



STATE OF CALIFORNIA
DEPARTMENT OF GENERAL SERVICES - PROCUREMENT DIVISION

CONTRACT NOTIFICATION

*** NOT MANDATORY ***

CONTRACT NUMBER: 1-07-80-06

DESCRIPTION: THERMOPLASTIC TRAFFIC STRIPING
MATERIAL

CONTRACTOR: LINE MASTER ENGINEERING

EFFECTIVE DATES: 3/13/2007 THROUGH 3/12/2009

SUPERSEDES CONTRACT NO.: 1-05-80-06

AREA: STATEWIDE

DISTRIBUTION: C-80-06

* TAX: Add appropriate sales and use tax.
Exempt from Federal Excise Tax.

*Food contracts are tax exempt.


for RITA HAMILTON, Deputy Director

Use of this agreement by all agencies is not mandatory.

To obtain assistance or report non-compliance by supplier, or for any suggestions or recommendations write:

Department of General Services, Procurement Division, P.O. Box 989054, W. Sacramento, CA 95798-9054,
or call: Contract Administrator, **BRUCE FONG** 916-375-4468

Contract (Not Mandatory): 1-07-80-06

SUPPLIER ID: 349198
NAME: LINE MASTER ENGINEERING
ADDRESS: PO BOX 91568
LONG BEACH, CA 90809-1568

CONTACT: 562-596-3236 ANITA GONZALES
FAX NUMBER: 562-596-8567
TERMS OF PAYMENT: NET 45 DAYS
FOB: Destination
MINIMUM ORDER: AS SPECIFIED

SELLER'S PERMIT NO.: 99-275190

SCOPE:

This contract covers the estimated two-year requirements of the State of California and participating local agencies for THERMOPLASTIC TRAFFIC STRIPING MATERIAL (GRANULAR), WHITE AND LEAD-FREE YELLOW, per the attached specifications. In addition, this contract contains an option to extend the contract for an additional one (1) year.

A local agency is any city, county, city and county, district or other local governmental body or corporation empowered to expend public funds (Public Contract Code 10298).

ORDERING PROCEDURES:

State Agency Ordering Procedures:

Issue State agency orders to the contract supplier. State agencies will be sending a Purchasing Authority Purchase Order (STD. 65). The DGS's fee for state agency use is available in the Price Book, located on the Department of General Services web site at www ofs.dgs.ca.gov/Price+Book/P/Purchasing.htm.

Local Agency Ordering Procedures:

Issue local agency orders directly to the contract supplier. (Blanket orders are no longer issued by the Procurement Division for local agency use.) The DGS's fee for State agency use is available in the Price Book, located on the Department of General Services web site at www ofs.dgs.ca.gov/Price+Book/P/Purchasing.htm.

For billing, for both State and local agencies, send a copy of your purchase order to:

DGS-Procurement Division
Attn: Data Entry Unit
PO Box 989052
West Sacramento, CA 95798-9052

MINIMUM ORDER:

The minimum order shall be 20 tons for State agencies. The minimum order for local agencies is 22 tons.

CONTRACTOR LOCATIONS:

Purchasing Authority Purchase Orders shall be submitted to:

Company Name: Line Master Engineering
Address: PO Box 91568
City, State, Zip Code: Long Beach, CA 90809-1568

Contact Person: Anita Gonzales
Telephone Number: (562) 596-3236
Fax Number: (562) 596-8567

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DELIVERY:

Delivery shall be completed in full within 30 calendar days of the receipt of order by the contractor. All deliveries must be made on flatbed trailer. Contractor is requested to make deliveries to counties within the State of California.

Deliveries for Southern California Only:

Contractor is requested to make deliveries in Los Angeles County, Orange County, San Bernardino Metropolitan Area, and San Diego Metropolitan Area during off-peak hours. Off-peak hours are 10:00 am to 4:00 pm.

LATE DELIVERY CHARGES:

Late delivery charges will be assessed if:

1. Complete orders are not delivered within 30 days after receipt of the order by the contractor.
2. Short or partial delivered within time schedule shown on the predetermined delivery schedule.
3. Random partial shipments are not delivered within 30 days after the receipt of a "REQUEST FOR DELIVERY" by the contractor.

It is therefore agreed by both parties, unless the delay is authorized in writing by the State, late delivery charges will be assessed. The contractor will pay late delivery charges of \$250.00 per calendar day per order to the Ordering Agency until such time that the product is delivered or until the date after which the delivery will not be accepted, as specified in writing by the State, whichever occurs first. In no case, shall the total delivery charge assessed against the contractor exceed 50 percent of the total value of the order in question. In the event the late delivery charges are not paid by the contractor, the State reserves the right to deduct the total late delivery charges from any amount due or that may become due to the contractor.

PACKAGING:

Each bag shall be labeled with production lot and batch number, bag weight, safety information, temperature to be heated, and recommended shelf life.

Packaging (bags) for granulated thermoplastic material must be compatible with the thermoplastic when melted together.

One-component primer to be supplied in five-gallon containers.

Each bag of thermoplastic material shall weigh 50 lbs. nominal.

Each pallet shall be loaded with 40 bags (one ton).

Pallet size shall be 42 inches square.

Bags shall be stacked on pallets to a nominally flat top surface to facilitate handling and storage.

Broken bags F.O.B. destination shall be returned to supplier at supplier's expense. If supplier does not elect to have broken bags of thermoplastic returned, he may elect to have Caltrans arrange other disposal at supplier's expense. In any case, no payment shall be made to the supplier for any material arriving F.O.B. destination in broken bags. In addition, supplier is required to replace the quantity of order arriving F.O.B. destination in broken bags within 14 days of notification by the State.

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Exterior packaging is to show the contents and the order number. All packaging is to conform to the applicable freight classifications, Surface Transportation Board and/or postal regulations, and is to be of a quality to assure final delivery without damage to the contents.

INVOICING REQUIREMENTS:

The contractor is to render invoices as instructed on individual orders. Invoices shall include the order number, the contract number, the commodity code number, the quantity, the unit price, and extensions. State sales and/or use tax is to be added to each invoice. The sales tax rate applied should be based on the rate of the area product is to be delivered to.

PRICES:

1. Prices quoted shall be maximum for a minimum period of 180 calendar days from the effective date of the contract.
2. The contractor may submit proposed escalation notice, in writing, to Procurement Division not earlier than 150 days from the effective date of the contract. Such notice shall include substantiated information to support the proposed escalation (e.g., manufacturer's price list, significant changes in published mark indicators for the industry, certified raw material cost data, and any other substantiated information as requested by the State of California).
3. Upon receipt of such notice the State reserves the right to either:
 - a. Accept the escalation as competitive with the general market price at that time, effective 30 days after written approval from the State; or
 - b. Negotiate proposed price escalation. Note: The State will notify, in writing, the contractor of its desire to negotiate. The State will have ten (10) working days to complete negotiations; or
 - c. Deny the escalation as non-competitive with the general market price at the time, and continue the contract term with current pricing.
4. No price increase shall apply to quantities ordered from the contract prior to the effective date of the price increase.

C. Price Declines

1. Under either of the above options, the contractor shall immediately notify the State of all manufacturer's price declines and the State shall receive full benefit of such declines, effective on the date of the manufacturer's general public announcement.
2. If the supplier fails to notify the State within five working days of the manufacturer's publicly announced price decline, the State may deem the contractor non-responsible, which can affect this contract and future bidding opportunities.

F.O.B. POINT:

All prices are F.O.B. destination.

QUANTITIES:

The quantities used in the solicitation are the estimated two-year requirements and are based on historical data. These quantities are for bid evaluation purposes only and do not represent any guarantee of participation, purchase pattern, or rate of consumption. The State will not be obligated to purchase contractor's excess inventory of any standard line item if actual purchases vary from the anticipated purchase pattern.

The State's obligation to pay is solely from funds appropriated for the acquisition of the products on this contract. If funds are not appropriated for future fiscal years, the contract dollar amount will be reduced accordingly.

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USAGE REPORTS:

The contractor is required to submit a detailed usage report every three months commencing from the date of award to the Procurement Division to the attention of the Contract Administrator. This report is to contain the following information:

1. Ordering Agency
2. Agency Bill Code
3. Invoice Number
4. Date of Invoice
5. Purchase Order Number
6. Line Item Number
7. Commodity Code Number
8. Description
9. Order Date
10. Delivery Date
11. Part Number
12. Quantity
13. Unit Price
14. Extended Price

Any report that does not follow the required format, or that excludes required information will be deemed incomplete and returned to the contractor.

EXTRAORDINARY EXTENSION OPTION:

In the event of an extraordinary circumstance the State may extend the contract for up to an additional year beyond the stated term and any noted extensions. Extensions during this period may occur in increments until the establishment of a new contract (not to exceed one-year). Exercise of this option may occur in the event that a replacement contract cannot be established due to the protest of an intent to award, or loss of key procurement staff, or extraordinary circumstance that would otherwise cause an unanticipated disruption in the contracting process.

If necessary, prices may be increased during an extraordinary extension option period, to the extent that the price determined to be "fair and reasonable." Requests for price increase(s) shall include substantiated information to support the proposed increase (e.g., manufacturer's price list, significant changes in published market indicators for the industry, certified raw material cost data, and any other substantiating information as requested by the State). In no event will price increases be accepted with retroactive effective dates.

TERMINATION FOR CONVENIENCE:

The State may terminate this agreement for convenience upon thirty (30) days written notice. Upon termination or other expiration of this contract, each party will assist the other party in an orderly termination of the contract, as may facilitate the orderly, non-disrupted business continuation of each party.

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ITEM NO.	COMMODITY NO. SUPPLIER PART NO.	SUPPLIER NO.	UNIT	DESCRIPTION	UNIT PRICE
				BRAND: Dobco Smart Melt MANUFACTURER: Dobco HYDROCARBON RESIN BINDER TYPE - THERMOPLASTIC Spec. #PTH-02HYDRO SOUTHERN CALIFORNIA Group 1	
1	8010-900-4002-6	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL WHITE EXTRUDED	774.0000
2	8010-900-4000-2	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL WHITE LOW VISCOSITY	774.0000
3	8010-900-4001-4	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL YELLOW LOW VISCOSITY	762.0000
4	8010-900-4003-8	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL YELLOW EXTRUDED	766.0000

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ITEM NO.	COMMODITY NO. SUPPLIER PART NO.	SUPPLIER NO.	UNIT	DESCRIPTION	UNIT PRICE
5	8010-900-4002-6	349198	TN	HYDROCARBON RESIN BINDER TYPE - THERMOPLASTIC Spec. #PTH-02HYDRO NORTHERN CALIFORNIA Group 2	786.0000
6	8010-900-4003-8	349198	TN	THERMOPLASTIC TRAFFIC STRIPPING MATERIAL WHITE EXTRUDED	779.0000
7	8010-900-4000-2	349198	TN	THERMOPLASTIC TRAFFIC STRIPPING MATERIAL WHITE LOW VISCOSITY	786.0000
8	8010-900-4001-4	349198	TN	THERMOPLASTIC TRAFFIC STRIPPING MATERIAL YELLOW LOW VISCOSITY	775.0000

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ITEM NO.	COMMODITY NO. SUPPLIER PART NO.	SUPPLIER NO.	UNIT	DESCRIPTION	UNIT PRICE
9	8010-900-4002-6	349198	TN	ALKYD RESIN BINDER TYPE - THERMOPLASTIC Spec. #PTH-02ALKYD SOUTHERN CALIFORNIA Group 3	785.0000
10	8010-900-4000-2	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL WHITE EXTRUDED	774.0000
11	8010-900-4001-4	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL YELLOW LOW VISCOSITY	766.0000
12	8010-900-4003-8	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL YELLOW EXTRUDED	766.0000

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ITEM NO.	COMMODITY NO. SUPPLIER PART NO.	SUPPLIER NO.	UNIT	DESCRIPTION	UNIT PRICE
13	8010-900-4002-6	349198	TN	ALKYD RESIN BINDER TYPE - THERMOPLASTIC Spec. #PTH-02ALKYD NORTHERN CALIFORNIA Group 4	798.0000
14	8010-900-4003-8	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL WHITE EXTRUDED	779.0000
15	8010-900-4000-2	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL YELLOW EXTRUDED	790.0000
16	8010-900-4001-4	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL WHITE LOW VISCOSITY	779.0000

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ITEM NO.	COMMODITY NO. SUPPLIER PART NO.	SUPPLIER NO.	UNIT	DESCRIPTION	UNIT PRICE
17	8010-900-4005-1	349198	TN	SPRAYABLE THERMOPLASTIC TRAFFIC STRIPING MATERIAL Spec. #PTH-02SPRAY SOUTHERN CALIFORNIA Group 5	860.0000
18	8010-900-4006-3	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL WHITE ALKYD RESIN TYPE	838.0000
19	8010-900-4007-5	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL YELLOW ALKYD RESIN TYPE	860.0000
20	8010-900-4008-7	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL WHITE HYDROCARBON RESIN TYPE	838.0000

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ITEM NO.	COMMODITY NO. SUPPLIER PART NO.	SUPPLIER NO.	UNIT	DESCRIPTION	UNIT PRICE
21	8010-900-4005-1	349198	TN	SPRAYABLE THERMOPLASTIC TRAFFIC STRIPING MATERIAL Spec. #PTH-02SPRAY NORTHERN CALIFORNIA Group 6	872.0000
22	8010-900-4006-3	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL WHITE ALKYD RESIN TYPE	850.0000
23	8010-900-4007-5	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL YELLOW ALKYD RESIN TYPE	872.0000
24	8010-900-4008-7	349198	TN	THERMOPLASTIC TRAFFIC STRIPING MATERIAL WHITE HYDROCARBON RESIN TYPE	850.0000
25	8010-909-0001-5	349198	VA	FOR DATA ENTRY USE ONLY PTBRSA-DGS/PROCUREMENT USE ONLY	VARIABLE

STATE OF CALIFORNIA
Department of Transportation
Specification for
Thermoplastic Traffic Striping Material,
Hydrocarbon Resin Binder, White and Lead-Free Yellow

1.0 SCOPE

This specification covers a hot-melt, retroreflective, thermoplastic traffic marking material that is suitable for producing durable traffic stripes and pavement markings on Portland cement concrete or asphalt concrete pavements. This material is heated and applied to road surfaces in a molten state using a mechanical applicator. While still hot, reflectorizing glass beads are applied to the surface of the applied thermoplastic striping material. Upon cooling to normal pavement temperatures this material shall produce durable, adherent, retroreflective traffic stripes and pavement markings that are capable of resisting deformation by traffic.

2.0 APPLICABLE SPECIFICATIONS

The following specifications, test methods and standards in effect on the opening date of the Invitation for Bid form a part of this specification where referenced.

- California Test Methods CT 423 and 402.
- California Department of Transportation, Standard Specifications, latest version.
- Federal Standard Designation: No. 595b, color #33538.
- American Association of State Highway and Transportation Officials, (AASHTO) Designation: M 247.
- American Society for Testing and Materials, (ASTM) Designations: D 476, D 3335, D 3718, D 4563, D 4764, D 5380, E 11 and E 1710.
- Commission International de l'Eclairage (C.I.E.) 1931 Chromaticity Diagram.
- California Code of Regulations: Title 22.

3.0 REQUIREMENTS

3.1 Composition:

The thermoplastic material shall be composed of 100% solids. The binder shall consist of synthetic hydrocarbon thermoplastic resins which are homogeneously blended together with all necessary prime pigments, fillers, glass beads and additives to produce a traffic striping material that meets the requirements as specified herein. All thermoplastic material shall be free from; lead, chromium, cadmium, barium and other toxic metals.

3.1.1 White Material:

White thermoplastic shall contain a minimum of 10% (by weight) of titanium dioxide pigment meeting ASTM Designation: D476 Type II (Rutile). The titanium dioxide content will be determined using ASTM Designations: D 4563, D 4764, D 5380 or other x-ray diffraction analysis method. White thermoplastic must meet the retroreflectivity requirement when applied with drop-on glass beads.

3.1.2 **Lead-Free Yellow Material:**

Lead-Free (L/F) yellow thermoplastic shall contain proper amounts of C.I. Pigment Yellow 83 (opaque version) and titanium dioxide (Rutile) to produce a yellow material that has a weather-fast and heat stable yellow color which meets the yellow color, reflectance, color stability (accelerated weathering) and retroreflectivity requirements as stated herein. Other pigments may be added to achieve these color requirements. The L/F yellow thermoplastic material shall appear yellow during both daytime and nighttime conditions when applied with drop-on beads.

3.1.3 **Other Ingredients:**

The remainder of the thermoplastic composition shall be determined by the manufacturer - within the constraints of the requirements below. It shall be the manufacturer's responsibility to produce a thermoplastic material containing the necessary plasticizers, antioxidants, and other additives so that the thermoplastic will retain its color, viscosity and all other properties as specified herein. In addition to being essentially lead and chromium free, the thermoplastic shall not contain any hazardous materials at levels that would cause the thermoplastic to be classified as a hazardous waste under Title 22, Division 4, section 66261.20 of the California Code of Regulations.

3.2 **Form:**

The thermoplastic material shall be supplied in either block or granular form as requested in the purchase order.

3.3 **Application Type/Viscosity:**

Two viscosity grades of thermoplastic material shall be available for purchase; Extruded-Viscosity and Low-Viscosity. Extruded-Viscosity grade is more suitable for screed type applicators and thicker applications (≤ 100 mils), including recessed applications. Low-Viscosity grade material is commonly used with ribbon or spray type applicators. The thermoplastic material shall be formulated to meet the viscosity grade at the application temperature of 425°F.

3.4 **Characteristics of the Finished Thermoplastic:**

Test in accordance with California Test Method, CT 423 unless otherwise specified.

3.4.1	Glass Bead Content, intermixed, meeting AASHTO Designation: M 247 Type I, percent by weight.	<u>White</u> 30-35	<u>L/F Yellow</u> 30-35
3.4.2	Binder Content, percent by weight, minimum.	<u>White</u> 18	<u>L/F Yellow</u> 18
3.4.3	Inert Fillers, insoluble in hydrochloric acid, percent passing U.S. Standard No. 100 sieve, percent by weight, minimum, ASTM Designation: E 11.	<u>White</u> 100	<u>L/F Yellow</u> 100

3.4.4	Titanium Dioxide (Rutile) Pigment meeting ASTM Designation: D476 Type II, analyze titanium dioxide content using ASTM Designations: D 4563, D 4764, D 5380 or California Test 402, percent by weight, minimum.	<u>White</u> 10	<u>L/F Yellow</u> ---
3.4.5	Specific Gravity, maximum,	<u>White</u> 2.15	<u>L/F Yellow</u> 2.15
3.4.6	Ring and Ball Softening Point,	<u>White</u> 93-121°C	<u>L/F Yellow</u> 93-121°C
3.4.7	Perform the remaining tests on the material after 4 hours heating with stirring at 218 ± 1°C. These 4 hours include time required (~1 hr.) for melting and temperature stabilization of the 6000 g (13 lb) sample.		
3.4.7.1	Tensile Bond Strength to an unprimed portland cement concrete brick, 125-mil thick film draw down at 218°C, tested at 25 ± 2°C, psi, minimum,	<u>White</u> 180	<u>L/F Yellow</u> 180
3.4.7.2	Brookfield Thermosel Viscosity, Low-Viscosity Grade ----- Extrude-Viscosity Grade ----- Spindle SC4-27, 20 rpm at 218°C, Poise,	<u>White</u> <40 45 to 100	<u>L/F Yellow</u> <40 45 to 100
3.4.7.3	Impact Resistance, 125 mil thick film draw down on an unprimed brick, test at 25 ± 2°C, inch-pounds, minimum	<u>White</u> >50	<u>L/F Yellow</u> >50
3.4.7.4	Daytime Luminance Factor	<u>White</u> 80 Minimum	<u>L/F Yellow</u> 42 to 59
3.4.7.5	Yellow Color, shall match Federal Standard 595b, color #33538 and shall lie within the following chromaticity limits "colorbox" defined by plotting the following four (x,y) pairs on a C.I.E. 1931 Chromaticity diagram; (x1,y1) = (0.5125, 0.4866) (x2,y2) = (0.4865, 0.4647) (x3,y3) = (0.5000, 0.4416)	<u>White</u> ---	<u>L/F Yellow</u> Pass

$(x_4, y_4) = (0.5348, 0.4646)$

Follow the spectrophotometer manufacturers instructions to obtain the (x,y) chromaticity coordinates.

3.4.7.6	Yellowness Index, maximum	<u>White</u> 10	<u>L/F Yellow</u> ---
3.4.7.7	Color Stability after Accelerated Weathering, Prepare sample by dipping an aluminum panel into the molten thermoplastic and removing it to obtain a 60-120 mil coating thickness of thermoplastic on the panel. Material must meet the color stability requirements below after 500 hours of accelerated weathering exposure.	<u>White</u> 20	<u>L/F Yellow</u> --- Pass
	White - Yellowness Index, maximum Yellow - Measured chromaticity coordinates must fall within a "colorbox" defined by plotting the following four (x,y) pairs on a C.I.E. 1931 Chromaticity diagram. $(x_1, y_1) = (0.5125, 0.4866)$ $(x_2, y_2) = (0.4650, 0.4466)$ $(x_3, y_3) = (0.4750, 0.4251)$ $(x_4, y_4) = (0.5348, 0.4646)$	<u>White</u> 20 ---	<u>L/F Yellow</u> --- Pass
3.4.7.8	Hardness, Shore A-2 Durometer, Note: Thermoplastic for recessed application shall have a Hardness between 30 and 50.	<u>White</u> 45 to 75	<u>L/F Yellow</u> 45 to 75
3.4.7.9	Abrasion Test, total weight loss, grams, maximum.	<u>White</u> 10	<u>L/F Yellow</u> 10
3.4.7.10	Lead, mg/kg in thermoplastic, maximum, ASTM Designation: D3335	<u>White</u> 20	<u>L/F Yellow</u> 20
3.4.7.11	Chromium, mg/kg in thermoplastic, maximum, ASTM Designation: D3718	<u>White</u> 5	<u>L/F Yellow</u> 5
3.4.7.12	Initial Retroreflectivity of applied thermoplastic striping (with beads), $\text{mcd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$, minimum	<u>White</u> 250	<u>L/F Yellow</u> 175

The thermoplastic shall produce delineation and pavement markings that have the required minimum level of retroreflectivity when applied with drop-on beads. Drop-on glass beads shall be uniformly applied at a minimum rate of 8 lbs of beads per 100 square feet of thermoplastic. The

retroreflectivity shall be measured as specified in ASTM Designation: D6359 using a retroreflectometer meeting ASTM Designation: E1710.

3.4.7.13 Color after Application

The daytime color of the applied white and yellow thermoplastic traffic stripes and pavement markings (with drop-on beads) shall meet the color requirements in section 3.4.7.7 (Color Stability after Accelerated Weathering). The color shall be measured within 60 days of application using an instrument described in CT 423, Part 13.

3.5 Other Requirements:

3.5.1 Applicability:

The molten thermoplastic material shall be readily applied at temperatures between 400°F and 450°F. When heated, the thermoplastic material shall completely melt to a homogeneous fluid with satisfactory application qualities and shall be free of debris. Upon application to the pavement, the thermoplastic material shall be sufficiently tack-free to carry traffic in not more than 2 minutes when the pavement surface temperature is 60°F, and in not more than 10 minutes when the pavement surface temperature is 130°F.

3.5.2 Workmanship:

The materials' ingredients (resins, pigments, glass beads, fillers and additives) shall be homogeneously blended. The finished product shall be uniform from bag to bag. The melted thermoplastic material shall have no indications of resin separation or incompatibility of resins when melted or after cooling. The material shall be free from all dirt, water, foreign matter, unmeltable debris and other deleterious substances capable of clogging screens, valves, pumps and other striping apparatus. The thermoplastic material shall be of such composition that it will not bleed, stain, or discolor when applied to pavements.

3.5.3 Shelf Life:

The material shall maintain the requirements of this specification for a minimum period of one (1) year from the date of manufacture. Any materials failing to do so shall be replaced at the expense of the manufacturer. Ordered thermoplastic shall be no more than 120 days old (based on date of manufacture) upon delivery to a Department of Transportation Maintenance facility. The date of manufacture shall be clearly marked on each bag of thermoplastic.

3.5.4 Air Pollution Compliance:

This material shall comply with all applicable air pollution control rules and regulations. The thermoplastic material shall not emit fumes that are toxic or injurious to persons or property when it is heated to application temperature. The material shall not emit excessive smoke during heating or application.

STATE OF CALIFORNIA
Department of Transportation
Specification for
Thermoplastic Traffic Striping Material,
Alkyd Resin Binder, White and Lead-Free Yellow

1.0 SCOPE

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2.0 APPLICABLE SPECIFICATIONS

The following specifications, test methods and standards in effect on the opening date of the Invitation for Bid form a part of this specification where referenced.

- California Test 423
- California Department of Transportation, Standard Specifications, latest revision
- Federal Standard Designation: No. 595b, color #33538.
- American Association of State Highway and Transportation Officials, (AASHTO) Designations: M 247.
- American Society for Testing and Materials, (ASTM) Designations: D-476, D 3335, D 3718, D 4563, D 4764, D 5380, D 6359, E 11 and E 1710.
- Commission International de l'Eclairage (C.I.E.) 1931 Chromaticity Diagram.
- California Code of Regulations: Title 22.

3.0 REQUIREMENTS

3.1 Composition:

The thermoplastic material shall be composed of 100% solids. The binder shall consist of a maleic-modified glycerol ester of rosin which is homogeneously blended together with all necessary prime pigments, fillers, glass beads and additives to produce a traffic striping material that meets the requirements as specified herein. All thermoplastic material shall be free from lead, chromium, cadmium, barium and other toxic metals.

3.1.1 White Material:

White thermoplastic shall contain a minimum of 10% (by weight) of titanium dioxide pigment meeting ASTM Designation: D476 Type II (Rutile). The titanium dioxide content will be determined using ASTM Designations: D 4563, D 4764, D 5380 or other x-ray diffraction analysis method. White thermoplastic must meet the retroreflectivity requirement when applied with drop-on glass beads.

3.1.2 **Lead-Free Yellow Material:**

Lead-Free (L/F) yellow thermoplastic shall contain proper amounts of C.I. Pigment Yellow 83 (opaque version) and titanium dioxide (Rutile) to produce a yellow material that has a weather-fast and heat stable yellow color which meets the; Yellow Color, Reflectance, Color Stability (Accelerated Weathering) and Retroreflectivity requirements as stated herein. Other pigments may be added to achieve these color requirements. The L/F yellow thermoplastic material shall appear yellow during both daytime and nighttime conditions when applied with drop-on beads.

3.1.3 **Other Ingredients:**

The remainder of the thermoplastic composition shall be determined by the manufacturer - within the constraints of the requirements below. It shall be the manufacturer's responsibility to produce a thermoplastic material containing the necessary plasticizers, antioxidants, and all other additives so that the thermoplastic will retain its color, viscosity and all other properties as specified herein. In addition to being essentially lead and chromium free, the thermoplastic shall not contain any hazardous materials at levels that would cause the thermoplastic to be classified as a hazardous waste under Title 22, Division 4, section 66261.20 of the California Code of Regulations.

3.2 **Form:**

The thermoplastic material shall be supplied in either block or granular form as requested in the purchase order.

3.3 **Application Type/Viscosity:**

Two viscosity grades of thermoplastic material shall be available for purchase; Extruded-Viscosity and Low-Viscosity. Extruded-Viscosity grade is more suitable for screed type applicators and thicker applications (>100 mils), including recessed applications. Low-Viscosity grade material is commonly used with ribbon or spray type applicators. The thermoplastic material shall be formulated to meet the viscosity grade specified in the purchase order.

3.4 **Characteristics of the Finished Thermoplastic:**

Use California Test Method, CT 423 unless otherwise specified:

3.4.1	Glass Bead Content, intermixed, meeting AASHTO Designation: M 247 Type I, percent by weight.	<u>White</u> 30-35	<u>L/F Yellow</u> 30-35
3.4.2	Binder Content, percent by weight, minimum.	<u>White</u> 18	<u>L/F Yellow</u> 18
3.4.3	Inert Fillers, insoluble in hydrochloric acid, percent passing U.S. Standard No. 100 sieve, percent by weight, minimum, ASTM Designation: E 11.	<u>White</u> 100	<u>L/F Yellow</u> 100

	<u>White</u>	<u>L/F Yellow</u>
3.4.4 Titanium Dioxide (Rutile) Pigment meeting ASTM Designation: D476 Type II, analyze titanium dioxide content using ASTM Designations: D 4563, D 4764, D 5380 or other x-ray diffraction method, percent by weight, minimum.	10	---
3.4.5 Specific Gravity, maximum,	<u>White</u> 2.15	<u>L/F Yellow</u> 2.15
3.4.6 Ring and Ball Softening Point,	<u>White</u> 93-121°C	<u>L/F Yellow</u> 93-121°C
3.4.7 Perform the remaining tests on the material after 4 hours heating with stirring at $218 \pm 1^\circ\text{C}$. This 4 hour heating time includes time required (~1 hr.) for melting and temperature stabilization of the 6000 g (13 lb) sample.		
3.4.7.1 Tensile Bond Strength to an unprimed portland cement concrete brick, 125-mil thick draw down at 218°C , test at $25 \pm 2^\circ\text{C}$, psi, minimum,	<u>White</u> 180	<u>L/F Yellow</u> 180
3.4.7.2 Brookfield Thermosel Viscosity, Low-Viscosity Grade ----- Extrude-Viscosity Grade ----- Spindle SC4-27, 20 rpm at 218°C , Poise,	<u>White</u> <40 45 to 100	<u>L/F Yellow</u> <40 45 to 100
3.4.7.3 Impact Resistance, 125 mil thick draw down on an unprimed brick. Test at $25 \pm 2^\circ\text{C}$, inch pounds,	<u>White</u> >50	<u>L/F Yellow</u> >50
3.4.7.4 Daytime Luminance Factor	<u>White</u> 80 Minimum	<u>L/F Yellow</u> 42 to 59
3.4.7.5 Yellow Color, shall match Federal Standard Designation: No. 595b, color #33538 and shall lie within the following chromaticity limits "colorbox" defined by plotting the following four (x,y) pairs on a C.I.E. 1931 Chromaticity diagram; (x1,y1) = (0.5125, 0.4866)	<u>White</u> ---	<u>L/F Yellow</u> Pass

(x2,y2) = (0.4865, 0.4647)

(x3,y3) = (0.5000, 0.4416)

(x4,y4) = (0.5348, 0.4646)

Follow the spectrophotometer manufacturer's instructions to obtain the (x,y) chromaticity coordinates.

3.4.7.6	Yellowness Index, maximum	<u>White</u> 10	<u>L/F Yellow</u> ---
3.4.7.7	<p>Color Stability after Accelerated Weathering, Prepare sample by dipping an aluminum panel into the molten thermoplastic and removing it to obtain a 60-120 mil coating thickness of thermoplastic on the panel. Material must meet the color stability requirements below after accelerated weathering.</p> <p>White - Yellowness Index, maximum Yellow - Measured chromaticity coordinates must fall within a "colorbox" defined by plotting the following four (x,y) pairs on a C.I.E. 1931 Chromaticity diagram. (x1, y1) = (0.5125, 0.4866) (x2, y2) = (0.4650, 0.4466) (x3, y3) = (0.4750, 0.4251) (x4, y4) = (0.5348, 0.4646)</p>	<u>White</u> 20 ---	<u>L/F Yellow</u> --- Pass
3.4.7.8	<p>Hardness, Shore A-2 Durometer, Note: Thermoplastic for recessed application shall have a Hardness between 30 and 50.</p>	<u>White</u> 45 to 75	<u>L/F Yellow</u> 45 to 75.
3.4.7.9	Abrasion Test, maximum total weight loss, grams	<u>White</u> 10	<u>L/F Yellow</u> 10
3.4.7.10	Lead, mg/kg in thermoplastic, maximum, ASTM Designation: D3335	<u>White</u> 20	<u>L/F Yellow</u> 20
3.4.7.11	Chromium, mg/kg in thermoplastic, maximum, ASTM Designation: D3718	<u>White</u> 5	<u>L/F Yellow</u> 5
3.4.7.12	Initial Retroreflectivity of applied thermoplastic striping (with beads), $\text{mcd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$, minimum	<u>White</u> 250	<u>L/F Yellow</u> 175

The thermoplastic shall produce delineation and pavement markings that have the required minimum level of retroreflectivity when applied with drop-on beads. Drop-on glass beads shall be uniformly

applied at a minimum rate of 8 lbs of beads per 100 square feet of thermoplastic. The retroreflectivity shall be measured as specified in ASTM Designation: D6359 using a retroreflectometer meeting ASTM Designation: E1710.

3.4.7.13 Color after Application

The daytime color of the applied white and yellow thermoplastic traffic stripes and pavement markings (with drop-on beads) shall meet the color requirements in section 3.4.7.7 (Color Stability after Accelerated Weathering). The color shall be measured within 60 days of application with the instrument described in CT 423, Part 13.

3.5 Other Requirements:

3.5.1 Applicability:

The molten thermoplastic material shall be readily applied at temperatures between 400°F and 450°F. When heated, the thermoplastic material shall completely melt to a homogeneous fluid with satisfactory application qualities and shall be free of debris. Upon application to the pavement, the thermoplastic material shall be sufficiently tack-free to carry traffic; in not more than 2 minutes when the pavement surface temperature is 60°F, and in not more than 10 minutes when the pavement surface temperature is 130°F.

3.5.2 Workmanship:

The materials' ingredients (resins, pigments, glass beads, fillers and additives) shall be homogeneously blended. The finished product shall be uniform from bag to bag. The melted thermoplastic material shall have no indications of resin separation or incompatibility of resins when melted or after cooling. The material shall be free from all dirt, water, foreign matter, unmeltable debris and other deleterious substances capable of clogging; screens, valves, pumps and other striping apparatus. The thermoplastic material shall be of such composition that it will not bleed, stain, or discolor when applied to pavements.

3.5.3 Shelf Life:

The material shall maintain the requirements of this specification for a minimum period of one (1) year from the date of manufacture. Any materials failing to do so shall be replaced at the expense of the manufacturer. Ordered thermoplastic shall be no more than 120 days old (based on date of manufacture) upon delivery to a Department of Transportation Maintenance facility. The date of manufacture shall be clearly marked on each bag of thermoplastic.

3.5.4 Air Pollution Compliance:

This material shall comply with all applicable air pollution control rules and regulations. The thermoplastic material shall not emit fumes that are toxic or injurious to persons or property when it is heated to application temperature. The material shall not emit excessive smoke during heating or application.

STATE OF CALIFORNIA
Department of Transportation
Specification for
Sprayable Thermoplastic Traffic Striping Material,
White and Lead-Free Yellow

1.0 SCOPE

This specification covers a hot-melt, retroreflective, thermoplastic traffic marking material that is suitable for producing durable traffic stripes and pavement markings on Portland cement concrete or asphalt concrete pavements. This material is heated and applied to road surfaces in a molten state using a mechanical applicator. While still hot, reflectorizing glass beads are applied to the surface of the applied thermoplastic striping material. Upon cooling to normal pavement temperatures this material shall produce durable, adherent, retroreflective traffic stripes and pavement markings that are capable of resisting deformation by traffic.

2.0 APPLICABLE SPECIFICATIONS

The following specifications, test methods and standards in effect on the opening date of the Invitation for Bid form a part of this specification where referenced.

- California Test Method, CT 423
- California Department of Transportation, Standard Specifications, latest revision
- Federal Standard Designation: No. 595b, color #33538.
- American Association of State Highway and Transportation Officials; (AASHTO) Designation: M247.
- American Society for Testing and Materials; (ASTM) Designations: D 476, D 3335, D 3718, D 4563, D 4764, D 5380, E 11 and E 1710.
- Commission International de l'Eclairage (C.I.E.) 1931 Chromaticity Diagram.
- California Code of Regulations: Title 22.

3.0 REQUIREMENTS

3.1 Composition:

The thermoplastic material shall be composed of 100% solids. The binder shall consist of hydrocarbon or alkyd thermoplastic resins which are homogeneously blended together with all necessary prime pigments, fillers, glass beads and additives to produce a traffic striping material that meets the requirements as specified herein. The type of resin binder (alkyd or hydrocarbon) may be specified in the purchase order. All thermoplastic material shall be free from; lead, chromium, cadmium, barium and other toxic metals.

3.1.1 White Material:

White thermoplastic shall contain a minimum of 10% (by weight) of titanium dioxide pigment meeting ASTM Designation: D476 Type II (Rutile). The titanium dioxide content will be determined using ASTM Designations: D 4563, D 4764, D 5380 or other x-ray diffraction analysis method. White thermoplastic must meet the Retroreflectivity requirement when applied with drop-on glass beads.

3.1.2 **Lead-Free Yellow Material:**

Lead-Free (L/F) yellow thermoplastic shall contain proper amounts of C.I. Pigment Yellow 83 (opaque version) and titanium dioxide (Rutile) to produce a yellow material that has a weather-fast and heat stable yellow color which meets the yellow color, reflectance, color stability (accelerated weathering) and retroreflectivity requirements as stated herein. Other pigments may be added to achieve these color requirements. The L/F yellow thermoplastic material shall appear yellow during both daytime and nighttime conditions when applied with drop-on beads.

3.1.3 **Other Ingredients:**

The remainder of the thermoplastic composition shall be determined by the manufacturer - within the constraints of the requirements below. It shall be the manufacturer's responsibility to produce a thermoplastic material containing the necessary plasticizers, antioxidants, and other additives so that the thermoplastic will retain its color, viscosity and all other properties as specified herein. In addition to being essentially lead and chromium free, the thermoplastic shall not contain any hazardous materials at levels that would cause the thermoplastic to be classified as a hazardous waste under Title 22, Division 4, section 66261.20 of the California Code of Regulations.

3.2 **Form:**

The thermoplastic material shall be supplied in either block or granular form as requested in the purchase order.

3.3 **Application Type/Viscosity:**

The thermoplastic material shall be suitable for air-atomized spray application at temperatures between 350°F and 400°F. The viscosity of the molten material at these temperatures shall be suitable for applying thermoplastic traffic stripes that are ~40 mils thick.

3.4 **Characteristics of the Finished Thermoplastic:**

Use California Test Method, CT 423 unless otherwise specified.

3.4.1	Glass Bead Content, intermixed, meeting AASHTO Designation: M 247 Type I, percent by weight	<u>White</u> 30-35	<u>L/F Yellow</u> 30-35
3.4.2	Binder Content, percent by weight, minimum.	<u>White</u> 25	<u>L/F Yellow</u> 25
3.4.3	Inert Fillers, insoluble in hydrochloric acid, percent passing a U.S. Standard No. 100 sieve, percent by weight, minimum, ASTM Designation: E 11.	<u>White</u> 100	<u>L/F Yellow</u> 100
3.4.4	Titanium Dioxide (Rutile) Pigment meeting ASTM Designation: D476 Type II, analyze titanium dioxide content using	<u>White</u> 10	<u>L/F Yellow</u> ---

ASTM Designation: D 4563, D 4764, D 5380
 or California Test 402, percent by weight, minimum.

3.4.5	Specific Gravity, maximum,	<u>White</u> 2.10	<u>L/F Yellow</u> 2.10
3.4.6	Ring and Ball Softening Point,	<u>White</u> 90°-121°C	<u>L/F Yellow</u> 90°-121°C
3.4.7	Perform the remaining tests on the material after 4 hours heating with stirring at 191 ± 2°C. These 4 hours includes time required (~1 hr.) for melting and temperature stabilization of the 6000 g (13 lb) sample.		
3.4.7.1	Tensile Bond Strength to an unprimed portland cement concrete brick, 63 mil thick film draw down at 191°C, tested at 25 ± 2°C, psi, minimum,	<u>White</u> 180	<u>L/F Yellow</u> 180
3.4.7.2	Brookfield Thermosel Viscosity, Spindle SC4-27, 20 rpm at 191°C, Poise,	<u>White</u> <20	<u>L/F Yellow</u> <20
3.4.7.3	Impact Resistance, 63 mil thick draw down on an unprimed portland cement concrete brick. Test at 25 ± 2°C, inch-pounds,	<u>White</u> >50	<u>L/F Yellow</u> >50
3.4.7.4	Daytime Luminance Factor	<u>White</u> 82 Minimum	<u>L/F Yellow</u> 42 to 59
3.4.7.5	Yellow Color, shall match Federal Standard 595B, color #33538 and shall lie within the following chromaticity limits "colorbox" defined by plotting the following four (x,y) pairs on a C.I.E. 1931 Chromaticity diagram; (x1,y1) = (0.5125, 0.4866) (x2,y2) = (0.4865, 0.4647) (x3,y3) = (0.5000, 0.4416) (x4,y4) = (0.5348, 0.4646) Follow the spectrophotometer manufacturers instructions to obtain the (x,y) chromaticity coordinates.	<u>White</u> ---	<u>L/F Yellow</u> Pass

	<u>White</u>	<u>L/F Yellow</u>
3.4.7.6 Yellowness Index, maximum	8	---

3.4.7.7 Color Stability after Accelerated Weathering,
 Prepare sample by dipping an aluminum panel into the molten thermoplastic and removing it to obtain a 40 to 80 mil coating thickness of thermoplastic on the panel.
 Material must meet the color stability requirements below after 500 hours in the weathering apparatus.

	<u>White</u>	<u>L/F Yellow</u>
White - Yellowness Index, maximum	20	---
Yellow - Measured chromaticity coordinates must fall within a "colorbox" defined by plotting the following four (x,y) pairs on a C.I.E. 1931 Chromaticity diagram.	---	Pass
(x1, y1) = (0.5125, 0.4866)		
(x2, y2) = (0.4650, 0.4466)		
(x3, y3) = (0.4750, 0.4251)		
(x4, y4) = (0.5348, 0.4646)		

	<u>White</u>	<u>L/F Yellow</u>
3.4.7.8 Hardness, Shore A-2 Durometer,	20 to 65	20 to 65

	<u>White</u>	<u>L/F Yellow</u>
3.4.7.9 Abrasion Test, total weight loss, grams, maximum.	10	10

	<u>White</u>	<u>L/F Yellow</u>
3.4.7.10 Lead, mg/kg in thermoplastic, maximum, ASTM Designation: D3335	20	20

	<u>White</u>	<u>L/F Yellow</u>
3.4.7.11 Chromium, mg/kg in thermoplastic, maximum, ASTM Designation: D3718	5	5

	<u>White</u>	<u>L/F Yellow</u>
3.4.7.12 Initial Retroreflectivity of applied thermoplastic striping (with beads), $\text{mcd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$, minimum	250	175

The thermoplastic shall produce delineation and pavement markings that have the required minimum level of retroreflectivity when applied with drop-on beads. Drop-on glass beads shall be uniformly applied at a minimum rate of 8 lbs of beads per 100 square feet of thermoplastic. The retroreflectivity shall be measured as specified in ASTM Designation: D6359 using a retroreflectometer meeting ASTM Designation: E1710.

3.4.7.13 Color after Application

The daytime color of the applied white and yellow thermoplastic traffic stripes and pavement markings (with drop-on beads) shall meet the color requirements in section 3.4.7.7 (Color Stability after Accelerated Weathering). The color shall be measured within 60 days of application with the instrument described in CT 423, Part 13.

3.5 Other Requirements:

3.5.1 Applicability:

The molten thermoplastic material shall be readily applied at temperatures between 350°F and 400°F. When heated, the thermoplastic material shall completely melt to a homogeneous fluid with satisfactory application qualities and shall be free of debris. Upon application to the pavement, the thermoplastic material shall be sufficiently tack-free to carry traffic in not more than 2 minutes when the pavement surface temperature is 60°F, and in not more than 10 minutes when the pavement surface temperature is 130°F.

3.5.2 Workmanship:

The materials' ingredients (resins, pigments, glass beads, fillers and additives) shall be homogeneously blended. The finished product shall be uniform from bag to bag. The melted thermoplastic material shall have no indications of resin separation or incompatibility of resins when melted or after cooling. The material shall be free from all dirt, water, foreign matter, unmeltable debris and other deleterious substances capable of clogging screens, valves, pumps and other striping apparatus. The thermoplastic material shall be of such composition that it will not bleed, stain, or discolor when applied to pavements.

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This material shall comply with all applicable air pollution control rules and regulations. The thermoplastic material shall not emit fumes that are toxic or injurious to persons or property when it is heated to application temperature. The material shall not emit excessive smoke during heating or application.