PART 1  GENERAL

1.1  REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)


ASTM D2621 (1987; R 2011) Infrared Identification of Vehicle Solids from Solvent-Reducible Paints

ASTM D2697 (2003; R 2014) Volume Nonvolatile Matter in Clear or Pigmented Coatings

ASTM D3335 (1985a; R 2014) Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy

ASTM D3718 (1985a; R 2015) Low Concentrations of Chromium in Paint by Atomic Absorption Spectroscopy


ASTM D3960 (2005; R 2013) Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings

ASTM D4280 (2012) Extended Life Type, Nonplowable, Raised, Retroreflective Pavement Markers

ASTM D4505 (2012) Preformed Retroreflective Pavement Marking Tape for Extended Service Life


ASTM D711 (2010; R 2015) No-Pick-Up Time of Traffic Paint

ASTM D792 (2013) Density and Specific Gravity (Relative Density) of Plastics by Displacement


ASTM E28 (2014) Softening Point of Resins Derived from Naval Stores by Ring and Ball Apparatus

ASTM G154 (2012a) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

ICRI 03732 (1997) Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

MASTER PAINTERS INSTITUTE (MPI)


U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595 (Rev C; Notice 1) Colors Used in Government Procurement

FS TT-B-1325 (Rev D; Notice 1) Beads (Glass Spheres) Retro-Reflective (Metric)

FS TT-P-1952 (2015; Rev F) Paint, Traffic and Airfield Markings, Waterborne
1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Reflective media for airfields
Reflective media for roads and streets
Paints for airfields

Paints for roads and streets

High Build Acrylic Coating (HBAC); [__________] Thermoplastic compound

Raised Pavement Markers and Adhesive

Equipment; [______]

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

SD-06 Test Reports

Reflective media for airfields
Reflective media for roads and streets
Paints for airfields

Paints for roads and streets
High Build Acrylic Coating (HBAC); [G[ [________]]] Thermoplastic compound

Raised Pavement Markers and Adhesive

Certified reports from sampling and testing made in accordance with paragraph entitled "Sampling and Testing" prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

SD-07 Certificates

Qualifications

Reflective media for airfields Reflective media for roads and streets Paints for airfields Paints for roads and streets Volatile Organic Compound, (VOC)

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

Thermoplastic compound

Construction equipment list

SD-08 Manufacturer's Instructions Paints

for airfields

Paints for roads and streets

Thermoplastic compound

Submit manufacturer's Material Safety Data Sheets.
1.3 DELIVERY AND STORAGE

Deliver paints, paint materials and thermoplastic compound materials in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the job site, only in areas approved by the Contracting Officer or authorized representative, for maintaining materials at temperatures recommended by the manufacturer. Make available paint stored at the project site or segregated at the source for sampling not less than 30 days prior to date of required approval for use to allow sufficient time for testing. Notify the Contracting Officer when paint is available for sampling.

1.4 WEATHER LIMITATIONS

Apply paint to clean, dry surfaces, and unless otherwise approved, only when the air and pavement surface temperature is at least 5 degrees above the dew point and the air and pavement temperatures are above 40 degrees F and less than 95 degrees F for oil-based materials; above 50 degrees F and less than 110 degrees F for water-based materials. Maintain paint temperature within these same limits.

1.5 EQUIPMENT

Machines, tools, and equipment used in the performance of the work shall be approved by the Contracting Officer and maintained in satisfactory operating condition. Submit construction equipment list for approval by the Contracting Officer.

1.5.1 Mobile and Maneuverable

Application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

1.5.2 Paint Application Equipment

Provide hand-operated push-type applicator machine of a type commonly used for application of paint to pavement surfaces. Paint applicator machine shall be acceptable for marking small street and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Applicator for water-based markings shall be equipped with non-stick coated hoses; metal parts in contact with the paint material shall be constructed of grade 302, 304, 316, or equal stainless steel.
Provide self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. Provide machine having a speed during application capable of applying the stripe widths indicated at the paint coverage rate specified herein and of even uniform thickness with clear-cut edges.

Provide paint applicator with paint reservoirs or tanks of sufficient capacity and suitable gages to apply paint in accordance with requirements specified. Equip tanks with suitable air-driven mechanical agitators. Equip spray mechanism with quick-action valves conveniently located, and include necessary pressure regulators and gages in full view and reach of the operator. Install paint strainers in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Provide pneumatic spray guns for hand application of paint in areas where the mobile paint applicator cannot be used. Applicator for water-based markings shall be equipped with non-stick coated hoses; metal parts in contact with the paint material shall be constructed of grade 302, 304, 316, or equal stainless steel.

1.5.3.1 Thermoplastic Material

Thermoplastic material shall be applied to the primed pavement surface by spray techniques or by the extrusion method, wherein one side of the shaping die is the pavement and the other three sides are contained by, or are part of, suitable equipment for heating and controlling the flow of material. By either method, the markings shall be applied with equipment that is capable of providing continuous uniformity in the dimensions of the stripe.

1.5.3.2 Application Equipment

a. Application equipment shall provide continuous mixing and agitation of the material. Conveying parts of the equipment between the main material reservoir and the extrusion shoe or spray gun shall prevent accumulation and clogging. All parts of the equipment which come into contact with the material shall be easily accessible and exposable for cleaning and maintenance. All mixing and conveying parts up to and including the extrusion shoes and spray guns shall maintain the material at the required temperature with heat-transfer oil or electrical-element-controlled heat.
b. The application equipment shall be constructed to ensure continuous
uniformity in the dimensions of the stripe. The applicator shall provide a
means for cleanly cutting off stripe ends squarely and shall provide a method
of applying "skiplines". The equipment shall be capable of applying varying
widths of traffic markings.

c. The applicator shall be equipped with a drop-on type bead dispenser capable
of uniformly dispensing reflective glass spheres at controlled rates of flow.
The bead dispenser shall be automatically operated and shall begin flow prior
to the flow of composition to assure that the strip is fully reflectorized.

1.5.3.3 Mobile and Maneuverable

Application equipment shall be mobile and maneuverable to the extent that
straight lines can be followed and normal curves can be made in a true arc. The
equipment used for the placement of thermoplastic pavement markings shall be
of two general types: mobile applicator and portable applicator.

1.5.3.4 Mobile Application Equipment

The mobile applicator shall be defined as a truck-mounted, self-contained
pavement marking machine that is capable of hot applying thermoplastic by either
the extrusion or spray method. The unit shall be equipped to apply the
thermoplastic marking material at temperatures exceeding 375 degrees F, at widths
varying from 3 to 12 inches and in thicknesses varying from 0.040 to 0.200 inch and
shall have an automatic drop-on bead system. The mobile unit shall be capable of
operating continuously and of installing a minimum of 20,000 lineal feet of
longitudinal markings in an 8-hour day.

The mobile unit shall be equipped with a melting kettle which holds a minimum of
6000 pounds of molten thermoplastic material. The kettle shall be capable of
heating the thermoplastic composition to temperatures of 375 to 425 degrees F. A
thermostatically controlled heat transfer liquid shall be used. Heating of the
composition by direct flame shall not be allowed. Oil and material temperature
gauges shall be visible at both ends of the kettle. The mobile unit shall be
equipped with a minimum of two extrusion shoes located one on each side of the
truck, and shall be capable of marking simultaneous edgeline and centerline
stripes. Each extrusion shoe shall be a closed, oil-jacketed unit; shall hold the
molten thermoplastic at a temperature of 375 to 425 degrees F; and shall be
capable of extruding a line of 3 to 8 inches in width; and at a thickness of not less
than 0.120 inch nor more than 0.190 inch, and of generally uniform cross section.

The mobile unit shall be equipped with an electronic programmable line pattern
control system. The control system shall be capable of applying skip or solid lines
in any sequence, through any and all of the extrusion shoes, or the spray guns,
and in programmable cycle lengths. In addition, the mobile unit shall be equipped
with an automatic counting mechanism capable of recording the number of lineal
feet of thermoplastic markings applied to the pavement surface with an accuracy
of 0.5 percent.
1.5.3.5 Portable Application Equipment

The portable applicator shall be defined as hand-operated equipment, specifically designed for placing special markings such as crosswalks, stopbars, legends, arrows, and short lengths of lane, edge and centerlines. The portable applicator shall be capable of applying thermoplastic pavement markings by the extrusion method. The portable applicator shall be loaded with hot thermoplastic composition from the melting kettles on the mobile applicator. The portable applicator shall be equipped with all the necessary components, including a materials storage reservoir, bead dispenser, extrusion shoe, and heating accessories, so as to be capable of holding the molten thermoplastic at a temperature of 375 to 425 degrees F, of extruding a line of 3 to 12 inches in width, and in thickness of not less than 0.120 inch nor more than 0.190 inch and of generally uniform cross section.

1.5.4 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION, at all operating speeds of the applicator to which it is attached.

1.5.5 Preformed Tape Application Equipment

Mechanical application equipment shall be used for the placement of preformed marking tape. Mechanical application equipment shall be defined as a mobile pavement marking machine specifically designed for use in applying precoated, pressure-sensitive pavement marking tape of varying widths, up to 12 inches. The applicator shall be equipped with rollers, or other suitable compactive device, to provide initial adhesion of the preformed, pressure-sensitive marking tape with the pavement surface. Additional hand-operated rollers shall be used as required to properly seat the thermoplastic tape.

1.5.6 Surface Preparation Equipment

1.5.6.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.
1.5.6.2 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked. Water will be furnished at no cost to the Contractor from a fire hydrant designated by the Contracting Officer or authorized representative and located within a reasonable proximity to the work area. The Contractor shall install a gate valve and a back-flow prevention device on the fire hydrant tap. The Contractor shall furnish all equipment, material, and labor required to obtain and deliver water from the designated fire hydrant to the work area(s). Marking Removal Equipment.

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

1.5.7.1 Shotblasting Equipment

Shotblasting equipment shall be capable of producing an adjustable depth of removal of marking and pavement. Each unit shall be self-cleaning and self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

1.5.7.2 Chemical Equipment

Chemical equipment shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradable residue.

1.5.8 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.6 MAINTENANCE OF TRAFFIC

1.6.2 Lighting

When night operations are necessary, all necessary lighting and equipment shall be provided. Lighting shall be directed or shaded to prevent interference with aircraft, the air traffic control tower, and other base operations. All lighting and related equipment shall be capable of being removed from the runway within 15 minutes of notification of an emergency. Night work must be coordinated with the Airfield Manager and approved in advance by the Contracting Officer or authorized representative. The Government reserves the right to accept or reject night work on the day following night activities by the Contractor.
1.6.3 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.7 WEATHER LIMITATIONS FOR REMOVAL

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals.

Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

PART 2 PRODUCTS

2.1 MATERIALS

Provide materials conforming to the requirements specified herein.

2.1.2 Paints for Roads and Streets

[ MPI 32 ][ FS TT-P-1952 ][ High Build Acrylic Coating (HBAC) ], color as [ indicated ] [ selected ].

2.1.4 Reflective Media for Roads and Streets FS

TT-B-1325, Type I, Gradation A.

2.1.5 Thermoplastic Compound

The thermoplastic reflectorized pavement marking compound shall be extruded or sprayed in a molten state onto a primed pavement surface. Following a surface application of glass beads and upon cooling to normal pavement temperatures, the marking shall be an adherent reflectorized strip of the specified thickness and width that is capable of resisting deformation by traffic.

2.1.5.1 Composition Requirements

The binder component shall be formulated as a hydrocarbon resin. The pigment, beads and filler shall be uniformly dispersed in the binder resin. The thermoplastic composition shall be free from all skins, dirt, and foreign objects and shall comply with the following requirements:
### Component Percent by Weight

<table>
<thead>
<tr>
<th>Component</th>
<th>White</th>
<th>Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Binder</strong></td>
<td>17 min</td>
<td>17 min</td>
</tr>
<tr>
<td><strong>Titanium dioxide</strong></td>
<td>10 min</td>
<td>-</td>
</tr>
<tr>
<td><strong>Glass beads</strong></td>
<td>20 min</td>
<td>20 min</td>
</tr>
<tr>
<td><strong>Calcium carbonate and inert fillers</strong></td>
<td>49 min</td>
<td>*</td>
</tr>
<tr>
<td><strong>Yellow pigments</strong></td>
<td>-</td>
<td>*</td>
</tr>
</tbody>
</table>

*Amount and type of yellow pigment, calcium carbonate and inert fillers shall be at the option of the manufacturer, providing the other composition requirements of this specification are met.

#### 2.1.5.2 Physical Properties

##### a. Drying time: When installed at 70 degrees F and in thicknesses between 0.120 and 0.190 inch, the composition shall be completely solid and shall show no damaging effect from traffic after curing 15 minutes.

##### b. Softening point: The composition shall have a softening point of not less than 194 degrees F when tested in accordance with ASTM E28.

##### c. Specific gravity: The specific gravity of the composition shall be between 1.9 and 2.2 as determined in accordance with ASTM D792.

#### 2.1.5.3 Primer

##### a. Asphalt concrete primer: The primer for asphalt concrete pavements shall be a thermosetting adhesive with a solids content of pigment reinforced synthetic rubber and synthetic plastic resin dissolved or dispersed in a volatile organic solvent. The solids content shall not be less than 10 percent by weight at 70 degrees F and 60 percent relative humidity. A wet film thickness of 0.005 inch, plus or minus 0.001 inch, shall dry to a tack-free condition in less than 5 minutes.
b. Portland cement concrete primer: The primer for portland cement concrete pavements shall be an epoxy resin primer. The primer shall be of the type recommended by the manufacturer of the thermoplastic composition.

2.1.6 PREFORMED TAPE
The preformed tape shall be an adherent reflectorized strip in accordance with ASTM D4505 Type I or IV, Class optional.

2.1.7 Raised Pavement Markers
Either metallic or nonmetallic markers of the button or prismatic reflector type may be used. Markers shall be of permanent colors as specified for pavement marking, and shall retain the color and brightness under the action of traffic. Button markers shall have a diameter of not less than 4 inches, and shall be spaced not more than 40 feet apart on solid longitudinal lines. Broken centerline marker spacings shall be in segments as indicated. Button markers shall have rounded surfaces presenting a smooth contour to traffic and shall not project more than 3/4 inch above level of pavement. Pavement markers and adhesive epoxy shall conform to ASTM D4280

2.1.8 High Build Acrylic Coating (HBAC)
Formulate High Build Acrylic Coating (HBAC) to meet the requirements of Table I.

2.1.8.1 Preapproved HBAC Vendors and Materials
Table II presents a partial list of HBAC vendors and materials. Up to specifications’s date of issue, preapproved materials met specification requirements. It is the user’s responsibility to confirm preapproved material formulations have not changed and specification requirements will be met. Other products may meet HBAC requirements.

PART 3 EXECUTION
3.1 SURFACE PREPARATION

Allow new pavement surfaces to cure for a period of not less than 30 days before application of marking materials. Thoroughly clean surfaces to be marked before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Remove rubber deposits, existing paint markings, residual curing compounds, and other coatings adhering to the pavement according to the removal requirements and procedures outlined in Section 32 01 11.51. For Portland Cement Concrete pavement, grinding, light shot blasting, and light scarification, to a resulting profile equal to ICRI 03732 CSP 2, CSP 3, and CSP 4, respectively, can be used in addition to water blasting, to either remove existing coatings or for surface preparation on most pavements: shot blasting shall not be
used on airfield pavements due to the potential of Foreign Object Damage (FOD) to aircraft. Scrub affected areas, where oil or grease is present on old pavements to be marked, with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinse thoroughly after each application. After cleaning oil-soaked areas, seal with shellac or primer recommended by the manufacturer to prevent bleeding through the new paint. Do not commence painting in any area until pavement surfaces are dry and clean.

Pretreat rigid pavements that require early painting with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride. Apply the solution to the areas to be marked.

For asphalt pavement systems requiring painting application at less than 30 days, apply the paint and beads at half the normal application rate, followed by a second application at the normal rate after 30 days.

3.2.1 Testing for Moisture

Apply pavement markings to dry pavement only. The Contractor shall test the pavement surface for moisture before beginning work after each period of rainfall, fog, high humidity, or cleaning, or when the ambient temperature has fallen below the dew point. Do not commence marking until the pavement is sufficiently dry and the pavement condition has been approved by the CO or authorized representative. Employ the "plastic wrap method" to test the pavement for moisture as follows: Cover the pavement with a 300 mm by 300 mm (12 inch by 12 inch) section of clear plastic wrap and seal the edges with tape. After 15 minutes, examine the plastic wrap for any visible moisture accumulation inside the plastic. Do not begin marking operations until the test can be performed with no visible moisture accumulation inside the plastic wrap.

3.2.2 Rate of Application

3.2.2.1 Reflective Markings

Apply paint evenly to the pavement area to be coated at a rate of 105 plus or minus 5 square feet per gallon. Apply High Build Acrylic Coating (HBAC) at a rate of 50 square feet per gallon. Apply glass spheres uniformly to the wet paint on road and street pavement at a rate of (6) plus or minus (0.5) pounds of glass spheres per gallon. Collect and record readings for white and yellow retroreflective markings at the rate of one reading per 1000 linear feet. The minimum acceptable average for
white markings is 200 millicandelas per square meter per lux (mcd/m²/lx) (measured with Mirolux 12 Retroreflectometer or similar instrument as agreed). The minimum acceptable average for yellow markings is 175 millicandelas per square meter per lux (mcd/m²/lx). Readings shall be computed by averaging a minimum of 10 readings taken within the area at random locations. Areas not meeting the retroreflective requirements stated above shall be re-marked.

3.2.2.2 Nonreflective Markings

Apply paint evenly to the pavement surface to be coated at a rate of 105 plus or minus 5 square feet per gallon. Apply High Build Acrylic Coating (HBAC) at a rate of 50 square feet per gallon.

3.2.2.3 Thermoplastic Compound

After surface preparation has been completed, prime the asphalt or concrete pavement surface with spray equipment. Allow primer materials to "set-up" prior to applying the thermoplastic composition. Allow the Portland Cement concrete primer to dry in accordance with the thermoplastic manufacturer recommendations. To shorten the curing time of the epoxy resins, an infrared heating device may be used on the concrete primer. Apply portland cement concrete primer to all concrete pavements (including concrete bridge decks) at a wet film thickness of between 0.04 to 0.05 inch 320 to 400 square feet per gallon. After the primer has "set-up", apply the thermoplastic at temperatures no lower than 375 degrees F nor higher than 425 degrees F at the point of deposition. Immediately after installation of the marking, apply drop-on reflective glass spheres mechanically at the rate of one pound per 20 square feet such that the spheres are held by and imbedded in the surface of the molten material. Apply all extruded thermoplastic markings at the specified width and at a thickness of not less than 0.125 inch nor more than 0.190 inch. Apply all sprayed thermoplastic markings at the specified width and the thickness designated in the contract plans. If the plans do not specify a thickness, apply centerline markings at a wet thickness of 0.090 inch, plus or minus 0.005 inch, and edgeline markings at a wet thickness of 0.060 inch, plus or minus 0.005 inch.

3.2.3 Painting

Apply paint pneumatically with approved equipment at rate of coverage specified herein. Provide guidelines and templates as necessary to control paint application. Take special precautions in marking numbers, letters, and symbols. Manually paint numbers, letters, and symbols. Sharply outline all edges of markings. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the markings until cause of the slow drying is determined and corrected.
3.2.4 Reflective Media

Application of reflective media shall immediately follow the application of paint. Accomplish drop-on application of the glass spheres to ensure even distribution at the specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, discontinue operations until deficiency is corrected.

3.2.5 Thermoplastic Compound

Place thermoplastic pavement markings upon dry pavement. At the time of installation the pavement surface temperature shall be a minimum of 40 degrees F and rising. Thermoplastics, as placed, shall be free from dirt or tint. Apply all centerline, skipline, edgeline, and other longitudinal type markings with a mobile applicator. Place all special markings, crosswalks, stop bars, legends, arrows, and similar patterns with a portable applicator, using the extrusion method.

3.2.6 Raised Pavement Markers

Prefabricated markers shall be aligned carefully at the required spacing or as directed and permanently fixed in place by means of epoxy adhesives. To ensure good bond, areas where markers will be set shall be thoroughly cleaned by water blasting and use of compressed air prior to applying adhesive.

3.3 FIELD TESTING, INSPECTION, AND DEMONSTRATIONS

3.3.1 Sampling and Testing

As soon as the paint and reflective and thermoplastic materials are available for sampling, obtain by random selection from the sealed containers, two quart samples of each batch in the presence of the Contracting Officer. Accomplish adequate mixing prior to sampling to ensure a uniform, representative sample. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Clearly identify samples by designated name, specification number, batch number, project contract number, intended use, and quantity involved. Test samples by an approved laboratory. If a sample fails to meet specification, replace the material in the area represented by the samples and retest the replacement material as specified above. Submit copy of the test results to the Contracting Officer. Include in the report of test results a listing of any specification requirements not verified by the test laboratory. At the discretion of the Contracting Officer, samples provided may be tested by the Government for verification.
3.3.2 Inspection

Examine material at the job site to determine that it is the material referenced in the report of test results or certificate of compliance. A certificate of compliance shall be accompanied by test results substantiating conformance to the specified requirements.

3.3.3 Surface Preparations and Application Procedures

Surface preparations and application procedures will be examined by the Contracting Officer to determine conformance with the requirements specified. Approve each separate operation prior to initiation of subsequent operations.

Prior to surface preparation, demonstrate surface preparation using the proposed materials, methods and equipment according to the procedures outlined in Section 32 01 11.51. Prepare areas large enough to determine cleanliness, adhesion of remaining coating and rate of cleaning.

Prior to paint application, demonstrate test stripe application within the work area using the proposed materials and equipment. Apply separate test stripes in each of the line widths and configurations required herein using the proposed equipment. The test stripes shall be long enough to determine the proper speed and operating pressures for the vehicle(s) and machinery, but not less than 50 feet long.

During the Test Stripe Demonstration, demonstrate compliance with the application rates specified herein. Document the equipment speed and operating pressures required to meet the specified rates in each configuration of the equipment and provide a copy of the documentation to the Contracting Officer or authorized representative prior to proceeding with the work.

After the test stripes have cured to a "no-track" condition, demonstrate compliance with the average retroreflective values specified herein. Take a minimum of ten readings on each test stripe with a Mirolux 12 Retroreflectometer, or similar instrument with the same measuring geometry and direct readout in millicandels per square meter per lux (mcd/m²/lx).
The Contracting Officer or authorized representative will be present the application demonstrations to observe the results obtained and to validate the operating parameters of the vehicle(s) and equipment. If accepted by the Contracting Officer or authorized representative, the test stripe shall be the measure of performance required for this project. Work shall not proceed until the demonstration results are satisfactory to the Contracting Officer or authorized representative.

Place warning signs near the beginning of the work site and well ahead of the work site for alerting approaching traffic from both directions. Place small markers along newly painted lines to control traffic and prevent damage to newly painted surfaces. Mark painting equipment with large warning signs indicating slow-moving painting equipment in operation. Do not use foil-backed material for temporary pavement marking because of its potential to conduct electricity during accidents involving downed power lines.

3.5 QUALITY ASSURANCE

Demonstrate success of bond of reflective media, new paint marking and the pavement surface, vacuum cured surface of new marking after a seven (7) day dry time. Inspect newly applied markings for signs of bond failure based on visual inspection and comparison to results from Test Stripe Demonstration paragraph.

3.5.1 Reflective Media and Coating Bond Verification

Within seven (7) days after pavement marking application, use industrial vacuum to sweep new markings. Visually inspect the pavement markings and the material captured by the vacuum. Verify that no significant loss of reflective media has occurred to the pavement marking due to the vacuum cleaning.

3.5.2 Reflective Media and Coating Application Verification

Use a wet film thickness gauge to measure the application of wet paint. Use a microscope or magnifying glass to evaluate the embedment of glass beads in the paint. Verify the glass bead embedment with approximately 50 percent of the beads embedded and 50 percent of the beads exposed.
### TABLE I - REQUIREMENTS FOR HIGH BUILD ACRYLIC COATINGS (HBAC)

<table>
<thead>
<tr>
<th>TEST</th>
<th>MINIMUM REQUIREMENT (AND MAXIMUM WHERE INDICATED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin System (ASTM D2621)</td>
<td>Waterborne 100 percent Acrylic</td>
</tr>
<tr>
<td>Percent Volume Solids (ASTM D2697)</td>
<td>58 percent</td>
</tr>
<tr>
<td><strong>Volatile Organic Compound, max. (ASTM D3960)</strong></td>
<td>1.25 lbs/gal</td>
</tr>
<tr>
<td>White (FED-STD-595)</td>
<td>37925</td>
</tr>
<tr>
<td>Yellow (FED-STD-595)</td>
<td>33538</td>
</tr>
<tr>
<td>Shore D Hardness (ASTM D2240)</td>
<td>45</td>
</tr>
<tr>
<td>1/8 inch Mandrel Bend at 5 mils Dry Film Thickness (DFT, one-week cure (ASTM D522/D522M, Method B)</td>
<td>No visual defects at bend (Conditions at ASTM D3924)</td>
</tr>
<tr>
<td>Adhesion to Concrete and Asphalitic Pavements (ASTM D4541)</td>
<td>140 psi or 100 percent cohesive failure in pavement</td>
</tr>
<tr>
<td>Accelerated Weathering, Yellow, 2500 Hours UV Exposure (ASTM G154: see note 1)</td>
<td>Max. color loss to 33655 (FED-STD-595)</td>
</tr>
<tr>
<td>Water Absorption at 168 Hours Immersion Tap Water (ASTM D471)</td>
<td>9.0 percent max. weight increase (conditions at ASTM D3924)</td>
</tr>
<tr>
<td>Application at 65 mils Wet, One Coat, One-week Cure, (see note 2)</td>
<td>No visual cracking or curling (conditions at ASTM D3924)</td>
</tr>
<tr>
<td>No Pick-Up at 25 mils (ASTM D711)</td>
<td>Wet 10 minutes max.</td>
</tr>
<tr>
<td>Lead (ASTM D3335)</td>
<td>0.06 percent max.</td>
</tr>
<tr>
<td>Cadmium (ASTM D3335)</td>
<td>0.06 percent max.</td>
</tr>
<tr>
<td>Test</td>
<td>Minimum Requirement (And Maximum Where Indicated)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Chromium (ASTM D3718)</td>
<td>0.00 percent</td>
</tr>
</tbody>
</table>

Notes:

1. Properly mix and apply yellow paint at 10 mils plus or minus 2 mils DFT over a suitably sized, clean aluminum substrate (ASTM D823), and cure for a minimum of 48 hours: four individual yellow samples shall be prepared. Expose three samples to continuous Ultraviolet (UV) light for 2500 hours, without cycles condensation, in accordance to ASTM G154: UVA-340 lamps shall be used in the testing apparatus. Following exposure, compare the three exposed samples to the "one" non-exposed sample using FED-STD-595 colors 33538 and 33655 as visual references: evaluate exposed samples for degree of visual color loss. Yellow paint shall receive a passing rating if each exposed sample appears equivalent to the non-exposed sample, and in addition, displays color loss no greater than FED-STD-595 color 33655.

2. Using double-stick, foam mounting tape (or equal) with a nominal thickness of 65 mils, apply a rectangular mold with inner dimensions of 3 in by 10 in to a clean aluminum sample approximately sized at 6 in by 12 in by 1/8 in. Do not remove the tape's plastic backing. Mix and apply excess paint into mold. Remove excess paint, by squeegee or other appropriate draw down technique, to a uniform thickness equal to the tape's height. Paint application and draw down shall be performed within a period of no more than 60 seconds. Approximately one to two minutes following the draw down, remove tape from sample and allow coating to cure for a minimum period of one week ASTM D3924. Using a micrometer or other appropriate device, measure cured coating thickness (less sample thickness) to confirm resulting coating application was at or above 38 mils DFT. Inspect coating for visual signs of cracking and curling. Following a one week cure, coating shall receive a passing rating if applied greater than 38 mils DFT and visually free of both cracking and curling.
### TABLE II - PREAPPROVED HBACs

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMT-Pathway 1021 North Mission Road Los Angeles, CA 90033 (800) 338-7680</td>
<td>Legend Build, #2712A9, White</td>
</tr>
<tr>
<td></td>
<td>Legend Build, #2713A9, Yellow</td>
</tr>
<tr>
<td>Pervo Paints 6624 Stanford Avenue Los Angeles, CA 90001 (323) 758-1147</td>
<td>Pervo 6050, White</td>
</tr>
<tr>
<td></td>
<td>Pervo 6053, Yellow</td>
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<tr>
<td>Vogel Traffic Services 1920 Albany Place South PO Box 140 Orange City, IA 51041 (712) 737-4016</td>
<td>UC-1516, White</td>
</tr>
<tr>
<td></td>
<td>UC-3588, Yellow</td>
</tr>
</tbody>
</table>

-- End of Section --