

No lane closures shall be allowed on multilane roadways between 6:00 AM and 7:00 PM on standard weekdays, i.e. Monday through Friday without prior permission from the Engineer. Consideration must be given to the duration of the closure, the number of lanes on the highway, the number of lanes affected by the closure and the conditions created by the closure. When prior permission is granted, the contractor shall ensure that lane closures are removed prior to peak periods on the roadway, typically from 6:00 AM to 9:00 A.M. and from 3:00 PM to 7:00 P.M. No lane closure on Two-lane roadways with AADT greater than or equal to 5000 vehicles shall occur between 6:00 AM to 9:00 A.M. and/or 3:00 PM to 7:00 P.M. on a standard weekday, i.e. Monday through Friday without prior permission from the Engineer. For Two-lane roadways with AADT less than 5000 vehicles per day lane closures typically will be allowed at any time. The contractor shall ensure that disruption to traffic is minimized at all times in all cases. Summer weekend operations may occur on non-beach route roadways subject to determination by the Engineer, but no summer weekend work shall take place on major beach routes. Nighttime work may occur on congested major roadway corridors and/or at locations as determined by the Engineer where day time lane closures will cause excessive disruption to traffic flow. Questions regarding the timing of lane closures on a particular roadway shall be directed to the DelDOT District Safety Officer. It shall be noted that the provisions above are for general guidance and that the Department can be more restrictive at its discretion.

**Materials:**

The contractor shall supply all temporary traffic control devices as necessary to protect the work area as provided for in the DE MUTCD. 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.

Temporary traffic control devices used on all highways open to public travel 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 work commencing in a particular location.

**Construction Methods:**

The method of installation shall be as prescribed in the DE MUTCD. For each of the temporary traffic control cases presented below, the Typical Application reference from the Delaware MUTCD is provided in parenthesis. The Temporary Traffic Control shall be distinguished based on the following roadway types and closures:

- Two Lane, Two-Way with Shoulder Closure (TA-3)
- Two Lane, Two-Way with Lane Closure (TA-10)
- Multilane Divided Highway with Shoulder Closure (TA-3A)
- Multilane Divided Highway with Lane Closure (TA-33)
- Interstates and Freeways, Shoulder Closure (TA-5A)
- Two Lane, Two-Way with Shoulder Closure, Mobile Operation (TA-4)
- Two Lane, Two-Way with Lane Closure, Mobile Operation (TA-17)
- Multilane Divided Highway with Shoulder Closure, Mobile Operation (TA-4A)
- Multilane Divided Highway with Lane Closure, Mobile Operation (TA-35)
- Multilane Divided Highway with Double Lane Closure (TA-37)
- Multilane Divided Highway with Double Lane Closure, Mobile Operation (TA-35A)
- Work in the Vicinity of an Exit Ramp on a Multilane Divided Highway (TA-42)
- Work in the Vicinity of an Entrance Ramp on a Multilane Divided Highway (TA-44)
- Partial Exit Ramp Closure (TA-43)
- Surveying Along a Two-Lane Road (TA-16)

**Method of Measurement:**

The quantity for Temporary Traffic Control shall be measured per Each for each case described in the DE MUTCD. The quantity of flaggers, portable light assemblies, portable changeable message signs, truck-mounted attenuators and traffic officers will be measured under separate applicable pay items.

The Temporary Traffic Control shall be distinguished based on the following roadway types and closures:

- Two Lane, Two-Way with Shoulder Closure (TA-3)
- Two Lane, Two-Way with Lane Closure (TA-10)
- Multilane Divided Highway with Shoulder Closure (TA-3A)
- Multilane Divided Highway with Lane Closure (TA-33)
- Interstates and Freeways, Shoulder Closure (TA-5A)
- Two Lane, Two-Way with Shoulder Closure, Mobile Operation (TA-4)
- Two Lane, Two-Way with Lane Closure, Mobile Operation (TA-17)
- Multilane Divided Highway with Shoulder Closure, Mobile Operation (TA-4A)
- Multilane Divided Highway with Lane Closure, Mobile Operation (TA-35)
- Multilane Divided Highway with Double Lane Closure (TA-37)
- Multilane Divided Highway with Double Lane Closure, Mobile Operation (TA-35A)
- Work in the Vicinity of an Exit Ramp on a Multilane Divided Highway (TA-42)
- Work in the Vicinity of an Entrance Ramp on a Multilane Divided Highway (TA-44)
- Partial Exit Ramp Closure (TA-43)
- Surveying Along a Two-Lane Road (TA-16)

**Basis of Payment:**

The quantity for Temporary Traffic Control will be paid for at the Contract unit price per Each. Price and payment will constitute full compensation for set up, removal, furnishing and placing all materials, labor, equipment, tools, appurtenances, drums, resetting of drums if required, signs, arrow panels and all incidentals necessary to complete the work. Each temporary traffic control item for the fifteen types of installations will be paid per one set up-take down cycle and shall cover all temporary traffic control required by the DE MUTCD. Each job order will indicate the number of allowable set up-take down cycles. Flaggers, portable light

assemblies, portable changeable message signs, truck mounted attenuators and traffic officers will be paid for separately under the applicable pay items.

The Basis of Payment is applicable to the following types of installations:

- Two Lane, Two-Way with Shoulder Closure (TA-3)
- Two Lane, Two-Way with Lane Closure (TA-10)
- Two Lane, Two-Way with Shoulder Closure, Mobile Operation (TA-4)
- Two Lane, Two-Way with Lane Closure, Mobile Operation (TA-17)
- Multilane Divided Highway with Shoulder Closure (TA-3A)
- Multilane Divided Highway with Lane Closure (TA-33)
- Multilane Divided Highway with Shoulder Closure, Mobile Operation (TA-4A)
- Multilane Divided Highway with Lane Closure, Mobile Operation (TA-35)
- Interstates and Freeways, Shoulder Closure (TA-5A)
- Multilane Divided Highway with Double Lane Closure (TA-37)
- Multilane Divided Highway with Double Lane Closure, Mobile Operation (TA-35A)
- Work in the Vicinity of an Exit Ramp on a Multilane Divided Highway (TA-42)
- Work in the Vicinity of an Entrance Ramp on a Multilane Divided Highway (TA-44)
- Partial Exit Ramp Closure (TA-43)
- Surveying Along a Two-Lane Road (TA-16)

Each of the above items shall include payment for the following:

1. Providing, transporting, locating, setting up and maintaining of all necessary temporary traffic control devices as prescribed above.
2. Removal and transporting of all devices back to the storage yard upon completion of the job task.

7/15/13

## 763621 - CONSTRUCTION ENGINEERING, REHABILITATION

**Description:**

Collect survey information and provide layout as described in this provision and as noted on the Plans. Assume full responsibility for any errors and/or omissions in the work of all engineering staff employed.

Provide and have available for the project adequate engineering staff that is:

1. Competent and experienced to set lines and grades needed to construct the project;

2. Able to perform the work to the scope and magnitude outlined herein.

Construction Engineering functions and requirements:

1. Provide all necessary surveying equipment required for all engineering work on the project.

    a. Check all equipment/instruments prior to use on the project.

    b. Immediately replace or recalibrate equipment found to be out of adjustment or inadequate to perform its function to the satisfaction of the Engineer.

2. Perform all computations necessary to establish the exact position of the work from control points and preserve.

    a. Maintain adequate workbooks of all computations survey notes and other records.

    b. Make available to the Department, neat and legible, all computations, survey notes and other records necessary to accomplish the work.

3. Preliminary topographic survey for all proposed curb ramps locations identified in the Plans and the layout of grade information provided by the Engineer for curb ramp construction;

4. Obtain topographic information a minimum of 25' in each direction from the back of curb where the curb ramp is proposed;

    a. Grades for the edge of pavement, gutter line (if applicable), top of curb, front and back edge of sidewalk, existing obstructions such as utility poles, junction wells, traffic poles and cabinets, manholes, valves, fire hydrants, drainage inlets, steps, retaining walls, building faces or other obstructions that are directly adjacent or within the proposed curb ramp limits.

    b. Collect data in a format that is compatible with DelDOT Design Standards and submit to the Engineer for evaluation curb ramps that are located in areas with multiple obstructions, limited area, or other unique characteristics that require more detailed layout. The Engineer will provide the final grades for construction of these curb ramps.

3. Establish necessary grades to ensure all proposed curb ramps, roadways or ditches, installation of drainage structures, or other items of work as determined by the Engineer, have positive drainage;

Note:

Professional services performed under this item by individuals/firms other than the Contractor are not subject to the subcontracting requirements of Subsection 108.01 of the Standard Specifications.

**Method of Measurement:**

The quantity of Construction Engineering - Rehabilitation will be measured as the actual number of hours the Contractor's survey crew is in the field actively engaged in Construction Engineering – Rehabilitation Work.

**Basis of Payment:**

The quantity of Construction Engineering – Rehabilitation will be paid for at the Contract unit price per hour. Price and payment constitutes full compensation for furnishing all labor, equipment, instruments, stakes, and other material necessary to satisfactorily complete the work as herein described under this item.

7/10/2012

# BID PROPOSAL FORMS

CONTRACT T201606301.01

CONTRACT ID: T201606301.01 PROJECT(S): T201606301

All figures must be typewritten.

CONTRACTOR :_____

SECTION 0001 Category 0001

| LINE NO | ITEM DESCRIPTION | APPROX. QUANTITY AND UNITS | UNIT PRICE DOLLARS | UNIT PRICE CTS | BID AMOUNT DOLLARS | BID AMOUNT CTS |
|---|---|---|---|---|---|---|
| 0010 | 202000 EXCAVATION AND EMBANKMENT | 50.000 CY | | | | |
| 0020 | 302005 GRADED AGGREGATE BASE COURSE, TYPE B | 200.000 TON | | | | |
| 0030 | 401823 BITUMINOUS CONCRETE, SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 160 GYRATIONS, PG 64-22, PATCHING | 6000.000 TON | | | | |
| 0040 | 401827 BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 64-22 (NON-CARBONATE STONE) | 8500.000 TON | | | | |
| 0050 | 401833 BITUMINOUS CONCRETE, SUPERPAVE, TYPE C, 160 GYRATIONS, PG 76-22, (NON-CARBONATE STONE) | 8500.000 TON | | | | |
| 0060 | 406001 BITUMINOUS CONCRETE PATCHING | 105000.000 SYIN | | | | |
| 0070 | 503001 PATCHING P.C.C. PAVEMENT, 6' TO 15', TYPE A | 500.000 SY | | | | |
| 0080 | 503002 PATCHING P.C.C. PAVEMENT GREATER THAN 15' TO 100', TYPE B | 300.000 SY | | | | |

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|---|---|---|---|---|---|---|
| 0090 | 503006 DOWEL BARS | 1000.000 EACH | | | | |
| 0100 | 503501 CRACK AND JOINT SEALING LESS THAN 3/4" WIDE | 1000.000 LF | | | | |
| 0110 | 503502 CRACK AND JOINT SEALING 3/4" TO 1 3/4" WIDE | 500.000 LF | | | | |
| 0120 | 503503 PATCHING CONCRETE | 500.000 SYIN | 5.65000 | | 2825.00 | |
| 0130 | 503517 P.C.C. PATCHING, PARTIAL DEPTH | 500.000 SYIN | | | | |
| 0140 | 612020 REINFORCED CONCRETE PIPE, 12", CLASS IV | 30.000 LF | | | | |
| 0150 | 612021 REINFORCED CONCRETE PIPE, 15", CLASS IV | 60.000 LF | | | | |
| 0160 | 612022 REINFORCED CONCRETE PIPE, 18", CLASS IV | 60.000 LF | | | | |
| 0170 | 612023 REINFORCED CONCRETE PIPE, 24", CLASS IV | 60.000 LF | | | | |
| 0180 | 612519 CORRUGATED POLYETHYLENE PIPE, TYPE C, 15" | 60.000 LF | | | | |

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|---|---|---|---|---|---|---|
| 0190 | 617001 REINFORCED CONCRETE FLARED END SECTION, 12" | 5.000 EACH | | | | |
| 0200 | 617002 REINFORCED CONCRETE FLARED END SECTION, 15" | 5.000 EACH | | | | |
| 0210 | 617003 REINFORCED CONCRETE FLARED END SECTION, 18" | 5.000 EACH | | | | |
| 0220 | 617005 REINFORCED CONCRETE FLARED END SECTION, 24" | 5.000 EACH | | | | |
| 0230 | 701010 PORTLAND CEMENT CONCRETE CURB, TYPE 1-8 | 1000.000 LF | | | | |
| 0240 | 701011 PORTLAND CEMENT CONCRETE CURB, TYPE 2 | 500.000 LF | | | | |
| 0250 | 701020 INTEGRAL PORTLAND CEMENT CONCRETE CURB & GUTTER, TYPE 1-8 | 500.000 LF | | | | |
| 0260 | 701021 INTEGRAL PORTLAND CEMENT CONCRETE CURB & GUTTER, TYPE 2 | 500.000 LF | | | | |
| 0270 | 701022 INTEGRAL PORTLAND CEMENT CONCRETE CURB & GUTTER, TYPE 3-8 | 300.000 LF | | | | |
| 0280 | 705001 P.C.C. SIDEWALK, 4" | 2500.000 SF | | | | |

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|---|---|---|---|---|---|---|
| 0290 | 705002 P.C.C. SIDEWALK, 6" | 1000.000 SF | | | | |
| 0300 | 705007 SIDEWALK SURFACE DETECTABLE WARNING SYSTEM | 300.000 SF | | | | |
| 0310 | 705008 CURB RAMP, TYPE 1 | 1500.000 SF | | | | |
| 0320 | 705009 CURB RAMP, TYPE 2, 3, AND/OR 4 | 7500.000 SF | | | | |
| 0330 | 705010 CURB RAMP, TYPE 5 | 500.000 SF | | | | |
| 0340 | 705505 RESET STONE/BRICK SIDEWALK AND/OR STONE/BRICK ROADWAY | 300.000 SF | | | | |
| 0350 | 705530 TRIANGULAR CHANNELIZING ISLANDS | 1000.000 SF | | | | |
| 0360 | 708050 DRAINAGE INLET, 34" X 18" | 5.000 EACH | | | | |
| 0370 | 708051 DRAINAGE INLET, 34" X 24" | 5.000 EACH | | | | |
| 0380 | 708060 REPLACE DRAINAGE INLET GRATE(S) | 10.000 EACH | | | | |

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|---|---|---|---|---|---|---|
| 0390 | 708061 REPLACE DRAINAGE INLET FRAME(S) | 10.000 EACH | | | | |
| 0400 | 710001 ADJUSTING AND REPAIRING EXISTING DRAINAGE INLET | 25.000 EACH | | | | |
| 0410 | 710002 ADJUSTING AND REPAIRING EXISTING MANHOLE | 25.000 EACH | | | | |
| 0420 | 710004 ADJUST & REPAIR EXISTING DOUBLE DRAINAGE INLET(S) | 15.000 EACH | | | | |
| 0430 | 727502 ADJUSTING EXISTING MONUMENT BOX | 5.000 EACH | | | | |
| 0440 | 743003 ARROWPANELS, TYPE C | 250.000 EADY | | | | |
| 0450 | 743004 FURNISH AND MAINTAIN PORTABLE CHANGEABLE MESSAGE SIGN | 100.000 EADY | | | | |
| 0460 | 743005 FURNISH AND MAINTAIN PORTABLE LIGHT ASSEMBLY | 100.000 EADY | | | | |
| 0470 | 743007 TRAFFIC OFFICERS | 500.000 HOUR | 75.00000 | | 37500.00 | |
| 0480 | 743010 FURNISH AND MAINTAIN TRUCK MOUNTED ATTENUATOR, TYPE II | 250.000 EADY | | | | |

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|---|---|---|---|---|---|---|
| 0490 | 743052 FLAGGER, SUSSEX COUNTY, STATE | 3000.000 HOUR | | | | |
| 0500 | 743064 FLAGGER, SUSSEX COUNTY, STATE, OVERTIME | 300.000 HOUR | | | | |
| 0510 | 744505 ADJUST OR REPAIR EXISTING CONDUIT JUNCTION WELL | 5.000 EACH | | | | |
| 0520 | 744506 CONDUIT JUNCTION WELL, TYPE 7, PRECAST POLYMER CONCRETE | 5.000 EACH | | | | |
| 0530 | 744530 CONCUIT JUNCTION WELL, TYPE 11, PRECAST CONCRETE/ POLYMER LID-FRAME | 5.000 EACH | | | | |
| 0540 | 744531 CONDUIT JUNCTION WELL, TYPE 14, PRECAST CONCRETE/ POLYMER LID-FRAME | 5.000 EACH | | | | |
| 0550 | 744532 CONDUIT JUNCTION WELL, TYPE 15, PRECAST CONCRETE/ POLYMET LID-FRAME | 5.000 EACH | | | | |
| 0560 | 744541 FURNISH & INSTALL FRAME AND LID FOR JUNCTION WELL, TYPE 11 | 5.000 EACH | | | | |
| 0570 | 744542 FURNISH & INSTALL FRAME AND LID FOR JUNCTION WELL, TYPE 14 | 5.000 EACH | | | | |

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|---|---|---|---|---|---|---|
| 0580 | 744543 FURNISH & INSTALL FRAME AND LID FOR JUNCTION WELL, TYPE 15 | 5.000 EACH | | | | |
| 0590 | 744544 ADJUST OR REPAIR EXISTING CONDUIT JUNCTION WELL | 5.000 EACH | | | | |
| 0600 | 745602 FURNISH & INSTALL UP TO 4" SCHEDULE 80 HDPE CONDUIT (BORE) | 300.000 LF | | | | |
| 0610 | 745603 FURNISH & INSTALL UP TO 4" SCHEDULE 80 PVC CONDUIT (OPEN CUT) | 300.000 LF | | | | |
| 0620 | 745604 FURNISH & INSTALL UP TO 4" SCHEDULE 80 PVC CONDUIT (TRENCH) | 300.000 LF | | | | |
| 0630 | 745606 FURNISH & INSTALL UP TO 4" GALVANIZED STEEL CONDUIT (TRENCH) | 300.000 LF | | | | |
| 0640 | 745607 FURNISH & INSTALL UP TO 4" GALVANIZED STEEL CONDUIT (BORE) | 300.000 LF | | | | |
| 0650 | 745608 FURNISH & INSTALL UP TO 4" GALVANIZED STEEL CONDUIT (OPEN CUT) | 300.000 LF | | | | |
| 0660 | 746614 POLE BASE EXTENSION | 35.000 CF | | | | |
| 0670 | 746844 POLE BASE, TYPE 2 | 5.000 EACH | | | | |

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|---|---|---|---|---|---|---|
| 0680 | 746847 POLE BASE, TYPE 3 | 5.000 EACH | | | | |
| 0690 | 746850 POLE BASE, TYPE 4 | 8.000 EACH | | | | |
| 0700 | 746883 PARTIAL REMOVAL OF CONCRETE POLE BASES AND CABINET FOUNDATIONS | 5.000 CY | | | | |
| 0710 | 746924 FURNISH & INSTALL LOOP WIRE 1-CONDUCTOR #14 AWG ENCASED IN 1/4" FLEXIBLE TUBING IN A LOOP SAWCUT | 2000.000 LF | | | | |
| 0720 | 747515 CABINET BASE, TYPE M | 3.000 EACH | | | | |
| 0730 | 747516 CABINET BASE, TYPE P | 3.000 EACH | | | | |
| 0740 | 748015 PERMANENT PAVEMENT STRIPING, SYMBOL/LEGEND ALKYD-THERMOPLAST IC | 7500.000 SF | | | | |
| 0750 | 748019 TEMPORARY MARKINGS, PAINT, 4" | 600000.000 LF | | | | |
| 0760 | 748026 TEMPORARY MARKINGS, PAINT SYMBOL/LEGEND | 15000.000 SF | | | | |

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|---|---|---|---|---|---|---|
| 0770 | 748502 RAISED/RECESSED PAVEMENT MARKER | 250.000 EACH | | | | |
| 0780 | 748530 REMOVAL OF PAVEMENT STRIPING | 1500.000 SF | | | | |
| 0790 | 748546 PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, SYMBOL/LEGEND | 1000.000 SF | | | | |
| 0800 | 748548 PERMANENT PAVEMENT STRIPING, EPOXY RESIN PAINT, WHITE/YELLOW, 5" | 300000.000 LF | | | | |
| 0810 | 748553 PREFORMED RETROREFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS, BIKE SYMBOL | 100.000 EACH | | | | |
| 0820 | 749687 INSTALLATION OR REMOVAL OF TRAFFIC SIGN(S) ON SINGLE SIGN POST | 500.000 EACH | | | | |
| 0830 | 749688 INSTALLATION OF 4" DIAMETER HOLE, LESS THAN OR EQUAL TO 6" DEPTH | 25.000 EACH | | | | |
| 0840 | 749689 INSTALLATION OF 4" DIAMETER HOLE, GREATER THAN 6" DEPTH | 25.000 EACH | | | | |
| 0850 | 749690 INSTALLATION OR REMOVAL OF TRAFFIC SIGNS ON MULTIPLE SIGN POSTS | 500.000 SF | | | | |

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|---|---|---|---|---|---|---|
| 0860 | 750000 ADJUST WATER VALVE BOXES | 30.000 EACH | | | | |
| 0870 | 758000 REMOVAL OF EXISTING PORTLAND CEMENTCONCRETE PAVEMENT, CURB, SIDEWALK, ETC. | 500.000 SY | | | | |
| 0880 | 760012 RUMBLE STRIPS, BIKE-FRIENDLY, HOT-MIX | 5000.000 LF | | | | |
| 0890 | 760016 RUMBLE STRIPS, HOT-MIX | 10000.000 LF | | | | |
| 0900 | 760018 RUMBLE STRIPS, CENTER LINE, HOT-MIX | 10000.000 LF | | | | |
| 0910 | 760502 PAVEMENT MILLING, TAPER CUT | 10000.000 SYIN | | | | |
| 0920 | 760507 PROFILE MILLING, BITUMINOUS CONCRETE | 280000.000 SYIN | | | | |
| 0930 | 761001 BUTT JOINTS, HOT MIX | 1000.000 SY | | | | |
| 0940 | 762001 SAW CUTTING, BITUMINOUS CONCRETE | 5000.000 LF | | | | |
| 0950 | 762002 SAW CUTTING, CONCRETE, FULL DEPTH | 3000.000 LF | | | | |

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|---|---|---|---|---|---|---|
| 0960 | 763000 INITIAL EXPENSE | LUMP | LUMP | | | |
| 0970 | 763556 ROAD LOCATION MOBILIZATION, ZONE 13 | 23.000 EACH | | | | |
| 0980 | 763557 ROAD LOCATION MOBILIZATION, ZONE 14 | 22.000 EACH | | | | |
| 0990 | 763605 TEMPORARY TRAFFIC CONTROL - TWO LANE, TWO-WAY WITH SHOULDER CLOSURE (TA-3) | 20.000 EACH | | | | |
| 1000 | 763606 TEMPORARY TRAFFIC CONTROL - TWO LANE, TWO-WAY WITH LANE CLOSURE (TA-10) | 20.000 EACH | | | | |
| 1010 | 763607 TEMPORARY TRAFFIC CONTROL - MULTILANE DIVIDED HIGHWAY WITH SHOULDER CLOSURE (TA-3A) | 25.000 EACH | | | | |
| 1020 | 763608 TEMPORARY TRAFFIC CONTROL - MULTILANE DIVIDED HIGHWAY WITH LANE CLOSURE (TA-33) | 25.000 EACH | | | | |
| 1030 | 763621 CONSTRUCTION ENGINEERING, REHABILITATION | 100.000 HOUR | | | | |
| 1040 | 908001 TOPSOIL (TON) | 200.000 TON | | | | |

CANNOT BE USED FOR BIDDING

CONTRACT ID: T201606301.01 PROJECT(S): T201606301

All figures must be typewritten.

CONTRACTOR :_____

| LINE NO | ITEM DESCRIPTION | APPROX. QUANTITY AND UNITS | UNIT PRICE DOLLARS | UNIT PRICE CTS | BID AMOUNT DOLLARS | BID AMOUNT CTS |
|---|---|---|---|---|---|---|
| 1050 | 908014 PERMANENT GRASS SEEDING, DRY GROUND | 1600.000 SY | | | | |
| 1060 | 908020 EROSION CONTROL BLANKET MULCH | 1600.000 SY | | | | |
| | SECTION 0001 TOTAL | | | | | |
| | TOTAL BID | | | | | |

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**CERTIFICATION**
Contract No. T201606301.01

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.

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 bidder and each person signing on behalf of any 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 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

**BIDDERS MUST ACKNOWLEDGE RECEIPT OF ALL ADDENDA**

**MUST INSERT DATE OF FINAL QUESTIONS AND ANSWERS ON WEBSITE:** _____

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Contract No. T201606301.01

**AFFIRMATION**:

Within the past five (5) years, has your firm, any affiliate, any predecessor company or entity, owner, Director, officer, partner or proprietor been the subject of a Federal, State, Local government suspension or debarment?

**YES**_____ **NO**_____ if yes, please explain _____

---

Sealed and dated this _____ day of _____ in the year of our Lord two thousand _____ ( 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

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**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 bound unto the **State** in the sum of _____ _____Dollars ($_____), or _____ percent not to exceed _____

_____ Dollars ($_____) of amount of bid on Contract No. T201606301.01, 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

CANNOT BE USED FOR BIDDING