|  |  |
| --- | --- |
| REVIEW OF NEW SPECIFICATION OR SPECIFICATION CHANGE  | 627-11 |
| **Specification Section No.:** 627 and 708 | **Item:** Pavement Marking Paint |
| **Originating Office:** Traffic and Safety Engineering Branch | **By:** Chevalier/Matthews |
| **Date Sent For Review:** Feb 4 2016 | **Date Comments Due: Mar 3 2016** |
| Submit response to: STANDARDS AND SPECIFICATIONS UNIT, DIVISION OF PROJECT SUPPORT 4TH FLOOR, CDOT HEADQUARTERS |
| **Vote****/N** | **Concurrent Reviews – Others Commenting** | The attached Draft Specification is submitted for your review and comments. If not returned by Date Comments Due, the draft specification will be considered to be approved unless the Standards and Specifications Unit of the Project Development Branch [(303) 757-9474, (303) 757-9402] is advised otherwise.**REMARKS:** If these proposed changes are approved, our unit will issue these in a revised version of this standard special provision. |
|  | **Spec Committee Members:** |  **✓** |
|  | Co-Chairman: Lacey |  |
|  | Region 1: Quirk |  |
|  | Region 1: Stratton |  |
|  | Region 2: Ferguson |  |
|  | Region 3: Necessary |  |
|  | Region 4: Locke |  |
|  | Region 5: Valentinelli |  |
|  | Project Development: Vacant |  |
|  | Specifications: Brinck |  |
|  | Bridge: Hasan |  |
|  | Contracts & Market Analysis: Eddy |  |
|  | Materials: Schiebel |  |
|  | Traffic Engineering: Matthews |  | REVIEWER COMMENTS:( ) Approved ( ) Disapproved ( ) ModifiedIf disapproved or modified, give reason why and show any modifications on the attached draft copy: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ Name/Signature Date |
|  | Maintenance: Weldon |  |
|  | FHWA: Egal |  |
|  | Attorney General: Milan |  |
|  |  |  |
|  | **Others:** |  |
|  | Colorado Contractors Assoc.: Moody |  |
|  |  |  |
|  | **Technical Committees:** |  |
|  | Bridge |  |
|  | Drainage Advisory Committee (DAC) |  |
|  | Joint Co-op, CDOT/CCA |  |

|  |  |
| --- | --- |
| **COLORADO DEPARTMENT OF TRANSPORTATION****SUBMITTAL OF NEW SPECIFICATION OR SPECIFICATION CHANGE** | Log No. (Assigned by Standards and Specifications Unit) |
| TO: Standards and Specifications Unit, Project Development, Suite 290 | FROM:Traffic and Safety Branch(Region, Branch or Technical Committee) |
| SPECIFICATION SECTION NO.627 | ITEMPavement Marking Paint | Priority Routine[x]  Fast[ ]  |
| Reason for this new or changed specification:Retroreflectivity needs to be tested daily to ensure proper application of paint. The proposed revisions identify how and when retroreflectivity testing is to be peformed |
| New or Revised Specification:SEE ATTACHED. |
| Note: See Procedural Directive 513.1 for a description of appropriate specification development procedures. |

 **CDOT Form 1215 10/01**

 January 31, 2013

REVISION OF SECTIONS 627 AND 708

PAVEMENT MARKING PAINT

**NOTICE**

This is a standard special provision that revises or modifies CDOT’s *Standard Specifications for Road and Bridge Construction.* It has gone through a formal review and approval process and has been issued by CDOT’s Project Development Branch with formal instructions for its use on CDOT construction projects. It is to be used as written without change. Do not use modified versions of this special provision on CDOT construction projects, and do not use this special provision on CDOT projects in a manner other than that specified in the instructions unless such use is first approved by CDOT’s Standards and Specifications Unit. The instructions for use on CDOT construction projects appear below.

Other agencies which use the *Standard Specifications for Road and Bridge Construction* to administer construction projects may use this special provision as appropriate and at their own risk.

**Instructions for use on CDOT construction projects:**

Use on projects having pavement marking paint.

REVISION OF SECTIONS 202, 627 AND 708

PAVEMENT MARKING PAING

Sections 202, 627 and 708 of the Standard Specifications are hereby revised for this project as follows:

1. *Removal of temporary pavement marking on final alignment.* Temporary pavement marking paint on the approved final alignment shall be removed completely from the roadway surface at locations of permanent pavement markings as shown on the plans. The ground location shall be clean, dry and free of laitance, oil, dirt, grease, paint or other foreign contaminants prior to application of final pavement marking. The Contractor shall not remove more pavement marking paint than what can be replaced with permanent pavement marking during the same working day or working period. If an event occurs that precludes the contractor from completing the work during the placement of permanent marking, the Contractor shall halt the removal operation and raised flexible pavement markers shall be placed at locations that have been removed but not marked while the pavement is drying prior to the marking application. Marking application shall resume when pavement is dry and has had no moisture for a minimum of 24 hours. Raised flexible pavement markers shall be installed with one marker at 40-foot centers.
2. *Removal of temporary pavement marking on transitions.* Removal of pavement marking paint on temporary transitional alignments shall be performed by grinding or water-blasting. The removal shall result in 100 percent removal of the paint and a wide swath of ground pavement surrounding the former location of the temporary paint. The width of the swath shall be as follows; the center of the swath shall be the location of the paint line:

|  |  |
| --- | --- |
| Width of Pavement Marking to be removed | Width of Swath |
| < 8 inches | 12 inches |
| > 8 inches | 18 inches |

Subsection 202.11 shall include the following:

Removal of temporary pavement marking on transitions will be measured as the actual square feet of the swath constructed for the required width. Removal of pavement marking for the permanent alignment will be measured as the actual number of square feet removed.

Subsection 202.12 shall include the following:

Payment will be made under:

**Pay Item** **Pay Unit**

Removal of Pavement Marking Square Foot

Removal of Pavement Marking (12 Inch) Square Foot

Removal of Pavement Marking (18 Inch) Square Foot

Raised pavement markings shall be at the Contractor’s expense.

In subsection 627.04, delete the first paragraph and replace with the following:

**627.04 Pavement Marking with Waterborne, Low Volatile Organic Compound (VOC) Solvent Base, and High Build Acrylic Waterborne Paint (High Build)**. Striping shall be applied when the air and pavement temperatures are no less than 45 °F for waterborne and high-build paint, and 35°F for low temperature waterborne paint on asphalt or portland cement concrete pavements. The pavement surface shall be dry and clean,and free of all latent materials, in accordance with manufacturer recommendations. Weather conditions shall be conducive to satisfactory results.

In subsection 627.04 delete the table and replace it with the following:

|  |  |  |
| --- | --- | --- |
|  | **Description** | **Paint** |
|  |  | Waterborne | Low Temp | High Build |
| Alignment  | Lateral Deviation | 2.0 inch per 200 foot Max |
| Coverage Rate | Sq. Ft. per Gallon | 90-100 | 90-100 | 67-73 |
| Thickness | Mil | 16-18 | 16-18 | 22-24 |
| Width | Inches | Per Plans +/- 0.25 |
| Dry Time | Minutes | 5-10 | 5-10 | 5-10 |
| Beads | Application Rate, lbs./gal | 7-8 | 9-10 |

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |
|  |  |  |  |  |
|  |  |  |  |

Subsection 627.13 shall include the following:

**Pay Item Pay Unit**

Pavement Marking Paint (High Build) Gallon

Pavement Marking Paint (Low Temperature) Gallon

Pavement Marking Paint (Waterborne) Gallon

Delete subsection 708.05 and replace with the following:

**708.05 Pavement Marking Materials**. Except for pavement marking paint, pavement marking materials shall be selected from the Department’s Approved Products List (APL). Prior to start of work, a Certified Test Report (CTR) for all pavement marking materials shall be submitted in accordance with subsection 106.13.

1. *Color.* The pavement marking paint, without drop-on beads, shall correspond following requirements:

White – Federal Standard No. 595B-17925. The Yellowness Index (YI) of white shall not exceed 8.0 per ASTM E-313-10 initially. The color after drying shall be a flat-white, free from tint, and shall provide the maximum amount of opacity and visibility under both daylight and artificial light.

Yellow – Materials for pavement markings shall meet the initial daytime chromaticity that fall within the box created by the following corner points:

Initial Daytime Chromaticity Coordinates (Corner Points)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** |
| x | 0.530 | 0.510 | 0.455 | 0.472 |
| y | 0.456 | 0.485 | 0.444 | 0.400 |

1. *Acrylic Waterborne Paint*. Acrylic waterborne paint shall be a lead-free, 100 percent Acrylic resin polymer waterborne *product*. The finished product shall maintain its consistency during application at temperatures compatible with conventional equipment.
2. *High Build Acrylic Waterborne Paint.* High build acrylic waterborne paint binder (nonvolatile portion of vehicle) shall be 100 percent HD 21 acrylic cross linking polymer, by weight, as determined by infrared analysis or other chemical analysis available to the Department.
3. *Low Temperature Acrylic Waterborne Paint.* Low Temperature Acrylic Waterborne Paint binder (nonvolatile portion of vehicle) shall be 100 percent XSR acrylic polymer, by weight, as determined by infrared analysis or other chemical analysis available to the Department.

Waterborne, Low Temperature Waterborne, and High Build Acrylic Waterborne paint shall meet the following requirements:

**Performance Requirements**: The paint shall be water resistant and shall show no softening or blistering.

**Table 708-1
WATERBORNE AND HIGH BUILD ACRYLIC WATERBORNE PAINT**

|  |  |  |  |
| --- | --- | --- | --- |
| **Property** | **White** | **Yellow** | 1. **Test Method**
 |
| Nonvolatile portion of vehicle (white and yellow), % | 43.0 (min) | 43.0 (min) | ASTM D 2205 |
| **Pigment Composition**  |  |  |  |
| Percent by weight♦ | 60.0 | 60.0 | ASTM D 4451ASTM D 3723 |
| Paint  |  |  |  |
| Titanium Dioxide Content, lb./gal | 1.0 (min) | 0.2 (max) | ASTM D 5381 |
|  |  |  |  |
| **Properties of the Finished Paint** |  |  |  |
| Total Non-volatiles, (solids) % by weight | 77.0 (min) | 77.0 (min) | FTMS 141C - Method 4053.1, ASTM D 2369, or ASTM D 4758 |
| Density, lbs./gal  | 14.0-14.6 | 13.7-14.3 | ASTM D 2205 |
| Consistency (Viscosity) White and Yellow, Krebs-Stormer Units | 85-95 | 85-95 | ASTM D 562 |
| Freeze Thaw Stability | Shall complete 5 or more test cycles successfully | ASTM D 2243 |
| Fineness of Grind, Cleanliness Rating B, minimum | 3 | 3 | ASTM D 1210 |
|  Scrub Resistance | 800 | 800 | ASTM D2486 |
| Directional Reflectance: [5 mil Wet Film] | 90 (min) | 50 (min) | ASTM E 1347 |
| Dry Opacity (Contrast Ratio): [5 mil Wet Film] | 0.95 (min) | 0.95 (min) | ASTM D 2805 |
| ♦Percent by weight shall include percent of organic yellow pigment. |

REVISION OF SECTIONS 202, 627 AND 708

PAVEMENT MARKING PAINT

Sections 202, 627 and 708 of the Standard Specifications are hereby revised for this project as follows:

In subsection 202.05 delete the third paragraph and replace with the following:

1. *Removal of temporary pavement marking on final alignment.* Temporary pavement marking paint on the approved final alignment shall be removed completely from the roadway surface at locations of permanent pavement markings as shown on the plans. The ground location shall be clean, dry and free of laitance, oil, dirt, grease, paint or other foreign contaminants prior to application of final pavement marking. The Contractor shall not remove more pavement marking paint than what can be replaced with permanent pavement marking during the same working day or working period. If an event occurs that precludes the contractor from completing the work during the placement of permanent marking, the Contractor shall halt the removal operation and raised flexible pavement markers shall be placed at locations that have been removed but not marked while the pavement is drying prior to the marking application. Marking application shall resume when pavement is dry and has had no moisture for a minimum of 24 hours. Raised flexible pavement markers shall be installed with one marker at 40-foot centers.
2. *Removal of temporary pavement marking on transitions.* Removal of pavement marking paint on temporary transitional alignments shall be performed by grinding or water-blasting. The removal shall result in 100 percent removal of the paint and a wide swath of ground pavement surrounding the former location of the temporary paint. The width of the swath shall be as follows; the center of the swath shall be the location of the paint line:

|  |  |
| --- | --- |
| Width of Pavement Marking to be removed | Width of Swath |
| < 8 inches | 12 inches |
| > 8 inches | 18 inches |

Subsection 202.11 shall include the following:

Removal of temporary pavement marking on transitions will be measured as the actual square feet of the swath constructed for the required width. Removal of pavement marking for the permanent alignment will be measured as the actual number of square feet removed.

Subsection 202.12 shall include the following:

Payment will be made under:

**Pay Item** **Pay Unit**

Removal of Pavement Marking Square Foot

Removal of Pavement Marking (12 Inch) Square Foot

Removal of Pavement Marking (18 Inch) Square Foot

Raised pavement markings shall be at the Contractor’s expense.

In subsection 627.04, delete the first paragraph and replace with the following:

**627.04 Pavement Marking with Waterborne, Low Temperature Waterborne, and High Build Acrylic Waterborne Paint (High Build)**. Striping shall be applied when the air and pavement temperatures are no less than 45 °F for waterborne and high-build paint, and no less than 35°F for low temperature waterborne paint on asphalt or portland cement concrete pavements. The pavement surface shall be dry and clean, and free of all latent materials, in accordance with manufacturer recommendations. . Weather conditions may be conducive to satisfactory results.

In subsection 627.04 delete the table and replace it with the following

|  |  |  |
| --- | --- | --- |
|  | **Description** | **Paint** |
|  |  | Waterborne | Low Temp | High Build |
| Alignment  | Lateral Deviation | 2.0 inch per 200 foot Max |
| Coverage Rate | Sq. Ft. per Gallon | 90-100 | 90-100 | 67-73 |
| Thickness | Mil | 16-18 | 16-18 | 22-24 |
| Width | Inches | Per Plans +/- 0.25 |
| Dry Time | Minutes | 5-10 | 5-10 | 5-10 |
| Beads | Application Rate, lbs./gal | 7-8 | 9-10 |

Subsection 627.13 shall include the following:

**Pay Item Pay Unit**

Pavement Marking Paint (High Build) Gallon

Pavement Marking Paint (Low Temperature) Gallon

Pavement Marking Paint (Waterborne) Gallon

Delete subsection 708.05 and replace with the following:

**708.05 Pavement Marking Materials**. Except for pavement marking paint, pavement marking materials shall be selected from the Department’s Approved Products List (APL). Prior to start of work, a Certified Test Report (CTR) for all pavement marking materials shall be submitted in accordance with subsection 106.13.

1. *Color.* The pavement marking paint, without drop-on beads, shall correspond following requirements:

White – Federal Standard No. 595B-17925. The Yellowness Index (YI) of white shall not exceed 8.0 per ASTM E-313-10 initially. The color after drying shall be a flat-white, free from tint, and shall provide the maximum amount of opacity and visibility under both daylight and artificial light.

Yellow – Materials for pavement markings shall meet the initial daytime chromaticity that fall within the box created by the following corner points:

Initial Daytime Chromaticity Coordinates (Corner Points)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** |
| x | 0.530 | 0.510 | 0.455 | 0.472 |
| y | 0.456 | 0.485 | 0.444 | 0.400 |

1. *Acrylic Waterborne Paint*. Acrylic waterborne paint shall be a lead-free, 100 percent Acrylic resin polymer waterborne *product*. The finished product shall maintain its consistency during application at temperatures compatible with conventional equipment.
2. *High Build Acrylic Waterborne Paint.* High build acrylic waterborne paint binder (nonvolatile portion of vehicle) shall be 100 percent HD 21 acrylic cross linking polymer, by weight, as determined by infrared analysis or other chemical analysis available to the Department.
3. *Low Temperature Acrylic Waterborne Paint.* Low Temperature Acrylic Waterborne Paint binder (nonvolatile portion of vehicle) shall be 100 percent XSR acrylic polymer, by weight, as determined by infrared analysis or other chemical analysis available to the Department.

Waterborne, Low Temperature Waterborne, and High Build Acrylic Waterborne paint shall meet the following requirements:

**Performance Requirements**: The paint shall be water resistant and shall show no softening or blistering.

**Table 708-1
WATERBORNE AND HIGH BUILD ACRYLIC WATERBORNE PAINT**

|  |  |  |  |
| --- | --- | --- | --- |
| **Property** | **White** | **Yellow** | **Test Method** |
| Nonvolatile portion of vehicle (white and yellow), % | 43.0 (min) | 43.0 (min) | ASTM D 2205 |
| **Pigment Composition**  |  |  |  |
| Percent by weight♦ | 60.0 | 60.0 | ASTM D 4451ASTM D 3723 |
| Paint  |  |  |  |
| Titanium Dioxide Content, lb./gal | 1.0 (min) | 0.2 (max) | ASTM D 5381 |
|  |  |  |  |
| **Properties of the Finished Paint** |  |  |  |
| Total Non-volatiles, (solids) % by weight | 77.0 (min) | 77.0 (min) | FTMS 141C - Method 4053.1, ASTM D 2369, or ASTM D 4758 |
| Density, lbs./gal  | 14.0-14.6 | 13.7-14.3 | ASTM D 2205 |
| Consistency (Viscosity) White and Yellow, Krebs-Stormer Units | 85-95 | 85-95 | ASTM D 562 |
| Freeze Thaw Stability | Shall complete 5 or more test cycles successfully | ASTM D 2243 |
| Fineness of Grind, Cleanliness Rating B, minimum | 3 | 3 | ASTM D 1210 |
|  Scrub Resistance | 800 | 800 | ASTM D2486 |
| Directional Reflectance: [5 mil Wet Film] | 90 (min) | 50 (min) | ASTM E 1347 |
| Dry Opacity (Contrast Ratio): [5 mil Wet Film] | 0.95 (min) | 0.95 (min) | ASTM D 2805 |
| ♦Percent by weight shall include percent of organic yellow pigment. |