



INVITATION FOR BID

IFB # 2020-08

TOWN OF BLUFFTON HISTORIC DISTRICT ROADWAY STRIPING

The Town of Bluffton is soliciting competitive sealed bids from experienced and qualified Offerors to provide the installation of pavement striping on roadways in the Bluffton Historic District, including but not limited to Calhoun Street, Thomas Heyward Drive, Wharf Street, Lawrence Street, and Guerrard Avenue.

Offerors must be able to provide all of the documents described in the instructions for bid, meet the minimum qualifications described herein, and agree to comply with applicable specifications, standards, laws, regulations, other Federal, State or local requirements to be considered a responsive and responsible Offeror.

The Town reserves the right to waive any irregularities, informalities or technicalities and may, at its discretion, request a new solicitation. The Town may cancel this solicitation in part or in its entirety if it is in the Town's best interest to do so.

This solicitation does not commit the Town to award a contract, or to pay for any cost incurred in the preparation of your bids, or to procure or contract for any articles of goods or services.

The Town reserves the right to reject all bids if such bids exceed available funds. The Town will decide which submittal is the lowest priced, qualified, responsive and responsible based on the following criteria:

1. Offeror maintains a permanent place of business. A vendor is eligible for Local Preference Certification if they maintain an office location within Beaufort County and the other criteria set forth in the Town Purchasing Ordinance, Section 2-265(r). Any Certified Local Vendor may have their evaluated bid price reduced by five percent (5%) not to exceed \$2500; the award price will reflect the original bid amount before Local Vendor Preference was applied. Submit the [Local Preference Certification form](#) with your bid.
2. Offeror has adequate resources or subcontractors to perform the work properly and expeditiously. The Town reserves the right to approve of all subcontractors.

3. Offeror has suitable financial status to meet obligations incident to the work.
4. Offeror has appropriate technical experience.
5. Offeror provides an acceptable schedule, where applicable.
6. Consideration may be given to matters such as contractor integrity, compliance with public policy, and record of past performance.

The solicitation and all associated documents can be accessed from the [Town of Bluffton's Purchasing webpage](#) under the Bid Opportunities icon. Answers to questions and any other changes or clarifications will be communicated via an addendum and posted on the Town's Purchasing Center website. It is the Offeror's responsibility to check the website for updates.

Questions and Inquiries

Offerors are required to submit questions in writing via email to the Project Manager no later than:

1:00 P.M, August 2, 2019

Derrick Coaxum

dcoaxum@townofbluffton.com

Answers to questions and any other changes or clarifications will be communicated via an addendum and posted on the Town's Purchasing Center webpage. It is the Offeror's responsibility to check the website for updates.

Offerors are expected to ask for clarifications in a timely manner. No assumptions, exceptions, or modifications to the bid sheet are permitted.

Submittal of Sealed Bids

Sealed bids shall be received by or prior to:

1:00 P.M., August 14, 2019

The closing date and time shall be scrupulously observed. Packages containing submittals shall be presented such that they may be easily identified. The outside of the package shall be identified as follows:

**Town of Bluffton
20 Bridge Street
Bluffton, South Carolina 29910**

**IFB # 2020-08
Town of Bluffton Historic District Roadway Striping
Attn: Derrick Coaxum**

Offerors shall submit one (1) original by the stated deadline. An additional copy saved on a thumb drive is required. Packages shall be delivered by USPS, other carrier or courier, or in person to the Customer Service counter.

Public Opening of Sealed Bids

A public opening will be held **15 minutes following the submittal deadline** at the following location:

**Town Hall Main Conference Room
20 Bridge Street
Bluffton, South Carolina 29910**

The name of Offerors submitting responses shall be read aloud and recorded. In the case of an Invitation for Bid, the total price offered may also be announced. An Intent to Award notification shall be posted on the [Town of Bluffton's Purchasing webpage](#) upon final determination.

Late Submittals

Under no circumstances shall submittals be delivered after the time specified. The Town will not be responsible for late deliveries or delayed mail. It is the Offeror's sole responsibility to assure that submittals are complete and delivered timely. Oral offers or offers by facsimile or email are not acceptable.

Restricted Discussions

All prospective Offerors are hereby instructed not to contact any member of the Town of Bluffton Town Council, the Town Manager, nor any Town of Bluffton staff member other than the named point of contact contained herein or the Town Purchasing & Contract Administrator regarding this opportunity during the solicitation process. Any such contact shall be a cause for rejection of the submittal.

INSTRUCTIONS AND INFORMATION FOR OFFERORS

DUE DILIGENCE

While the Town has used considerable efforts to ensure an accurate representation of the information in this IFB, each prospective Offeror is urged to conduct its own investigation into the material facts. The Town shall not be held liable or accountable for any error or omission in any part of this IFB.

COST SCHEDULE / BID SHEET

Offeror must fill in unit prices in figures, make extensions of each item and total as indicated on the form provided. No assumptions, exceptions, or modifications to the bid sheet are permitted. Prices shall be valid for ninety (90) days from the date of submittal.

IMPLEMENTATION SCHEDULE

Offeror must attach a schedule of major milestones by date and tasks by duration not to exceed 10 days from notice to proceed. Schedule may either be in MS Project or Excel format.

PROPRIETARY INFORMATION MUST BE MARKED

A bid is a public document under the South Carolina Freedom of Information Act (FOIA) except as to information which may be treated as commercial, financial, or privileged and confidential as defined by S.C. Code Section 11-35-410. Firms should mark the pages containing any commercial, financial or privileged and confidential information as "PROPRIETARY".

ADDENDA

All addenda issued shall be acknowledged in the place so designated.

BID SUBMITTALS

A bid cannot be withdrawn after it is filed, unless Offeror makes written request to the Town prior to time set for opening of bids, or unless the Town fails to accept bid within 90 days after date fixed for opening of bids. If any Offeror refuses to enter into a contract, the Town will retain any Bid Security provided as liquid damages but not as a penalty.

FORM OF AGREEMENT

Form of Agreement is added as an attachment hereto.

AWARD

The Town's intent is to make an award within funds available to the lowest priced, qualified, responsive and responsible Offeror. The Town reserves the right to reject any or all bids and to waive technicalities and informalities.

The Town reserves the right to select pricing alternates in determining the lowest bid. If such bid exceeds available funds, the Town may reject all bids.

CONTRACTOR/SUBCONTRACTORS TO BE SATISFACTORY TO TOWN

The Contract will not be awarded to any Offeror or Offerors who have failed in any contractual

obligations to the Town, or who has on any previous contract performed in a manner unsatisfactory to the Town, either as to the character of the work, the fulfillment of guarantees or the time consumed in its completion. Subcontractors shall also be satisfactory to the Town. Contractor shall identify intended Subcontractors; Subcontracts shall include all Federal, State, local regulatory and other Agency requirements, as well as the insurance requirements of the prime contract between Contractor and the Town.

SURETY AND INSURANCE COMPANIES

The Contract provides that the surety and insurance companies must be acceptable to the Town. To avoid inconvenience, any Offeror or subcontractor should confer with the Town to determine whether the surety or insurance companies expected to be used on the work are acceptable to the Town. Insurance coverages are attached hereto as an attachment to the contract.

PROTEST

Any prospective Offeror, offeror, contractor or subcontractor who is aggrieved in connection with the solicitation of this contract or with the intended award may protest to the Town in accordance with Section 2-289 of the Town of Bluffton Purchasing Ordinance.

COMPLIANCE

Offerors, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. Offerors will not participate directly or indirectly in the discrimination prohibited by Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21. This includes FHWA or FTA specific program requirement.

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “contractor”) agrees to comply with the following non-discrimination statutes and authorities, including but not limited to:

- Title VI of the 1964 Civil Rights Act (42 U.S.C. 28000 *et seq.*, 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin); and 49 CFR Part 21;
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. §4601) Prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects;
- The Federal-aid Highway Act of 1973, (23 U.S.C. §324 *et seq.*), (prohibits discrimination on the basis of sex);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. 794 *et seq.*), as amended, (prohibits discrimination on the basis of disability); and 49 CFR Part 27;
- The Age Discrimination Act of 1975, as amended (42 U.S.C. §6101 *et seq.*), (prohibits discrimination on the basis of age);


- Airport and Airway Improvement Act of 1982, (42 U.S.C. §47123), as amended, (prohibits discrimination on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (P.L. 100-209), (Broadened, the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§12131-12189) as implemented by Department of Transportation regulations at 49 CFR Parts 37 and 38;
- The Federal Aviation Administration’s Non-discrimination statute (49 U.S.C. §47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures nondiscrimination by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance, recipients must take reasonable steps to ensure that LEP persons have meaningful access to programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendment of 1972, as amended, which prohibits discrimination on the basis of sex in education programs or activities (20 U.S.C. 1681 *et seq.*).

Offerors shall at all times comply with all applicable wage and hour acts, including but not limited to the Fair Labor Standards Act (FLSA) (29 U.S.C. 201 *et seq.*); the Davis-Bacon Act (40 U.S.C. 3141 *et seq.*); McNamara-O’Hara Service Contract act (41 U.S.C. 351 *et seq.*); Contract Work Hours and Safety Standards Act (40 U.S.C. 3701 *et seq.*); Walsh-Healy Public Contracts Act (41 U.S.C. 35 *et seq.*); Copeland Anti-Kickback Act (40 U.S.C 3145).

Offerors shall at all times comply with the Occupational Safety and Health Act (OSH Act)(29 U.S.C. chapter 15) and the South Carolina OSHA-approved state plan, which covers most private sector workers and all state and local government workers.

Offerors shall make best efforts to ensure that minority and disadvantaged businesses are offered a fair opportunity to fully participate in the overall procurement of subcontracted goods and services.

Check items attached:

 TOWN OF BLUFFTON		SOLICITATION NO: 2020-08 ISSUED BY: DERRICK COAXUM EMAIL: dcoaxum@townofbluffton.com	
SUBMITTAL PACKAGES DUE: CLOSING DATE: Wednesday, August 14, 2019 CLOSING TIME: 1:00 P.M.		FAX / E-Mail not accepted	
PROJECT TITLE & DESCRIPTION: TOWN OF BLUFFTON HISTORIC DISTRICT ROADWAY STRIPING			
ACKNOWLEDGEMENT OF ADDENDA: This bid is submitted subject to Addenda numbers ____ through ____.			
THIS FORM MUST BE SIGNED TO BE CONSIDERED FOR AWARD			
COMPANY NAME:		DATE:	
MAILING ADDRESS:		PHONE:	
		FAX:	
CITY:	STATE:	ZIP:	
SSN OR FEDERAL TAX NO:	TITLE OF AUTHORIZED REPRESENTATIVE:		
E-MAIL:		WEB URL:	
AUTHORIZED SIGNATURE:		PRINTED NAME:	
By my signature I certify that this response is made without prior understanding, agreement, or connection with any corporation, firm, business entity, or person submitting a response to this solicitation for the services to be provided, and is in all respects true, accurate and without collusion or fraud. I certify that pricing submitted is valid for 90 days from the date of submittal.			
<input type="checkbox"/> Cost schedule / bid sheet	<input type="checkbox"/>	<input type="checkbox"/> Special certifications	
<input type="checkbox"/> Implementation schedule	<input type="checkbox"/>	<input type="checkbox"/> Local Vendor Certification	



IFB # 2020-08
TOWN OF BLUFFTON HISTORIC DISTRICT ROADWAY STRIPING
BID FORM

SCDOT Spec.	Description	Unit	Qty	Unit Cost	Cost
1031000	MOBILIZATION	LS	1	\$	\$
1071000	TRAFFIC CONTROL	LS	1	\$	\$
6250010	4" WHITE SOLID LINES (PVT. EDGE LINES) - FAST DRY PAINT	LF	3,180	\$	\$
6250015	8" WHITE SOLID LINES – FAST DRY PAINT	LF	161	\$	\$
6250020	12" WHITE SOLID LINES - FAST DRY PAINT	LF	132	\$	\$
6250025	24" WHITE SOLID LINES (STOP LINES) - FAST DRY PAINT	LF	218	\$	\$
6250110	4"YELLOW SOLID LINE (PVT.EDGE&NO PASSING ZONE) - FAST DRY PAINT	LF	3,352	\$	\$
6301100	PERMANENT YELLOW PAVEMENT MARKERS BI-DIR.- 4"X4"	EA	14	\$	\$
6319505	REMOVAL OF PAVEMENT MARKINGS	LF	350	\$	\$
TOTAL BASE BID					\$
ALTERNATES					
6271020	12" WHITE SOLID LINES - THERMO. - 125 MIL.	LF	132	\$	\$
6271025	24" WHITE SOLID LINES (STOP/DIAG LINES)- THERMO. - 125 MIL	LF	218	\$	\$
6271074	4" YELLOW SOLID LINES (PVT.EDGE LINES) THERMO - 90 MIL.	LF	350	\$	\$
TOTAL BID					\$

CONTRACTOR: _____

Owner/Manager: _____

Signature: _____

Telephone Number: _____

Business License #: _____

Date: _____

This bid is in effect for 90 days following bid opening.



Town of Bluffton Historic District Striping

1 - Scope of Work

- A. Contractor shall have all appropriate business licenses and permits to conduct work with the Town of Bluffton.
- B. Work under this contract shall meet the requirements of the South Carolina Department of Transportation (SCDOT) Standard Specifications for Highway Construction, latest edition; SCDOT Construction Manual, latest edition; SCDOT Standard Drawings, latest edition; SCDOT Procedures and Guidelines for Work Zone Traffic Control Design and the Manual on Uniform Traffic Control Devices for Streets and Highways, latest edition. Applicable SCDOT Specifications and Standard Drawings have been attached hereto.
- C. Contractor shall apply to produce pavement markings of the dimensions indicated/existing; which are straight or of uniform curvature; of consistent width; and with crisp, uniform edges.
 - a. The finished line markings shall be free from waviness and the lateral deviations.
 - b. No markings shall be less than the specified/existing width.
- D. Contractor shall Provide Traffic Control throughout all striping activities in accordance with the SCDOT Procedures and Guidelines for Work Zone Traffic Control Design.
- E. Contractor shall provide a traffic control plan to the Town's representative.
 - a. Traffic control plan must be approved by the Town a minimum of 3 days prior to proceeding with the work to be performed.
 - b. The Contractor shall furnish and place all warning devices, flag persons, flashing arrow boards, and other traffic control devices required to direct, control, and protect the traveling public while marking operations are in progress. Traffic shall have

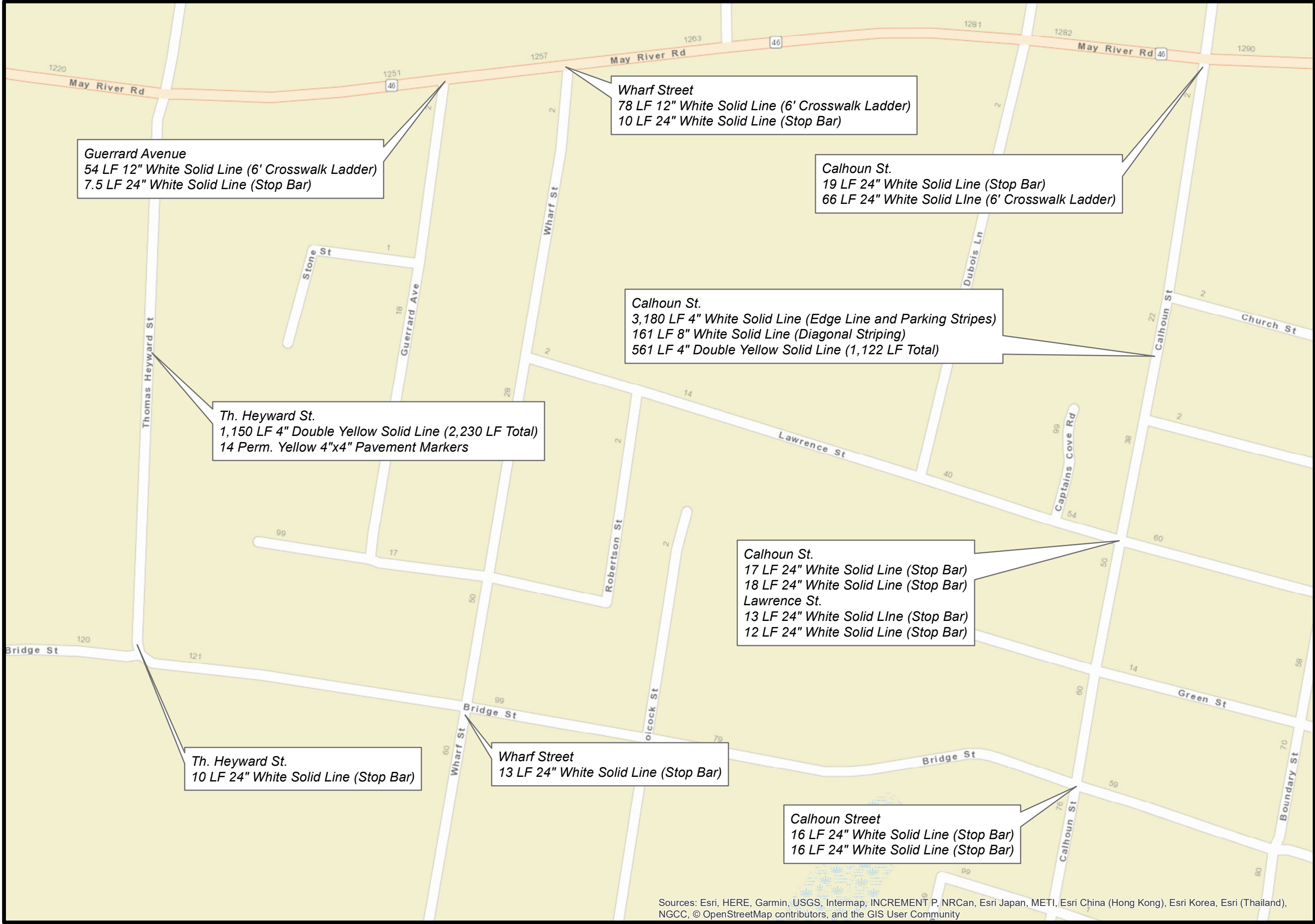
minimal, if any interruption. The work conducted shall be done with the least convenience to traffic. Vehicles must have egress capabilities at all times.

- c. Contractor shall only close one lane at a time. Both lanes cannot be closed at the same time for any reason.
 - d. Contractor shall protect the markings from traffic until dry.
- F. Contractor shall provide Personnel that are experienced in operating the striping equipment, requiring little or no training necessary to expeditiously commence the work and pursue it to completion.
- G. Contractor shall apply pavement markings when weather is conducive to installing pavement markings. Thermoplastic markings shall not be applied by any means when the surface of the pavement contains evidence of moisture, regardless of temperature.
- H. The Contractor is responsible to protect all existing and newly installed work, materials, equipment, improvements, utilities, structures, and vegetation at all times during the course of this contract. In case any direct or indirect damage is done to public or private property by or because of the work, or in consequence of any act or omission on the part of the Contractor, his employees or agents, the Contractor shall, at his own cost, restore such property to a condition similar or equal to that existing before such damage was done, by repairing, rebuilding, or otherwise restoring, as may be required by the Town, or shall make good such damage in a satisfactory manner;
- I. INSURANCE
- a. Workers Compensation – The Contractor shall agree to maintain Worker's Compensation Insurance & Employers Liability in accordance with the State of South Carolina Code.
 - b. Business Auto Policy – The Contractor shall maintain Business Automobile Liability at a limit of liability not less than \$500,000 each occurrence for all owned, non-owned and hired automobiles.
 - c. Commercial General Liability – The Contractor shall have minimum limits of \$1,000,000 per claim, \$2,000,000 per occurrence for Personal Injury, Bodily Injury, and Property Damage Liability. Coverage shall include Premises and/or Operations, Independent Contractors, Products and/or Complete Operations, Contractual Liability and Broad Form Property Damage Endorsements. Coverage shall not contain an exclusion or limitation endorsement for Contractual Liability or Cross Liability. All insurance policies shall be issued from a company or companies duly licensed by the State of South Carolina. Specific endorsements will be requested depending upon the type and scope of work to be performed.

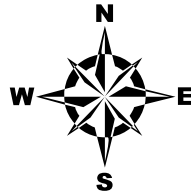
- d. Additional Insured Requirements – Except as to Workers’ Compensation and Employers’ Liability, said Certificate(s) shall clearly state that coverage required by the contract has been endorsed to include the Town of Bluffton, a municipality of the State of South Carolina, its officers, agents and employees as Additional Insured with a CG 2026-Designated Person or Organization endorsement, or similar endorsement, to its’ Commercial General Liability. The name for the Additional Insured endorsement issued by the insured shall read “Town of Bluffton”, political subdivision of the State of South Carolina, its officers, employees and agents along with the Contract and Bid number. The Certificate of Insurance shall unequivocally provide thirty (30) days written notice to the Town prior to any adverse changes, cancellation, or non-renewal of coverage thereunder. Said liability insurance must be acceptable by and approved by the Town as to form and types of coverage. In the event that the statutory liability of the Town is amended during the term of this agreement to exceed the above limits, the Contractor shall be required, upon thirty (30) days written notice by the Town, to provide coverage at least equal to the amended statutory limit of liability of the Town.

J. Bid Proposal

- a. A Bid Proposal has been supplied for general reference purposes only. The Contractor is responsible for conducting a thorough site visit to familiarize themselves with existing conditions and measure the existing markings to generate actual quantities to complete the project.
- b. The quantities provided in the Bid Proposal were estimated using the Town of Bluffton Explorer and field inspection.
- c. The Contractor is responsible to provide the actual quantities measured when bid is submitted.



Legend



150
Feet

**TOWN OF
BLUFFTON
HISTORIC
DISTRICT
STRIPING**

tions as evidenced by endorsement CG 20 37(10 01) or its equivalent. The endorsement must be submitted to the Department as part of the Certificate of Insurance. Ensure that all policies waive rights of subrogation against the SCDOT, and that the Contractor's deductibles do not exceed \$250,000 without written consent of the SCDOT.

- 5 Provide Certificates of Insurance acceptable to the Department as verification that the required insurance has been obtained. Contracts will not be executed by the Department until such certificates are furnished. Ensure that these certificates contain a provision that coverage afforded under the policies cannot be cancelled or reduced until at least 30 days prior written notice has been given to the Department and that the certificates show the deductible amounts. Make certain that the policies are endorsed to reflect this requirement.

103.9 Deferral and Cancellation of Contract

- 1 If before the Department receives a bid, awards a Contract, or executes contract documents, the low bidder is indicted (directly or through its officers, directors, employees, subsidiaries, affiliates, or parent corporation) for activities that if convicted, may result in its disqualification as a bidder pursuant to Department regulations; the Department reserves the right to pursue any or all of the following actions:
 - Defer the award and execution of the Contract until the criminal charges have been resolved.
 - Cancel the award without forfeiture of the proposal guaranty.
 - Re-bid the project upon any conviction or plea of guilty or nolo contendere.

If the criminal charges have not been resolved within 90 days of the indictment, the Department reserves the right to cancel the award without forfeiture of the proposal guaranty and to re-bid the project.

- 2 A low bidder indicted (directly or through its officers, directors, employees, subsidiaries, affiliates, or parent corporation) after the letting, but before either award or execution of the Contract, is entitled to promptly withdraw its bid without forfeiture of the proposal guaranty provided that such indicted Contractor is not eligible to re-bid the project before resolution of the criminal indictment should the Department elect to reject all other initial bids and re-advertise the project.

103.10 Mobilization

- 1 Mobilization consists of the preparatory operations including: moving personnel and equipment to the project site; paying bond and insurance premiums; establishing offices, buildings, and other facilities necessary for work on the project; and all other preparatory work or costs incurred before beginning work on the project.

103.11 Measurement and Payment

- 1 Mobilization is paid at the lump sum price bid, which price and payment is full compensation for organizing and moving all forces, supplies, equipment and incidentals to the project site, regardless of the number of times such moves are made, and all preconstruction costs incurred after award of the Contract. The price and payment also includes costs for demobilization.
- 2 Payments for mobilization are included on the first and second construction estimates. Each payment is for 1/2 of the lump sum price for Mobilization, subject to the limits shown in the following table:

Contract Amount (CA)			Max. Payment in First Estimate	Max. Payment in Second Estimate
\$0	-	\$100,000	$CA \times 0.05$	$CA \times 0.05$
\$100,000 and above			$CA \times 0.025$	$CA \times 0.025$

- 3 If there is a remaining amount of the lump sum price for Mobilization after payments are made according to the table above, then the remaining amount is paid after all work on the project has been completed and accepted.
- 4 Completion of erection of materials processing plants, if any, is not required as a condition for the release of the second payment.
- 5 Partial payment for this item in no way acts to preclude or limit any of the provisions of partial payments otherwise provided for by the Contract or these specifications.
- 6 Payment for this item includes all direct and indirect costs and expenses required to complete the work.
- 7 Pay items under this section include the following:

Item No.	Pay Item	Unit
1031000	Mobilization	LS

SECTION 625

PERMANENT PAVEMENT MARKINGS FAST DRY WATERBORNE PAINT

625.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for furnishing and applying reflectorized, heavy metals free, fast drying, waterborne paint for pavement markings.
- 2 Use markings that are the color (white or yellow) and pattern indicated in the *Pavement Marking Plans*, *Pavement Marking Typical*s, or the *MUTCD*, as applicable. This work includes supplying all necessary equipment and materials for the correct application of the marking material to the pavement surface, protecting pavement markings during installation, determining no passing zones for two-lane facilities in accordance with the *MUTCD*, and providing the Department data used in establishing no passing zones on two-lane facilities.

625.2 Materials

625.2.1 General

- 1 Use pavement marking that consists of traffic paint, meeting the requirements given herein, upon which spherical glass beads are applied by dropping immediately following paint application. If required, clean the pavement surface in an appropriate manner as described herein immediately prior to application.

625.2.2 Paint

- 1 Use paint conforming to the requirements of this specification for this work. Do not use paint that is more than 12 months old. Use paint that is in conformance with all applicable specifications and has been tested by the OMR before commencement of work. Upon satisfactory completion of testing, the OMR will assign a unique Laboratory Number to each paint batch. Stencil the Laboratory Test Number on the side of each paint container to indicate OMR approval. Provide documentation to the RCE with each batch containing the information specified in **Subsection 625.2.2.7**. The RCE will forward a copy of this information to the OMR in order to track usage of each paint batch tested.

625.2.2.1 General Requirements

- 1 Provide white and yellow paint that meets the following general requirements:
 - A. Formulated and manufactured from top grade materials and free from defects and imperfections that might adversely affect the serviceability of the finished product.
 - B. Formulated and processed specifically for service as a suitable binder for glass beads for use on traffic-carrying pavements, includ-

ing Portland cement concrete, asphalt pavement, and brick.

- C. Dries to an elastic adherent finish that does not darken after exposure to sunlight, does not show appreciable discoloration with age, or darken under service such that the color or visibility to the reflectorized marking is impaired. Ease and uniformity of application and covering properties.
- D. Free of heavy metals as defined in **Subsection 625.2.2.4.11**.
- E. Provides the proper anchorage and refraction for glass beads when both binder and spheres are applied in the stipulated quantities with specialized equipment using pressurized bead guns.
- F. Manufactured and sealed in containers in such manner that during normal shelf life does not show evidence of settling or livering that causes the paint to be unusable or is detrimental to the specialized equipment used in application.
- G. Does not show evidence of skinning when received in sealed containers.

625.2.2.2 Vehicle

- ¹ Use a vehicle portion that has a combination of 100% acrylic emulsion resins and sufficient surfactants, dispersants, defoamers, water, and coalescing agents that produce a pigmented binder meeting the requirements of these specifications.

625.2.2.3 Testing and Production Variation

- ¹ When minimum or maximum values are given in these specifications, they represent values that are reliably obtained from testing. They do not represent acceptable mean production values. It is the responsibility of the manufacturer to consider variations in production and between testing laboratories when setting manufacturing tolerances.

625.2.2.4 Detailed Requirements

625.2.2.4.1 Viscosity

- ¹ Use paint with a viscosity of 80 to 95 K.U. when tested at 77°F in accordance with ASTM D 562.

625.2.2.4.2 Drying Time

625.2.2.4.2.1 Laboratory Drying Time

- ¹ Test paint in accordance with ASTM D 711 at a wet film thickness of 15 mils (± 1 mil) to determine time to "no-pickup" condition. Conduct the test in a standard laboratory atmosphere during which the relative humidity is maintained at 50% ($\pm 5\%$), and the temperature is maintained at 73.5°F ($\pm 3.5^\circ\text{F}$) and air flow is maintained at a rate of 2.2 mph (± 0.45 mph). Use paint that will dry to a "no-pickup" condition in 8 minutes or less.

625.2.2.4.2.2 Field Drying Time

- 1 Provide paint that when applied at a wet film thickness of 15 mils and a bead application rate of 6 pounds/gallon, dries to a "no-track" condition in the following times under the stipulated conditions:

Relative Humidity \leq 85%, Surface Temperature \geq 54°F	
Paint Temperature at Tip	Maximum "No-Track" Time
77°F	4 minutes
122°F – 131°F	90 seconds
131°F – 140°F	60 seconds

- 2 Consider paint to have reached a "no-track" condition when the marking is traversed by a standard automobile simulating a passing maneuver at a speed of approximately 40 mph without visible tracking of the reflectorized line. Tracking is defined to be visible if it is discernable when viewed at a distance of 50 feet.

625.2.2.4.3 Flexibility

- 1 Cast a 5 mil wet film of the paint on a clean 30-gauge tin panel approximately 3 inches by 6 inches. Air-dry the panel at room temperature for 18 hours (\pm 2 hours), and then, bake at 122°F (\pm 4°F) for 2 hours (\pm 0.25 hour). Allow the panel to cool at room temperature for 30 minutes (\pm 10 minutes), and then, bend around a 0.5-inch metal rod. Use paint that withstands this test with no sign of film failure or loss of adhesion when viewed without the use of magnification.

625.2.2.4.4 Dry Opacity

- 1 Provide white and yellow paint that has a minimum contrast ratio of 0.965 when tested at a wet film thickness of 10 mils in accordance with ASTM D 2805.

625.2.2.4.5 Directional Reflectance

- 1 Use paint that has daylight reflectance, without drop-on glass spheres, of not less than 86% for white paint, and not less than 50% for yellow paint relative to magnesium oxide when tested in accordance with ASTM E 1347.

625.2.2.4.6 Abrasion Resistance

- 1 Provide paint that passes the following abrasion resistance test:
- Prepare 4 plate samples for each lot to be tested on the Taber Abrader. Apply paint with a drawdown blade having a clearance of 26 mils. Dry the paint abrasion samples at room temperature for approximately 30 minutes, and then, dry at 105°C for 18 hours (\pm 0.2 hour). After this time, clean, dress, weigh, and abrade the paint for 1000 cycles. After abrading, clean the samples with a soft brush and weigh again. Provide a corresponding loss for the 4 plates that does not ex-

ceed 50mg per plate. Operate the Taber Abrader with a weight of 500g and CS-10 wheels.

625.2.2.4.7 Glass Bead Adhesion

- ¹ Use paint that is formulated and processed as both white and yellow colors specifically for service as a binder of drop-on beads to produce maximum adhesion, refraction, and reflection during the life of the marking applied at 15 mils wet film thickness.

625.2.2.4.8 Bleeding

- ¹ Use a paint that has a minimum bleeding ratio of 0.98 when tested in accordance with the method given in Federal Specification TT-P-1952B, paragraph 4.5.13.

625.2.2.4.9 Total Non-Volatile, Vehicle Solids, and Flash Point

- ¹ Provide paint with volatile organic compounds (VOC) that does not exceed 100 grams/liter. Use a non-volatile vehicle that is greater than or equal to 42.00%, reported to the nearest one hundredth of a percent, when the whole paint is ashed for one hour at 877°F (± 45°F). Use white and yellow paints that have 75.00% to 80.00% total non-volatiles, reported to the nearest one hundredth of a percent, when tested in accordance with ASTM D 3723. Provide paint that has a closed cup flash point that is greater than or equal to 140°F.

625.2.2.4.10 Composition

- ¹ Use a white paint that contains a minimum of 1.0 pound/gallon of titanium dioxide in the white pigment. For all colors, conform the titanium dioxide to ASTM D 476, Types II, III, or IV.

625.2.2.4.11 Lead Content

- ¹ For yellow heavy metals free binder, use a finished binder that does not exceed the legal limit of 6% maximum when tested for lead content. Use yellow pigments that are organic yellows containing no lead, chromium, or other heavy metal containing pigments. Establish the color using a blend of Color Index PY 75 and Rutile Titanium Dioxide Type II or blends of CI PY 75, CI PY 65, and Rutile Titanium Dioxide Type II. Use only small quantities of tinting aids if needed to establish an acceptable color.

625.2.2.4.12 Color

- ¹ Use paint that is capable of maintaining its original color throughout the life of the line (approximately 2 years). Use paint with color that meets the requirements of 23CFR, Part 655, Table 1. The following CIE chromaticity coordinates describe the instrumental boundaries of the required color match:

Chromaticity Coordinates				
	White		Yellow	
	x	y	x	y
1	0.303	0.300	0.498	0.412
2	0.368	0.366	0.557	0.442
3	03.93	0.340	0.520	0.479
4	0.274	0.329	0.438	0.472

625.2.2.4.13 Distinguishable Color

- 1 Use yellow color that is very distinguishable from white markings under day or night conditions when applied on the roadway and is capable of remaining distinguishable during the life of the marking.

625.2.2.4.14 Grind and Freedom from Lumps

- 1 Use pigmented binder that has a grind of not less than 3 on the Hegman Grind Gauge and that passes a No. 50 mesh sieve at the time of packaging.

625.2.2.4.15 Settling

- 1 Test the pigmented binder for settling by the following method:
 1. Use full pint, triple-sealed, friction top paint cans lined with an appropriate material designed to be non-reactive with waterborne paints.
 2. Fill the cans to the bottom of the friction seal lip and place in an inverted position for one hour to ensure a complete seal between the cover and the body of the can.
 3. At the end of one hour, place the filled can in an upright position for at least one hour before being placed in an air temperature of 122°F (± 2°F). Place the can or cans in a single tier.
 4. Store these cans free of vibration at an air temperature of 122°F (± 2°F) for a period of 5 days.
 5. After a heating period of 5 days, cool the cans at room temperature for 4 to 5 hours and evaluate the degree of settling in accordance with ASTM D 869.

Provide paint that exhibits no dense or hard settling and has a degree of settling rating of 6 or better when evaluated in accordance with ASTM D 869.

625.2.2.4.16 pH Factor

- 1 Provide a pigmented binder that has a pH factor of 9.5 minimum as packaged without thinning or diluting. Use the following resins: Rohm and Haas E-2706 Resin, Rohm and Haas Rhoplex Fastrack 3427, Dow DT211, or an approved equal for enhancing the time to "no-track." Request approval by the RCE of any substitute resin other those expressly mentioned here before its

use. Inform the OMR of the resin intended for use when supplying samples. Ensure that the supplier does not change resins during the life of the Contract without prior approval from the RCE. In the event that low pH water is used to manufacture the finished binder, pH buffers may be used to obtain the minimum pH factor.

625.2.2.4.17 Solvents

- 1 Use potable water from a public water supply as the solvent for the binder manufactured by these specifications.

625.2.2.5 Control Tolerances

625.2.2.5.1 Percent Pigment

- 1 Use total pigment solids that are 58.00 to 63.00 percent by weight, reported to the nearest one hundredth of a percent, when tested in accordance with ASTM D 3723.

625.2.2.5.2 Volumetric Weight

- 1 Use pigmented binders that have a density of 14.0 pounds/gallon (± 0.3 pound/gallon) for white and 13.7 pounds/gallon (± 0.3 pound/gallon) for yellow. Determine weight per gallon in accordance with ASTM D 1475.

625.2.2.5.3 Vehicle Solids and Total Non-Volatile

- 1 Provide paint that meets the requirements given in **Subsection 625.2.2.4.9** of these specifications.
- 2 As noted in **Subsection 625.2.2.3**, it is the manufacturer's responsibility to consider testing and production variation when selecting mean production values. It is strongly recommended that the vehicle solids be one to two percent higher than the specified minimum values.

625.2.2.5.4 Viscosity

- 1 Use paint that meets the requirements given in **Subsection 625.2.2.4.1** of these specifications.

625.2.2.5.5 Drying Time

- 1 Use paint that meets the requirements for Laboratory Drying time given in **Subsection 625.2.2.4.2** of these specifications.

625.2.2.6 Samples and Tests Required

625.2.2.6.1 Qualification of Samples

- 1 Before shipment or use, submit the following items for each type and color of paint supplied:
 - Two samples consisting of one-quart cans of paint that the manufacturer proposes to furnish.
 - Manufacturer's testing results for the samples. Provide testing results that minimally include the items given in **Subsection 625.2.2.5** of these specifications and the brand and type of resin used.

625.2.2.6.1

625.2.2.7.1

- Manufacturer's statement of compliance with all requirements of these specifications. This statement explicitly states that the paint provided is essentially free of lead, cadmium, and other heavy metals.
 - *Material Safety Data Sheets*, essentially similar to *Form OSHA-20*, for the material provided.
- 2 Furnish the items above to the following address:
- SCDOT Office of Materials and Research
1406 Shop Road
Columbia, SC 29201
- 3 Do not ship or use paint until testing indicates that the material proposed is in conformance with these specifications.

625.2.2.6.2 Production Control Tests

- 1 Perform laboratory tests on each batch of paint produced under these specifications to ensure compliance with these specifications. Include the results of these tests with samples provided as specified in **Subsection 625.2.2.6.1**.

625.2.2.6.3 Department Samples

- 1 After award of the contract, the Department reserves the right to perform in-plant sampling of the finished paint during packaging operations and/or sampling of the packaged paint after it is received. During packaging operations for each batch and at the time the manufacturer obtains samples for each batch, obtain two one-quart samples, sealed properly, and forwarded along with the results of the manufacturer's production control tests and a certification of compliance with these specifications to the OMR at the address shown in **Subsection 625.2.2.6.1** of these specifications. The samples are tested by the Department in whatever manner is deemed necessary. Department inspectors or their designated agents observe the performance of all sampling. Samples taken by the manufacturer without supervision are not acceptable without permission of the RCE. The inspectors will designate at random two containers from each batch to be sampled for testing and enclose a copy of the sampling inspection with the samples.

625.2.2.7 Materials Acceptance Criteria

625.2.2.7.1 Shipping Records

- 1 Once a batch of paint has been approved for shipment, send a form with the following information to the RCE for each shipment:
- Date
 - Consignee
 - Shipped To
 - Type of Paint
 - No. of Gallons Shipped

- Batch Number
- Laboratory Number furnished by OMR for approved batch(es).

625.2.2.8 Packing and Marking

625.2.2.8.1 Bulk Containers

- 1 Supply paint in an intermediate bulk container capable of holding 250 gallons. Provide a container that is new or reconditioned, stainless steel, and conforms to Federal DOT Specification 57 from 49 CFR, Part 178.251, or 49 CFR, Part 178 Subpart O and all other appropriate rules and regulations. Provide a container that has a certificate of construction compliance with 49 CFR, Part 178.2(C), (1), (i) and (ii) or Part 178 Subpart O regarding drop test requirements. Use a container that is equipped with disposable airtight bladders (not liners), minimum 5-mil thickness, constructed of polyethylene or similar flexible materials that will not react with the specified waterborne paint. Provide a bladder that has a minimum working volume of 250 gallons. Use a bladder that is designed to allow for valve access and proper drainage of the container contents, while minimizing air space around the paint during storage and use. Use a bladder that completely encapsulates the paint within the container and that can be easily opened for field sampling and easily closed to remain airtight. Do not allow direct air to contact paint between the bladder and the container. Reuse of the bladder is prohibited.
- 2 Use containers that comply with the following specifications:
 - A. Capable of holding approximately 250 gallons.
 - B. Designed to accommodate their lifting and transporting with forklift or front-end loader.
 - C. Stackable, at least two high.
 - D. Has either a hinged or bolted hatch and/or screw top opening that is at least 16 inches in diameter. Use containers with a bolt-down hatch that have an additional screw top opening of 6-inch minimum diameter.
 - E. Has a 2-inch ball valve fitted with a male quick disconnect and valves that are 100% compatible with waterborne paint. Has a valve that no portion, including the in-place cap assembly, extends beyond the vertical plane of the forklift. No galvanized, copper, chrome, or brass valves allowed.
 - F. Has a security feature that protects the valve from being opened by accident or by vandals.
 - G. 100% compatible with waterborne paint.
 - H. Has proper venting of the tank by either a vacuum relief valve or an access port that can be opened. Opening the container for vacuum relief will not cause the paint to come in direct contact with air.

625.2.2.8.2 Fill Level for Bulk Containers

- 1 Fill each bulk container with 250 gallons of paint to provide an air space at the top. This space is to reduce spillage when stirring is required. Add several liters of an appropriate floating ammonia solution to the top of the paint to retard evaporation and skinning.

625.2.2.8.3 Five Gallon Containers

- 1 When 5-gallon containers are used, use buckets that are USDOT hazmat certified containers for shipping liquids conforming to this specification. Ensure that they are made of not less than 26-gauge steel or plastic buckets with 90-mil minimum wall thickness, a 26-gauge metal lid, and are open-head design with lug cover and flowed-in gasket. Ensure that metal pails have at least one reinforcing bead at the upper end.
- 2 If a tapered design is used, provide two beads; one above and one below the point at which the handle is attached to the side of the metal buckets. Provide a suitable wire bail-type handle.

625.2.2.8.4 Fifty-Five Gallon Containers

- 1 Use open-head type 55-gallon drums conforming to USDOT 1A1 hazmat approved containers, as amended by this specification. Ensure that they are constructed of not less than 18-gauge steel and have a removable head that is solid and contains no bungs. Use a $\frac{5}{8}$ " bolt to secure the ring clamp that secures the removable head. Tighten the ring clamp to prevent spillage when the drum is tilted during unloading.

625.2.2.8.5 Container Marking

- 1 Plainly mark or label all containers to show the following information as appropriate: "Waterborne Lead Free - White," or "Waterborne Lead Free - Yellow." Also, show the following:
 - Net gallons and/or liters,
 - Name of manufacturer,
 - Batch number,
 - Date of manufacture (month and year), and
 - Type of resin used.
- 2 Use containers that are labeled with the information listed above in a method that is able to withstand exposure to elements for up to one year and retain all of the required information. The Department reserves the right to require an improved marking/labeling method in the event that the identifying information is not retained on the container during the storage period to the satisfaction of the RCE.

625.2.2.8.6 Container Color

- 1 Use containers provided under these specifications that are painted or otherwise colored blue. Other colors may be used with prior approval of the

RCE. Yellow, white, and black are not acceptable container colors.

625.2.2.8.7 Container Lining

- 1 Ensure that each drum or metal pail has a baked-on epoxy lining on the inside of the container. Provide containers with a coating of phenolic epoxy or equal coating.

625.2.2.8.8 Alternative Method of Packaging

625.2.2.8.8.1 General

- 1 At the Contractors option, an alternative method of packaging may be used. This alternative packing consists of caged bottle paint totes also known as composite intermediate bulk containers (IBCs). If totes are used, make certain that containers consist of blow-molded, high molecular, high density polyethylene (HDPE) enclosed by a galvanized square tubular steel cage and have a capacity of 275 gallons.

625.2.2.8.8.2 Materials

- 1 Ensure that the HDPE resin is certified by the tote manufacturer to contain a U.V. stabilizer compounded by the resin manufacturer. Make certain that the frame is zinc-galvanized tubular steel and the pallet is either plastic (HDPE) or zinc-galvanized tubular steel.
- 2 Make certain totes are equipped with disposable airtight bladders (not liners), minimum 127-micron (5-mil) thickness, constructed of polyethylene or similar flexible materials that will not react with the specified waterborne traffic paint.

625.2.2.8.8.3 Requirements

- 1 Use reusable HDPE totes capable of handling bulk liquids with 1.9 specific gravity. Make certain containers have a footprint dimensions that does not exceed 48 inches for either width or depth.
- 2 Ensure that totes are UN/DOT certified for shipping and handling of bulk liquids with a maximum of 1.9 specific gravity as required by 49 CFR, Part 178.
- 3 Use totes that have a base that allows four-way forklift and pallet jack handling. Make certain that the totes are capable of being stacked a minimum of two high when completely filled with paint.
- 4 Ensure that the minimum working volume of the bladder is 275 gallons and that the bladder is designed to allow for valve access and proper drainage of the container contents, while minimizing air space around the paint during storage and use. Ensure that the bladder completely encapsulates the paint within the container and does not allow any direct air to paint contact between the bladder and the container. Reuse of the bladder is prohibited.
- 5 Ensure that the finished tank wall is as free, as commercially practicable, of visual defects such as foreign inclusions, dried paint, air bubbles, pinholes, pimples, crazing, cracking and delaminations that will impair the serviceability

of the vessel. Fine bubbles are acceptable with tanks to the degree in which they do not interfere with proper fusion of the resin melt.

625.2.2.8.8.4 Tank Fittings and Attachments

- 1 Make certain that a bottom drain ball valve is recessed 2 inches with has a 2-inch male quick disconnect fitting. Ensure that the fill port and disconnect are leak free and compatible with waterborne paint. No galvanized, copper, chrome, or brass valves are allowed. Make certain that no portion of the valve, including the in-place cap assembly, extends beyond the vertical plane of the forklift.
- 2 Ensure that the top lid is a 6-inch screw cap style lid, and is easily opened by hand, and the screw cap has a 2-inch bung incorporated into it to provide a vacuum vent.

625.2.2.8.8.5 Markings and Certifications

- 1 Use totes that have a molded-in gallon marker for at-a-glance monitoring.
- 2 Make certain that totes that have the following markings required by 49 CFR, Part 178.703:
 - UN/DOT shipping classification,
 - Capacity,
 - Tare mass,
 - Month, day and year of manufacture, and
 - Manufacturer's name, city and state.
- 3 Use totes that have either a document holder attached or direct stenciling to the side that clearly convey the following information:
 - Company name,
 - Color of paint,
 - Quantity of paint contained,
 - Batch number,
 - Formula code, and
 - Other information as may be specified/requested by the Department.

625.2.2.9 Supplier Qualification

625.2.2.9.1 Supplier Experience

- 1 The firm or corporation that supplies paint is required to have a history of production and sales of the material furnished under these specifications. If requested by the Department and before use, have the supplier meet in person and/or furnish a statement to the satisfaction of the Department of the above history along with the names of other government agencies that have successfully used its products.

625.2.2.9.2 Laboratory Facilities

- 1 Ensure that the supplier possesses or has sufficient access to laboratory facilities capable of assuring accuracy and quality of formulation by performing laboratory tests as required in these specifications.

625.2.2.9.3 Service Technician

- 1 Proper application is deemed essential to the success of this process. To ensure proper usage of material provided under these specifications, provide at least one technician to instruct in the application of materials when requested by the Department. Provide a technician that is familiar with marking application equipment and has had successful experience in the placing of reflective markings and the use of reflective marking materials.

625.2.3 Glass Beads

- 1 Use glass beads meeting the requirements of this specification in the performance of this work. Use beads manufactured from 100% recycled cullet glass. This may include windowpane glass, architectural glass, automotive glass, or other glass sources.
- 2 Ensure that the beads meet all the requirements of AASHTO M 247, Type 1 with moisture resistant coating, with the following exceptions:
- 3 Replace Section 5.1 of AASHTO M 247, Type 1 with the following:

Package the beads in 50 or 55 pound waterproof multiple-layer type treated paper bags with a sheet of plastic moisture barrier between paper layers. Ensure that the bags are not less than five-ply construction, including the plastic moisture barrier. Furnish all pallets with the same quantity of bags and secure each pallet with shrink-wrap.

Mark each package with the following information:

 - Name and address of manufacturer,
 - Shipping point,
 - Trademark or name,
 - Wording: "Glass Beads",
 - Number of pounds,
 - Lot or batch number, and
 - Month and year of manufacture.
- 4 Other larger containers may be used subject to approval by the RCE.
- 5 The Department reserves the right to perform sampling of the packaged or unpackaged material at the point of manufacture, the Contractor's facilities, or at the job site. These samples will be tested in the manner deemed appropriate by the RCE. Before commencement of the work, provide a Certification of Compliance to the RCE for the glass beads as specified herein. At least one 50 or 55 pound bag of beads will be sampled by the RCE at random for each 44,000 pounds of beads used. Forward the bead samples and a copy of the

certification information to the OMR in Columbia for testing.

625.3 Equipment

625.3.1 Traveling Applicator

- ¹ Use a traveling pavement marking applicator that is adaptable to traveling at a uniform, predetermined rate of speed both uphill and downhill in order to produce a uniform application of paint. Use a spray-type paint machine that is capable of satisfactorily applying the paint under pressure with a uniformity of feed through nozzles spraying directly upon the pavement. Use a machine that is capable of applying at least two separate stripes, either solid or skip, in any specified pattern by using at least two adjacent spray nozzles simultaneously. Use paint tanks equipped with satisfactory cutoff valves, which can apply broken, or skip lines automatically. Make certain that the controls allow the operator to override set automatic cycles to extend a line or to begin a new cycle at any selected point. Use nozzles with a mechanical bead dispenser that operates simultaneously and in coordination with the spray nozzle and distributes the beads in a uniform pattern at the rate specified. Ensure each nozzle is equipped with suitable line guides. Use a traveling applicator equipped with paint meters that will indicate the amount of paint dispensed from each tank.

625.3.2 Cleaning Equipment

- ¹ Use pavement cleaning equipment consisting of the necessary brushes, brooms, scrapers, grinders, high-pressure water jets, and air blast equipment required to satisfactorily remove all foreign matter from the surfaces to be painted. Conduct cleaning in such a manner so that the underlying pavement is not damaged.

625.3.3 Hand Painting Equipment

- ¹ Use hand painting equipment consisting of suitable applicators, templates, and guides necessary to produce satisfactory results. Limit the use of this equipment to smaller areas such as traverse lines and stenciled symbols.

625.3.4 Equipment on Site

- ¹ Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

625.4 Construction

625.4.1 Use and Coordination of Traffic Control

- ¹ It is the Contractor's responsibility to use and coordinate the proper traffic control indicated in the Contract, the *SCDOT Standard Drawings*, the *MUTCD*, or as directed by the RCE to allow for the safe removal of existing pavement markings, surface preparation, and installation of new pavement markings.

625.4.2 Surface Preparation

- 1 Ensure that the pavement is dry and free of glaze, oil, dirt, grease, or other foreign contaminants. Where directed by the RCE, remove any existing markings that conflict with the *Pavement Marking Plans* by an approved method before the application of painted pavement marking. Use approved removal methods, which are shot blast, sand blast, or grinding.
- 2 In cases where the existing symbol markings (i.e. arrows, ONLY, etc.) differ from or are in conflict with the Plans, the *MUTCD*, or the *SCDOT Standard Drawings*, the RCE will determine which governs. For symbol marking relocation or replacement, remove 95% of the conflicting markings by buffing, water blasting, sand blasting, or otherwise ensuring that the pavement surface is in proper condition for adequate bonding of the new pavement markings. Include the cost of removal in the bid prices for placement of the new symbol markings.
- 3 On Portland cement concrete surfaces including bridge decks, remove at least 95% of any existing markings by an approved method to provide for adequate bonding of the pavement marking. Make the width of the removal 2 inches wider than the line to be applied.
- 4 When removing existing markings from the pavement surface, provide a positive means to control dust and accumulation of debris resulting from the removal operation. Capture the removed material utilizing a separate vacuum equipped vehicle or other approved system, to prevent its dispersal, and to properly dispose of this material. Do not allow any visible marking material debris to remain on the pavement shoulders. Ensure that the clean-up operations include removal and disposal of the excess or waste materials away from the project site.
- 5 Ensure that the removal or dust and debris collection operations do not damage the existing pavement surfaces (concrete or asphalt) or damage the pavement joint materials. Repair any significant damage occurring from the removal operations to the satisfaction of the RCE at no expense to the Department.
- 6 Immediately before application of the new marking material, clean all surfaces to be marked with a jet of compressed air. At the time of marking application, ensure that the pavement surface is free of dust, dirt, oil, grease, and any remaining loose or flaking existing marking material.

625.4.3 Application of Markings**625.4.3.1 Maximum Temperature and Heat Exchanger Dwell Time (Waterborne Paint)**

- 1 When waterborne paint is utilized, do not allow the temperature at the heat exchanger of the paint truck to exceed 150°F. Do not allow paint to dwell in the exchanger for more than 2 hours.

- 2 It is strongly recommended that the exchanger temperature be reduced to 120°F or that heat to the exchanger and lines be turned off if the material is not to be applied within one hour.

625.4.3.2 Alignment of Markings

- 1 Ensure that the markings are straight or uniform in curvature and conform uniformly to tangents, curves, and transitions. Make certain that symbols are of dimensions shown in the Plans and the *SCDOT Standard Drawings*. Ensure that markings are the dimensions shown on the *Pavement Marking Plans* and the *SCDOT Standard Drawings* or as directed by the RCE. Provide sufficient control points to serve as guides for the application of markings.
- 2 Ensure that the finished line markings are free from waviness and the lateral deviations do not exceed 2 inches in 15 feet. Any greater deviation will be sufficient cause for requiring the removal and correction of the markings. Remove and correct any symbol markings not meeting the dimensional requirements shown on the Plans, the *Pavement Marking Plans*, and the *SCDOT Standard Drawings*.

625.4.3.3 Applicator Type

- 1 Place all longitudinal markings with a truck-mounted applicator except when approved by the RCE. Such an exception may occur where the length of a particular marking is too short or the curvature too great to permit efficient use of a truck-mounted applicator. Transverse markings may be applied with a portable unit.

625.4.3.4 Application Restrictions

- 1 Unless otherwise permitted by the RCE, no markings may be applied to areas of pavement when any of the following conditions are present:
 1. Moisture or foreign matter is present on the surface.
 2. The air temperature is below 50°F.
 3. The relative humidity is above 85%.
- 2 The RCE may waive the temperature and humidity requirements on newly placed pavement when markings are immediately required for safe conduct of traffic.

625.4.3.5 Hours of Operation

- 1 Conduct marking operations only during daylight hours unless nighttime operations are required by the Contract or by the RCE. Ensure that all markings are sufficiently dry before opening to traffic.

625.4.3.6 Rate of Application

- 1 Provide all markings with a wet film thickness of 15 mils. Place glass beads at a minimum rate of 6 pounds per gallon of paint.

625.4.3.7 Protective Measures

- 1 When marking operations are conducted under traffic, take protective measures as outlined in the *Traffic Control Plan*. At the discretion of the RCE, repair and correct markings damaged by traffic, or markings tracked by crossing traffic as specified in **Subsection 625.4.3.9**.

625.4.3.8 Tolerance and Appearance

- 1 Ensure that markings are applied at the dimensions shown on the Plans, the *Pavement Marking Plans*, and the *SCDOT Standard Drawings*. Markings less than the specified width will not be accepted. Lengths of painted segment of skip lines less than 10 feet will not be accepted. Gaps between the painted segments that vary more than ± 6 inches from the specified dimensions will not be accepted. Ensure that all markings present a clean-cut, uniform, and workmanlike appearance. Correct all markings that fail to have a uniform, satisfactory appearance during day or night. Continued deviation from required dimensions will be cause for stopping the work and correcting the non-conforming markings as specified in **Subsection 625.4.3.9**.

625.4.3.9 Corrective Measures

- 1 All work will be subject to checks of dimensions and application rates for beads and paint. Correct all traffic markings that fail to meet the requirements given herein. Remove all areas of misted, dripped, and/or splattered paint to the satisfaction of the RCE. In all instances, when it is necessary to remove paint, remove it by means that are satisfactory to the RCE and which does not damage the underlying pavement.

625.5 Measurement

- 1 The quantities for fast dry painted pavement marking for lines are measured by the linear foot (LF) along the center of the pavement marking lines for each width and color of pavement marking line in-place, complete and accepted. The measurement includes the length of the painted marking only and excludes spaces between broken lines.
- 2 The quantities for fast dry painted pavement marking symbols (arrow, word, railroad crossing, handicap, and biking symbol, etc.) are measured by each (EA) symbol in-place, complete and accepted. A railroad crossing symbol consists of "X RR".
- 3 Traffic control utilized during the performance of painted pavement marking work is not measured under items covered by this section, but is included in the item Traffic Control in accordance with **Subsections 107.12** and **601.5**.
- 4 Unless included in other pay items in the Contract, the work required to remove existing pavement markings is considered incidental to the work under this section and is not measured separately.
- 5 Unless included in other pay items in the Contract, determination of the no passing zones for two-lane facilities and providing the Department with the data used in establishing the zones is considered incidental work for the

painted pavement marking items and is not measured for payment.

625.6 Payment

- 1 Payment for the accepted quantity for each type of pavement marking, measured in accordance with **Subsection 625.5**, is determined using the contract unit bid price for the applicable item. Payment is full compensation for applying painted pavement markings as specified or directed and includes preparing the pavement surface; removing unacceptable pavement markings; and all other materials, labor, equipment, supplies, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 Removal of existing pavement markings is considered incidental to the other items of work and no separate payment is made for this work unless separate pay items are included in the Contract.
- 3 Unless otherwise included in the proposal, traffic control for surface preparation and the application and/or removal of pavement markings is included in the item Traffic Control in accordance with **Subsections 104.7 and 601.6**
- 4 Determination of the no passing zones for two-lane facilities and providing the Department with the data is considered incidental to the other various items of work, and no separate payment is made for this work.
- 5 Payment for each item includes all direct and indirect costs and expenses required to complete the work.
- 6 Pay items under this section include the following:

Item No.	Pay item	Unit
6250005	4" White Broken Lines (Gaps Excluded) - Fast Dry Paint	LF
6250007	6" White Broken Lines (Gaps Excluded) - Fast Dry Paint	LF
6250008	6" Black Broken Lines (Gaps Excluded) - Fast Dry Paint	LF
6250010	4" White Solid Lines (Pavement Edge Lines) - Fast Dry Paint	LF
6250012	6" White Solid Lines (Pavement Edge Lines) - Fast Dry Paint	LF
6250015	8" White Solid Lines (Crosswalk & Channelization) - Fast Dry Paint	LF
6250020	12" White Solid Lines - Fast Dry Paint	LF
6250025	24" White Solid Lines - (Stop/Diagonal Lines) - Fast Dry Paint	LF
6250030	White Single Arrow (Left, Straight, Right) - Fast Dry Paint	EA

(table continued on the next page)

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Item No.	Pay item	Unit
6250031	White Single Bike Lane Arrow (Left, Straight, Right) - Fast Dry Paint	EA
6250035	White Word Message "Only" - Fast Dry Paint	EA
6250040	White Combination Arrow (Straight & Right or Straight & Left) - Fast Dry Paint	EA
6250043	White Lane Drop Arrow (Left or Right) - Fast Dry Paint	EA
6250045	Railroad Crossing Symbols - Fast Dry Paint	EA
6250050	Handicap Symbol - Fast Dry Paint	EA
6250055	Bike Lane Symbol - Fast Dry Paint	EA
6250105	4" Yellow Broken Lines - (Gaps Excluded) - Fast Dry Paint	LF
6250107	6" Yellow Broken Lines - (Gaps Excluded) - Fast Dry Paint	LF
6250110	4" Yellow Solid Line - (Pavement Edge & No Passing Zone) - Fast Dry Paint	LF
6250111	6" Yellow Solid Line - (Pavement Edge & No Passing Zone) - Fast Dry Paint	LF
6250112	6" Yellow Solid Line on Curb/Median - Fast Dry Paint	LF
6250113	6" Yellow Solid Lines on 6" Concrete Curb (Top & Side) - Fast Dry Paint	LF
6250115	24" Yellow Diagonal Lines - Fast Dry Paint	LF

SECTION 627

THERMOPLASTIC PAVEMENT MARKINGS

627.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for furnishing and applying permanent thermoplastic pavement markings within the limits of the project to delineate the travel lanes and channelize traffic.
- 2 This work includes protection of pavement markings during installation, determination of no passing zones for two-lane facilities in accordance with the *MUTCD*, and providing the Department data used in establishing no passing zones on two-lane facilities.

627.2 Materials

627.2.1 General

- 1 Provide thermoplastic pavement marking material that is a reflectorized mixture of a thermoplastic binder and spherical glass beads upon which additional glass beads are applied by dropping immediately following application. Coat Portland concrete pavement surfaces, including bridge decks, with a primer-sealer material before application of the thermoplastic binder material. Coat other surfaces as well if recommended by the thermoplastic manufacturer.

627.2.2 Thermoplastic Binder Compound

627.2.2.1 General

- 1 Ensure that the thermoplastic binder compound meets all requirements of AASHTO M 249 as modified herein.
- 2 The material may be shipped in the granulated form or the block form. Use alkyd based thermoplastic pavement markings. Apply alkyd/maleic thermoplastic pavement markings by extrusion methods only. Extrusion may be accomplished using either conventional extrusion equipment or ribbon gun extrusion devices.
- 3 Ensure that the alkyd/maleic binder consists of a mixture of synthetic resins containing high boiling point plasticizers and at least one synthetic resin that is solid at room temperature. Use a binder with at least one-half of its composition consisting of 100% maleic-modified glycerol of resin and not less than 15% by weight of the entire material formulation. Make certain that the binder does not contain petroleum hydrocarbon resins. Ensure that resins/rosins used are maleic-modified glycerol esters.
- 4 Ensure that the thermoplastic material dissolves immediately in diacetone alcohol. Slow dissolution is evidence of the presence of hydrocarbon binder components, which are not allowed.

627.2.2.2 Yellow Thermoplastic

- 1 Use a yellow thermoplastic that is lead-free (L/F). Ensure that it does not contain more than 3ppm of lead by weight in a cured state and not more than 100ppm of total Heavy Metals as defined by Resource Conservation and Recovery Act (RCRA) including lead and hexavalent chromium when tested in accordance with Environmental Protection Agency (EPA) Methods 3050 and 6010. Ensure that the yellow thermoplastic contains proper amounts of pigment to produce a material that is weather-fast, heat stable, and meets the Yellow Color, Reflectance, Color Stability (Accelerated Weathering), and Retroreflectivity requirements specified herein. Make certain that the lead-free yellow thermoplastic material appears yellow during both daytime and nighttime conditions when applied with drop-on beads. Ensure that the thermoplastic does not contain any hazardous materials at levels that would cause the thermoplastic to be classified as a hazardous waste as defined by RCRA Subarticle C rules and Table 1 of 40 CFR 261.24 Toxicity Characteristic.
- 2 Ensure that the yellow color of unbeaded material matches Federal Standard Designation No. 595b, color No. 33538 and is within the following chromaticity limits (color box) defined by plotting the following four (x, y) pairs on a C.I.E. 1931 Chromaticity diagram:

(x1, y1)	(.5300, .4560)
(x2, y2)	(.5100, .4850)
(x3, y3)	(.4550, .4440)
(x4, y4)	(.4720, .4000)

Reflectance (Y) between 45 and 55
 Measurement conditions = 2 degrees observer/illuminant D65
 Instrument: BYK – Gardner “Color-Guide” Spectrophotometer

627.2.2.3 Accelerated Color Stability

- 1 Ensure that the accelerated weathering of white and yellow (L/F) thermoplastic meets the requirements of ASTM G 155, Table X3.1, Cycle I for 1500 hours total exposure time. Prepare sample by dipping a sheet aluminum panel into the molten thermoplastic and removing it to obtain a 1.5 to 3.0 mm coating thickness of thermoplastic on the panel. Place the panel in the weathering apparatus for 1500 hrs.
- 2 After accelerated weathering, measure the Yellow Color or Yellowness Index of the unbeaded material as stated in AASHTO M 249, Section 4.3.1 or 4.3.7. Material must meet the color stability requirements below after this exposure:
 - White – ASTM E 313 – Yellowness Index, max. 20
 - Yellow – Measured chromaticity coordinates falls within a “color box” defined by the following four (x, y) pairs on a C.I.E. 1931 Chromaticity diagram:

(x1, y1) (.5300, .4560)
 (x2, y2) (.5100, .4850)
 (x3, y3) (.4350, .4290)
 (x4, y4) (.4490, .3770)

627.2.2.4 Color Stability of In-Service White and Yellow Thermoplastic

- 1 The daytime color of the applied white and yellow thermoplastic pavement marking material (with drop-on beads) must meet the color requirements shown in **Subsection 627.2.2.3** (Accelerated Color Stability). The color may be measured within 60 days of application using a portable BYK-Gardner "Color-Guide" Spectrophotometer (see **Subsections 627.2.2.2** and **627.2.2.3**) and must remain within the "color-box" as noted in **Subsection 627.2.2.3**.

627.2.2.5 Hardness and Indentation Resistance

- 1 Measure the hardness according to ASTM D 2240, except condition the sample for 2 hours in a 115°F water bath, before measuring the hardness. Condition the Durometer at 115°F in a forced air oven. Remove the sample from the water bath and quickly place the Durometer on the sample while starting a stopwatch. Record the hardness after 15 seconds. Ensure that the total weight of the Durometer is 2000 grams. Make certain the hardness is a minimum of 40 and a maximum of 70.

627.2.2.6 Flash Point

- 1 Ensure that the flash point of the thermoplastic pavement marking is a minimum of 475°F (245°C) when tested in accordance with ASTM D 92.

627.2.3 Glass Beads

- 1 Ensure that Type 1, Type 3, and Type 4 glass beads meet the requirements of AASHTO M 247 with the following exceptions:

Glass beads are a minimum of 80% true spheres when tested according to ASTM D 1155 and meet the following gradation requirements when tested in accordance with ASTM D 1214:

Sieve Size	Percent by Mass Passing Designated Sieve (ASTM D 1214)		
	Grading Designation		
	Type 1 (AASHTO)	Type 3 (FP 96)	Type 4 (FP 96)
No. 8	---	---	---
No. 10	---	---	100
No. 12	---	100	95 - 100
No. 14	---	95 - 100	80 - 95

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Sieve Size	Percent by Mass Passing Designated Sieve (ASTM D 1214)		
	Grading Designation		
	Type 1 (AASHTO)	Type 3 (FP 96)	Type 4 (FP 96)
No. 16	100	80 - 95	10 - 40
No. 18	---	10 - 40	0 - 5
No. 20	95 - 100	0 - 5	0 - 2
No. 25	---	0 - 2	---
No. 30	75 - 95	---	---
No. 40	---	---	---
No. 50	15 - 35	---	---
No. 80	---	---	---
No. 100	0 - 5	---	---

- 2 Ensure that the intermixed glass beads meet the requirements for Type I with the following exception:

The intermixed glass beads are incorporated into the thermoplastic binder at a minimum of 35% and a maximum of 40% by mass weight.

627.2.4 Primer-Sealer

- 1 Use a two-part epoxy primer-sealer recommended by the manufacturer of the thermoplastic pavement marking material on Portland cement pavement surfaces and bridge surfaces that have not been overlaid with asphalt. Use the primer-sealer on any type of pavement before the placing of any pavement symbols. Use the primer-sealer on asphalt concrete pavement surfaces if recommended by the manufacturer of the thermoplastic pavement marking material. Ensure that the primer-sealer forms a continuous film that will mechanically adhere to the pavement and neither discolor nor cause any noticeable change in the pavement outside of the finished pavement markings. Apply the primer-sealer in accordance with the manufacturer's recommendations.

627.2.5 Quality Assurance Provisions And Certification

- 1 Obtain actual laboratory test results from the manufacturer of the thermoplastic binder indicating compliance with all requirements of AASHTO M 249 for each batch or lot of material furnished, along with a final certification that the material furnished meets the requirements of the Department's specifications. Also, obtain from the manufacturer of the drop-on glass beads a certification stating that the material furnished meets all the requirements of the

Contract specifications. Furnish copies of the above-described affidavits to the RCE.

627.3 Equipment

627.3.1 Application Equipment

- 1 Use equipment that enables the installation of thermoplastic pavement markings by methods in accordance with AASHTO M 249 with the addition of the following requirements.
- 2 Applicators may be either a truck-mounted liner or a portable unit. A truck-mounted unit is defined as a self-propelled vehicle with six or more wheels and an enclosed cab for housing a driver. Make certain that the operator has controls that allow override of pre-set automatic cycles in order to extend a line or to begin a new cycle at any selected point.
- 3 Prepare material with an insulated batching machine recommended or furnished by the manufacturer and consists of a special kettle for melting and heating the composition. Ensure that heating of kettles and melters is done by controlled heat transfer systems that are oil jacketed or indirect flame air jacketed. Do not use direct flame heating equipment. Make certain that all kettles and melters are equipped with an automatic thermostatic control device and proper thermometers to control the temperature of the material at the manufacturer's recommended application temperature range. Ensure that all mixing and conveying parts up to the final dispensing nozzle/shaping die maintain the material at the appropriate temperature. Ensure that the applicator and kettle are equipped and arranged to satisfy the requirements of all state and local requirements.
- 4 Ensure that the batching machine provides continuous mixing and agitation of the material. Make certain that all parts of the equipment that come in contact with the material are easily accessed and exposed for cleaning and maintenance and are designed to prevent accumulation and clogging.
- 5 Apply thermoplastic pavement markings by extrusion methods. Extrusion may be accomplished either with a conventional extrusion equipment, wherein one side of the shaping die is the pavement surface and the other three sides are contained by, or are part of, suitable equipment for heating and controlling the flow of material, or with ribbon gun extrusion devices. Make certain that the applicators have a means for cleanly cutting off square ends.
- 6 Ensure that the applicators are capable of producing the various widths of traffic markings required in the *MUTCD* and/or on the Plans. Make certain that the applicators are mobile and maneuverable so that it can follow straight lines and make normal curves in a true arc. Use a truck-mounted liner with a method of automatically applying "skip" or solid longitudinal lines, including right and left edge lines, or any combination of single or double line configurations (color and pattern) as illustrated in the *MUTCD*. Adjust application equipment to prevent nozzle/shaping die overruns without the use of pans,

aprons, or other devices.

- 7 Apply glass beads to the surface of the completed marking with an automatic bead dispenser attached to the applicator so that the beads are dispensed almost instantly following application of the marking material.

627.3.2 Equipment on Site

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

627.4 Construction

627.4.1 Use and Coordination of Traffic Control

- 1 It is the Contractor's responsibility to use and coordinate the proper traffic control indicated in the Specification, on the Plans and the *SCDOT Standard Drawings*, in the *MUTCD*, or as directed by the RCE to allow for the safe removal of existing pavement markings if required, surface preparation, and installation of new pavement markings.

627.4.2 Surface Preparation

- 1 Ensure that the pavement is dry and free of glaze, oil, dirt, grease, or other foreign contaminants. Where directed by the RCE, remove any existing markings that conflict with the *Pavement Marking Plans* by an approved method before the application of thermoplastic material. Use approved removal methods, which are shot blast, sand blast, or grinding.
- 2 In cases where the existing symbol markings (i.e. arrows, ONLY, etc.) differ from or are in conflict with the Plans, the *MUTCD*, or the *SCDOT Standard Drawings* the RCE will determine which governs. For symbol marking relocation or replacement, remove 95% of the conflicting markings by buffing, water blasting, sand blasting, or otherwise ensuring that the pavement surface is in proper condition for adequate bonding of the new thermoplastic markings. Include the cost of removal in the bid prices for placement of the new symbol markings.
- 3 On Portland cement concrete surfaces including bridge decks, remove at least 95% of any existing markings by an approved method to provide for adequate bonding of the thermoplastic material. Make the width of the removal 2 inches wider than the line to be applied. Apply a primer sealer, recommended by the thermoplastic manufacturer, to the prepared surface before the application of the thermoplastic material.
- 4 When removing existing markings from the pavement surface, provide a positive means to control dust and accumulation of debris resulting from the removal operation. Capture the removed material utilizing a separate vacuum equipped vehicle or other approved system, to prevent its dispersal, and to properly dispose of this material. Do not allow visible marking material debris

to remain on the pavement shoulders. Ensure that the clean-up operations include removal and disposal of the excess or waste materials away from the project site.

- 5 Ensure that the removal or dust and debris collection operations do not damage the existing pavement surfaces (concrete or asphalt) or damage the pavement joint materials. Repair any significant damage occurring from the removal operations to the satisfaction of the RCE and at no expense to the Department.
- 6 Immediately before application of the new marking material, clean all surfaces to be marked with a jet of compressed air. At the time of marking application, ensure that the pavement surface is free of dust, dirt, oil, grease, and any remaining loose or flaking existing marking material.

627.4.3 Application of Primer-Sealer

- 1 Where required, spray the primer-sealer on the pavement surface where the lines are to be applied. Follow the recommendations of the manufacturer of the primer sealer and/or thermoplastic material for the application thickness and curing time before application of the thermoplastic material.

627.4.4 Application of the Thermoplastic Pavement Marking Material

- 1 Except when directed or approved by the RCE, place all longitudinal markings with a truck-mounted applicator in conformance with the requirements of **Subsection 627.3**. Such an exception may occur where the length of a particular marking is too short or the curvature too great to permit efficient use of the truck-mounted liner. Transverse markings may be applied with a portable unit.
- 2 Ensure that the markings are straight or uniform in curvature and conform uniformly to tangents, curves, and transitions. Make certain that symbols are of the dimensions shown in the *SCDOT Standard Drawings*. Ensure that markings are of the dimensions and are placed as shown on the *Pavement Marking Plans* or as directed by the RCE. Provide sufficient control points to serve as guides for the application of markings at no additional expense to the Department.
- 3 Ensure that the finished line pavement markings are free from waviness and lateral deviation does not exceed 2 inches in 15 feet. Any greater deviation is sufficient cause for removal and correction of such markings at no additional expense to the Department. Remove and correct symbol pavement markings not meeting the dimensional requirements shown in the *SCDOT Standard Drawings*. Protect the pavement markings until dry by placing guarding or warning devices as necessary. If a vehicle crosses the wet marking, remove the pavement marking and any tracking lines made by the moving vehicle and apply new markings at no additional expense to the Department.
- 4 Place pavement markings only when the pavement is dry as determined by visual inspection or other approved method and the pavement temperature is

a 55°F or greater and the air temperature is 50°F or greater. No work is allowed when any moisture is visible on the pavement surface or pavement is wet. Provide each work crew with a hand-held infrared non-contact thermometer with a temperature range of 0°F to 1000°F to verify the minimum surface temperature and a pocket thermometer capable of accurately measuring air temperature. Measure air temperature away from heat generating equipment.

- 5 Do not apply thermoplastic pavement markings between December 15 and March 15, inclusive. Additionally, the RCE may disallow application on any days when the weather is cold and/or rainy and there is some question as to whether the surface temperature will be above 55°F for a period adequate to obtain quality pavement markings. Application may also be disallowed on any day when, in the opinion of the RCE, moisture conditions are not satisfactory for obtaining quality pavement markings.
- 6 Ensure that new asphalt concrete surfaces are in place a minimum of 7 days before application of thermoplastic pavement markings. Remove the curing compound on new Portland cement concrete surfaces before application of pavement markings.
- 7 Have on hand an adequate number of personnel experienced in the handling and application of this type of material to ensure that the work is done properly. Run the marking machine only in the direction of normal traffic flow during marking operations.
- 8 Perform work only during daylight hours unless specified otherwise. Ensure that all markings are sufficiently dry before sunset to permit crossing by traffic. Remove all protective devices before sunset to allow free movement of traffic at night.
- 9 Apply the thermoplastic pavement marking material at a temperature between 390°F and 420°F that provides the best adhesion to the pavement as recommended by the manufacturer. Heat the material uniformly throughout, and ensure that it has a uniform disbursement of binder, pigment, and glass beads when applied to the surface of the pavement.
- 10 Apply extruded lines 12 inches or less in width with a die that equals the width of the line. Extruded lines greater than 12 inches may be applied with two dies whose combined width is equal to the width of the line.

627.4.5 Rate of Application of Thermoplastic Material

- 1 Apply the thermoplastic material at the specified widths and at the rate of new dry material thickness as specified as follows.
 - 90 mils for edge lines and median lines including:
 - 4-inch solid white lines,
 - 4-inch solid yellow lines,
 - 4-inch broken yellow lines,
 - 6-inch solid white lines, and

- 6-inch solid yellow lines.
- 90 mils for lane lines including:
 - 4-inch broken white lines and
 - 6 inch broken white lines.
- 90 mils for center lines on two-lane roads including:
 - 4-inch broken yellow lines and
 - 4-inch solid yellow lines.
- 125 mils for all symbols, words, or other lines not listed above.

627.4.6 Application of Glass Beads

627.4.6.1 General

- 1 Mechanically apply drop-on glass beads to the surface of the pavement marking material immediately after the material is applied to the pavement surface while the pavement marking material is still molten. Ensure that the beads are held by, and mechanically embedded in, the surface of the material. Make certain that the beads are uniformly distributed over the entire surface of the marking utilizing the single-drop or double-drop method specified below.
- 2 Uniformly apply drop-on glass beads to the surface of the molten thermoplastic material using either Single-Drop or Double-Drop method as required. Make certain that beads are embedded at 60% of their diameter and at a rate of 8 to 10 lbs per 100 square feet. Ensure that Type I glass spheres used for Single-Drop applications have a dual coating for adhesion promotion and moisture resistance.

627.4.6.1 Double Drop Method

- 1 Use the double-drop method of applying glass beads for all Interstate highways and for other roadways when specified or required by the plans.
- 2 Use small glass beads meeting the gradation for Type 1 required in **Subsection 627.2.3**.
- 3 Use large glass beads meeting the gradation for Type 3 or 4 required in **Subsection 627.2.3** and are a minimum of 80% true spheres.
- 4 Apply large beads uniformly to the surface of the thermoplastic material so that they are embedded at 60% of their diameter at a rate of 8 to 10 lbs. per 100 square feet of material. Immediately follow the application of the large beads with application of the smaller spheres at a rate of 8 to 10 lbs. per 100 square feet of material.
- 5 Ensure that the beads are properly embedded and adhered to the thermoplastic line; if not, cease all marking operations until corrections are made.
- 6 Make certain that the marking is uniformly retroreflectorized upon cooling.

627.4.7 Reflectance Requirements

- 1 Ensure that the markings have the minimum retroreflectance values shown in the following table at the time of installation as obtained with a LTL 2000 Retroreflectometer. Make certain these values are maintained for a minimum of 30 days from the time the markings are placed. Make certain that each marking is uniformly retroreflectorized upon cooling.

Retroreflectivity (mcd/lux/m ²)		
	White	Yellow
Single-Drop	375	250
Double-Drop	450	350

627.4.8 Inspection and Departmental Sampling

- 1 In addition to initial acceptance, thermoplastic material may be required to be sampled, tested, and approved by the OMR or their designated representative before shipment.
- 2 At the discretion of the Department, additional sampling and testing at the job site may be performed. Submit to the RCE a certification from the manufacturer for each shipment, certifying through actual laboratory test results that the thermoplastic meets the requirements of AASHTO M 249 as amended herein for each type of thermoplastic material. No thermoplastic material may be used or be paid for until the thermoplastic certification is received and accepted by the RCE. The Department reserves the right to sample and test any thermoplastic material supplied for any SCDOT project at any time.
- 3 A lot consists of a batch or consecutive batches of thermoplastic manufactured on the same day using the same formulation. A lot must be more than 2000 lbs and less than 44,000 lbs of thermoplastic material. A batch is that amount of thermoplastic that was manufactured and packaged in a single operation. Make certain thermoplastic material from the same lot is palletized, stretch-wrapped, labeled with the manufacturer's lot and batch numbers (on each pallet) and batch number (on each bag) and stored in a common area to facilitate random sampling of the entire lot by the Department's Inspector.
- 4 Ensure that the following information is included on the manufacturer's certification:
 - State Specification No.,
 - Manufacturer's Product No.,
 - Color (White or Lead-Free Yellow),
 - Weight of the sample,
 - Identification numbers of batches comprising the lot and lot number,
 - Date of Manufacture,

- Form (block or granular),
 - Binder Type – Alkyd,
 - Sampling Method (splitting, thieving, quartering, random bag, etc.), and
 - SC File No. or Contract No.
- 5 Submit to the OMR or their designee a manufacturer's test report showing actual laboratory test results on each lot of thermoplastic material. Include the following information in the manufacturer's test report:
- Binder Content,
 - Pigment Content,
 - Glass Bead Content,
 - Daylight Luminous Reflectance,
 - 4 Hour Daylight Luminous Reflectance after 4 hrs at 425°F,
 - Yellow Color – Chromaticity Coordinates (for yellow only),
 - Yellowness Index (for white only),
 - Ring and Ball Softening Point,
 - Hardness,
 - Flowability,
 - Extended Flowability, and
 - Flash Point.
- 6 The Department reserves the right to retest any batch/lot of thermoplastic material after delivery. Results from such retesting will prevail over all other tests and failure will be the basis of rejection. Remove material not meeting the specification from the project and replaced at no expense to the Department, including all costs for handling, retesting and shipping.

627.4.9 Testing

- 1 Perform tests according to the specified test methods. Qualitative and quantitative analysis may also be performed by other methods of analysis at the option of the Department. Ensure that the manufacturer maintains a laboratory sufficiently staffed and equipped to maintain the quality of the product called for in these specifications.
- 2 The Department may require the manufacturer to fully disclose details of the systems and processes in its QA/QC Program.

627.4.10 Inspection and Acceptance of Work

- 1 All thermoplastic pavement markings will be inspected for proper line thickness and width, adhesion, and cycle length. The markings will also be observed in both daytime and nighttime conditions to determine whether all requirements of the Contract have been met. Remove and replace markings that fail to have a satisfactory appearance during either daytime or nighttime conditions at no additional expense to the Department.

- 2 The final acceptance of the thermoplastic pavement markings will be delayed for a period of 90 days after the last date of marking on the project to permit observation of performance. The Contractor is responsible for the maintenance and performance of pavement markings during the 90-day observation period. The markings are guaranteed under the payment and performance bond. Traffic must be operating on the facility during the entire 180-day observation period unless otherwise directed.
- 3 Replace markings or markers that, in the opinion of the RCE, have not performed satisfactorily during this 90-day period due to defective materials and/or workmanship.
- 4 Ensure that the pavement marking material provided shows no signs of failure due to blistering, excessive cracking, chipping, bleeding, staining, discoloration, oil content of the pavement materials, smearing or spreading under heat, deterioration due to contact with grease deposits, oil, or gasoline drippings, spilling, poor adhesion to the pavement materials, loss of retroreflectivity, and normal wear.
- 5 Ensure that the thermoplastic marking maintains minimum retroreflectance values shown in the following table throughout the observation period. These measurements will be taken within 30 days before the end of the observation period. The retroreflectance values will be taken using a LTL 2000 Retroreflectorometer.

180-Day Retroreflectivity (mcd/lux/m ²)		
	White	Yellow
Single-Drop	325	200
Double-Drop	400	300

627.5 Measurement

- 1 The quantities for thermoplastic pavement markings for lines are measured by the linear foot (LF) along the center of the pavement marking lines for each type of line, width, color, and dry thickness of pavement marking line in-place, complete and accepted. Measurement is made of the pavement marking only and excludes the spaces between broken lines.
- 2 The quantities for thermoplastic pavement marking symbols (arrows, words, and railroad crossing symbols) are measured by each (EA) arrow (straight, right, left or combination), word or words, and railroad crossing symbol in-place, complete and accepted. A railroad-crossing symbol consists of "X RR".
- 3 Traffic control utilized during the performance of thermoplastic pavement marking work is not measured under items covered by this section, but is included in the item Traffic Control in accordance with **Subsections 107.12** and **601.5**.

- 4 Unless included in other pay items in the Contract, the work required to remove existing pavement markings is considered incidental work for the thermoplastic pavement marking items and is not measured separately.
- 5 Unless included in other pay items in the Contract, the work required to determine the no passing zones for two-lane facilities and to provide the Department with the data used in establishing the zones is considered incidental to the work under this section and is not measured for payment.

627.6 Payment

- 1 Payment for the accepted quantity for each type of thermoplastic pavement markings measured in accordance with **Subsection 627.5** is determined with the contract unit bid price for the applicable item. Payment is full compensation for applying thermoplastic pavement markings as specified or directed and includes preparing the pavement surface; removing unacceptable pavement markings; and all other materials, labor, equipment, supplies, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 Removal of existing pavement markings is considered incidental to the other items of work and no separate payment is made for this work unless separate pay items are included in the Contract.
- 3 Unless otherwise included in the Contract, traffic control for application and/or removal of pavement markings is included in the pay item Traffic Control in accordance with **Subsections 107.12** and **601.6**.
- 4 Determination of the no passing zones for two-lane facilities and providing the Department with the data is considered incidental to the other various items of work, and no separate payment is made for this work.
- 5 Payment for each item includes all direct and indirect costs and expenses required to complete the work.
- 6 Pay items under this section include the following:

Item No.	Pay Item	Unit
6271005	4" White Broken Lines (Gaps Excluded) Thermoplastic - 90 mil.	LF
6271007	6" White Broken Lines (Gaps Excluded) Thermoplastic- 90 mil.	LF
6271010	4" White Solid Lines (Pavement Edge Lines) Thermoplastic - 90 mil.	LF
6271012	6" White Solid Lines (Pavement Edge Lines) Thermoplastic - 90 mil.	LF
6271015	8" White Solid Lines Thermoplastic - 125 Mil.	LF

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Item No.	Pay Item	Unit
6271020	12" White Solid Lines (Stop Lines) - Thermoplastic -125 mil.	LF
6271023	12" X 18" White Triangular Yield Bar (Gaps Excluded) Thermoplastic – 125 mil.	LF
6271025	24" White Solid Lines (Stop/Diagonal Lines) – Thermoplastic - 125 mil.	LF
6271030	White Single Arrows (Left, Straight, Right) - Thermoplastic - 125 mil.	EA
6271035	White Word Message "Only" - Thermoplastic - 125 mil.	EA
6271036	White Word Message "Stop Ahead" - Thermoplastic - 125 mil.	EA
6271037	White Word Message "School" - Thermoplastic - 125 mil.	EA
6271040	White Combination Arrows (Straight & Right or Straight & Left) Thermoplastic – 125 mil.	EA
6271043	White Lane Drop Arrow (Left or Right) Thermoplastic – 125 mil.	EA
6271045	Railroad Crossing Symbols - Thermoplastic - 125 mil.	EA
6271050	Handicap Symbol - Thermoplastic - 125 mil.	EA
6271064	4" Yellow Broken Lines (Gaps Excluded) Thermoplastic - 90 mil.	LF
6271066	6" Yellow Broken Lines (Gaps Excluded) Thermoplastic - 90 mil.	LF
6271074	4" Yellow Solid Lines (Pavement Edge Lines) Thermoplastic - 90 mil.	LF
6271076	6" Yellow Solid Lines (Pavement Edge Lines) Thermoplastic - 90 mil.	LF
6271078	8" Yellow Solid Lines (Pavement Edge Lines) Thermoplastic - 90 mil.	LF
6271080	24" Yellow Solid Lines - Thermoplastic - 125 mil.	LF

SECTION 630

PERMANENT RAISED PAVEMENT MARKERS

630.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for furnishing and installing durable, abrasion-resistant retroreflective pavement markers (RPM) at locations designated on the Plans and as directed by the RCE. Also included is protection of the RPM during installation.

630.2 Materials

630.2.1 General

- 1 Ensure that the RPM meets the requirements of ASTM D 4280 and conform to the provisions in this section. Drawings of markers shown in the Plans are for illustrative purposes only and are not intended to specify any particular product.

630.2.2 Shape and Color

- 1 Provide RPM with a base approximately 4 inches x 4 inches or 5 inches X 2 inches both approximately $\frac{5}{8}$ inch in height with 30-degree sloping sides (nominal dimensions). Make certain that the outer surface of the marker is smooth and all corners and edges exposed to traffic are rounded. Provide RPM of the color(s) indicated on the Plans and with either one or two reflective faces as required on the Plans. When illuminated by automobile headlights, ensure that the reflective faces redirect light of the required color and as specified herein. Make certain that the color of the reflectors when illuminated and when not illuminated is similar. The color of RPM will be evaluated by the Department, and off-colors or non-similar color samples will constitute grounds for rejection.

630.2.3 Physical Requirements

- 1 Provide RPM with a smooth exterior surface of the shell and contain one (mono-directional) or two (bi-directional) prismatic reflector faces, as required on the Plans, molded to reflect incident light and having a minimum surface area of 2.50 square inches.
- 2 Ensure that the markers have a hard, durable, abrasion resistant surface (untempered glass or a special abrasion resistant coating), bonded to the reflective face surface of the marker. The red lenses on two color units are exempt from this requirement.
- 3 Make certain that the abrasion resistant surface of the reflector lens can withstand radial cracking and show only concentric cracks when damaged by impact of hard objects embedded in vehicle tires.

630.2.4 Samples

- 1 Twenty-five markers of each type selected at random from each shipment or lot will constitute a representative lot sample for testing by the OMR. Markers undamaged from testing by the OMR will be available for the Contractor to reclaim and use.
- 2 Ensure that 20 markers selected from the lot sample meet the requirements for the size and material for the reflective face surface for a lot or shipment to be accepted. However, if 19 markers meet this requirement, a resample may be allowed at the request of the Contractor. If all 20 markers of the resample meet the requirements for the size and material for the reflective face surface the lot or shipment will be accepted with the stipulation that if any deficient markers are detected during installation the remainder of the lot or shipment may be rejected.

630.2.5 Tests**630.2.5.1 General**

- 1 The OMR will test the RPM samples in accordance with ASTM D 4280.

630.2.5.2 Optical Test

- 1 Ten markers from each lot sample will be tested as prescribed in ASTM D 4280. If all pass the optical test, the lot will be accepted.
- 2 If any fail, 10 additional samples will be tested. If any of the second 10 markers fail the optical test, a resample may be allowed if requested; however, if more than 2 markers from the original sample fail the optical test, no resample will be allowed, and the lot or shipment will be rejected. If 19 of the 20 markers comprising the resample pass the optical test, the lot or shipment will be accepted.

630.2.5.3 Abrasion Test

- 1 Three markers picked at random from each lot sample will be tested as prescribed in ASTM D 4280. If all pass the abrasion test, the lot will be accepted.
- 2 If any marker fails the abrasion test, a resample may be allowed if requested. If any of the 3 markers tested from the resample fail the requirements, the lot or shipment will be rejected.

630.2.5.4 Impact Test

- 1 Three markers picked at random from the lot sample will be impact tested as prescribed in ASTM D 4280. If all pass the impact test, the lot will be accepted.
- 2 If any marker fails the impact test, a resample may be allowed if requested. If any of the three markers tested from the resample fail the requirements, the lot or shipment will be rejected.

630.2.5.5 Longitudinal Flexural Strength Test

- 1 Three markers picked at random from the sample lot will be load tested as prescribed in ASTM D 4280. Each marker must support a minimum load of 2000 pounds.
- 2 If only 2 of the 3 markers selected for strength testing meet the requirements of these specifications, the lot or shipment may still be accepted provided 6 additional markers selected from the sample lot for strength testing all meet the requirements. If 2 or more of the original 3 markers fail the strength test the lot or shipment will be rejected.

630.2.5.6 Compressive Strength Test

- 1 Three markers picked at random from the sample lot will be load tested as prescribed in ASTM D 4280. Each marker must support a minimum load of 6000 pounds.
- 2 If only 2 of the 3 markers selected for strength testing meet the requirements of these specifications, the lot or shipment may still be accepted provided 6 additional markers selected from the sample for strength testing all meet the requirements. If 2 or more of the original 3 markers fail the strength test the lot or shipment will be rejected.

630.2.5.7 Manufacturer's Q/C Test Report

- 1 Furnish the RCE 4 copies of a notarized certified report from the manufacturer of the markers showing the results of its quality control tests.

630.3 Equipment

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

630.4 Construction**630.4.1 Installation of RPM****630.4.1.1 Restrictions**

- 1 No permanent raised markers may be installed between December 15 and March 15 inclusive, except with the written permission of the RCE.

630.4.1.2 Location of RPM

- 1 Locate the lane line markers, edge line markers, center line markers, entrance and exit ramp markers as shown in the Plans and typicals.

630.4.1.3 Method of Bonding RPM to Pavement**630.4.1.3.1 General**

- 1 Markers may be bonded to the pavement by using either the epoxy method or the bituminous adhesive method. Ensure that the ambient temperature

and road surface temperature during application is at least 50°F for use of the epoxy method or 40°F for use of the bituminous adhesive method of bonding.

- 2 If the epoxy method is used, furnish the RCE 4 copies of a certification stating that the epoxy meets the requirements of AASHTO M 237, Type 1. If the bituminous adhesive method is used, furnish the RCE 4 copies of a certification stating that the bituminous adhesive meets the requirements of these specifications.

630.4.1.3.2 Epoxy Method

- 1 If the epoxy method of bonding RPM to the pavement is elected, use an epoxy adhesive that meets the requirements of AASHTO M 237, Type 1. In addition to the manufacturer's recommendations, comply with the following requirements:
 - A. Maintain the temperature of the adhesive components at 60°F to 100°F before mixing.
 - B. Just before use, mix Components A and B in accordance with manufacturer's recommendations.
 - C. Clean the road surface by sandblasting the area to which the marker is to be bonded. Ensure that the sand is clean and dry. Make certain that the road surface where markers are to be placed is thoroughly dry before applying epoxy.
 - D. When markers are placed over existing traffic paint stripes, remove all old paint and primer down to bare concrete or asphalt.
 - E. Ensure that the machine mixer and applicator are capable of accurately and uniformly proportioning Component A to Component B in a volume ratio in accordance with the manufacturer's recommendations.
 - F. Ensure that the mixing chamber produces the mixed adhesive with a uniform gray color with no visible evidence of streaks of either black or white on the surface or within the mixed adhesive.
 - G. Make certain that voids in a cured undisturbed sample $\frac{1}{16}$ inch thick from the extrusion nozzle do not exceed 4%.
 - H. Make periodic checks of the proportioning equipment to determine the actual volume ratio of Component A to B. Do this by placing containers before the mixing chamber and measuring the actual volume of Components A and B dispensed.

630.4.1.3.3 Bituminous Adhesive Method

- 1 If the bituminous adhesive method of bonding the RPM to the pavement is elected, use a bituminous type hot-melt adhesive that meets the requirements of these specifications.
- 2 Ensure that the adhesive is suitable for bonding ceramic and plastic markers to Portland cement concrete, asphalt concrete, and chip-seal road surfaces and is applicable when road surface and marker temperatures are in

the approximate range of 40°F to 160°F. Make certain that the composition of the adhesive is such that its properties do not deteriorate when heated to and applied at temperatures up to 425°F using either air or oil-jacketed melters.

- 3 Use adhesive packaged in self-releasing cardboard containers with essentially flat and parallel top and bottom surfaces such that the packages stack properly. Ensure that each package has a net weight of either 50 or 60 pounds and weighs within 2 pounds of the stated weight. Make certain that the packaging has self-releasing cardboard dividers that separate each package into sections weighing not more than 15 pounds each. Make sure each package shows the following:
 - Manufacturer's Name,
 - Net Weight,
 - Lot or Batch Number, and
 - The words "Bituminous Adhesive for Pavement Markers" or similar wording identifying the contents.

630.4.1.3.4 Prequalification of Adhesive

- 1 Use adhesives from manufacturers that have had their adhesives successfully tested by the National Transportation Product Evaluation Program (NTPEP) in compliance with *SCDOT Qualified Product Policy 42* and listed on *SCDOT Qualified Product List 42*.

630.4.1.4 Observation and Acceptance

- 1 The RPM will be inspected during both daytime and nighttime conditions to determine whether the intent of this specification has been achieved. Remove and replace markers failing to have satisfactory appearance in either daytime or nighttime conditions at no additional expense to the Department.
- 2 The final acceptance of the RPM will be delayed for a period of 180 days after the last date of marker placement to permit observation of performance. Remove and replace any marker that, in the opinion of the RCE, has not performed satisfactorily during this 180-day period due to defective materials and workmanship in manufacture and application at no additional expense to the Department.

630.5 Measurement

- 1 The quantity for the pay item Permanent (*Clear, Yellow, or Red/Clear*) Pavement Markers (*Mono-Directional or Bi-Directional*) – (*4"X4" or 5"X2"*) is measured by each (EA) permanent raised mono-directional or bi-directional retroreflective pavement marker of each color, type, and size in-place, complete and accepted.
- 2 The quantity of clear replacement reflectors for existing raised pavement markers is measured by each (EA) clear mono-directional raised pavement marker reflector in place, complete and accepted.
- 3 Traffic control utilized during the performance of raised pavement marker work is not measured under items covered by this section, but is included in

the item Traffic Control in accordance with **Subsections 107.12** and **601.5**.

- 4 Unless included in other pay items in the Contract, the work required to remove existing raised pavement markers is considered incidental work for raised pavement marker items and is not measured separately.

630.6 Payment

- 1 Payment for the accepted quantity for Permanent (*Clear, Yellow, or Red/Clear*) Pavement Markers (*Mono-Directional or Bi-Directional*) – (*4"X4" or 5"X2"*), measured in accordance with **Subsection 630.5**, is determined using the contract unit bid price for the applicable item. Payment is full compensation for installing raised pavement markers as specified or directed and includes preparing pavement surface; providing and applying proper adhesive; removing existing markers where required; removing and replacing unaccepted markers; and all other materials, labor, equipment, tools, supplies, and incidentals to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 Payment for the accepted quantity for Clear Mono-Directional Replacement Reflectors, measured in accordance with **Subsection 630.5**, is determined using the contract unit bid price for the pay item. Payment is full compensation for furnishing and replacing raised pavement marker reflectors as specified or directed and includes providing an applying adhesive; removal of existing reflectors (where required); installation of reflectors; and all other material, labor, equipment, tools, supplies, and incidentals necessary to satisfactorily complete the work.
- 3 Traffic control for surface preparation and the application and/or removal of raised pavement markers or replacement reflectors is included in the item Traffic Control in accordance with **Subsections 107.12** and **601.6**
- 4 Payment for each item includes all direct and indirect costs and expenses required to complete the work.
- 5 Pay items under this section include the following:

Item No.	Pay Item	Unit
6300005	Permanent Clear Pavement Markers Mono-Dir.- 4"X 4"	EA
6300010	Permanent Clear Pavement Markers Mono-Dir.- 5"X 2"	EA
6300029	Clear Mono-Directional Replacement Reflector	EA
6301005	Permanent Yellow Pavement Markers Mono-Dir.- 4"X 4"	EA
6301010	Permanent Yellow Pavement Markers Mono-Dir.- 5"X 2"	EA
6301100	Permanent Yellow Pavement Markers Bi-Dir.- 4"X 4"	EA
6301110	Permanent Yellow Pavement Markers Bi-Dir.- 5"X 2"	EA
6302001	Permanent Red/Clear Pavement Markers Bi-Dir. - 4"X 4"	EA

SECTION 631

REMOVAL OF EXISTING PAVEMENT MARKINGS

631.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for removal of existing pavement markings before installation of new markings when specified. This work includes removal of existing markings, capture of removed material by an approved means and disposal of the captured material.

631.2 Materials

- 1 None specified.

631.3 Equipment

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

631.4 Construction

- 1 Remove the existing long lines (edge lines, lane lines and gore markings) on the Interstate highway mainline and ramps by water blasting, sandblasting, grinding, or other method approved by the RCE. Do not use chemicals for removal of existing markings. Upon completion of the removal, make certain that the pavement surface is in proper condition for bonding of the new marking material.
- 2 On smooth surfaces, remove at least 95% of the existing lines. On open-graded asphalt or grooved concrete surfaces, remove the existing lines in a manner such that none of the marking material remains above the pavement surface (i.e. the existing marking is planed even with the pavement surface). Residual material may remain in the grooves or voids on such surfaces.
- 3 When removing existing markings from the pavement surface, provide a positive means to control dust and accumulation of debris resulting from the removal operation. Capture the removed material utilizing a separate vacuum equipped vehicle or other approved system, to prevent its dispersal, and properly dispose of this material. No visible marking material debris may remain on the pavement shoulders. Ensure that the recovery system is within a maximum of 75 feet behind the removal operation. If the recovery system fails, cease the removal operations until the recovery system is operating properly. Clean up, remove, and dispose of excess or waste materials from the project site.
- 4 Ensure that the removal operation and the dust and debris collection operation does not damage existing pavement surfaces (concrete or asphalt) or

damage pavement joint materials. Repair any significant damage occurring because of removal operations to the satisfaction of the RCE.

- 5 In cases where the existing symbol markings (arrows, words, etc.) differ from or are in conflict with the Plans or the *SCDOT Standard Drawings*, the RCE will determine which to follow. For symbol marking relocation or replacement, remove 95% of the conflicting markings by buffing, water blasting, sand blasting or otherwise assuring that the pavement surface is in proper condition for adequate bonding of the new thermoplastic markings.
- 6 Replace all mainline and ramp edge lines (white and yellow) and entrance and exit gore markings within 3-calendar days of removal. Replace all mainline lane lines the same day that the existing lines are removed. Immediately before application of the new marking material, clean all surfaces to be marked with a jet of compressed air. At the time of marking application, ensure that the pavement surface is free of dust, dirt, oil, grease, and any remaining loose or flaking marking material.

631.5 Measurement

- 1 The quantity for the pay item Removal of Pavement Markings is the length of existing pavement markings removed and is measured by the linear foot (LF) of a 6-inch width of pavement marking measured along the center of existing edge lines, lane lines, and gore markings removed excluding spaces between broken lines, complete and accepted.
- 2 For each lane line removed, the quantity is a minimum of 10 feet, regardless of the actual line length removed. The length of 12-inch gore markings is multiplied by a factor of 2 (i.e. 300 feet of 12 inch line = 600 LF of removal).
- 3 Removal of arrows, words, and symbols is considered incidental work for the replacement items and no separate measurement is made for this work.

631.6 Payment

- 1 Payment for the accepted quantity for Removal of Pavement Markings, measured in accordance with **Subsection 631.5**, is full compensation for the removal and disposal of existing pavement markings as specified or directed and includes dust control, debris removal, and all other materials, labor, equipment, tools, supplies, transportation and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 No payment is made for the removal of arrows, words, and symbols. This work is incidental to the in the unit bid price for placement of the new symbol markings.
- 3 Traffic control for removal of existing pavement markings is included in the pay item Traffic Control in accordance with **Subsections 107.12** and **601.6**
- 4 Payment for each item includes all direct and indirect costs and expenses required to complete the work.

631.6

631.6

- ⁵ Pay items under this section include the following:

Item No.	Pay Item	Unit
6319505	Removal of Pavement Markings	LF

REFERENCES

SIGNING AND MARKING ENGINEER

SOUTH CAROLINA

REGISTERED PROFESSIONAL ENGINEER

NO. 23845

MARK H. ANTHONY

SIGNATURE

2-12-08

DATE

6			
5			
4			
3			
2			
1			
0			
#	DATE	CHK	DESCRIPTION

SCDOT

SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION

DESIGN STANDARDS OFFICE

955 PARK STREET

ROOM 405

COLUMBIA, SC 29201

STANDARD DRAWING

PAVEMENT MARKING TYPICAL

RAISED MARKER

PLACEMENT & DETAIL

630-105-00

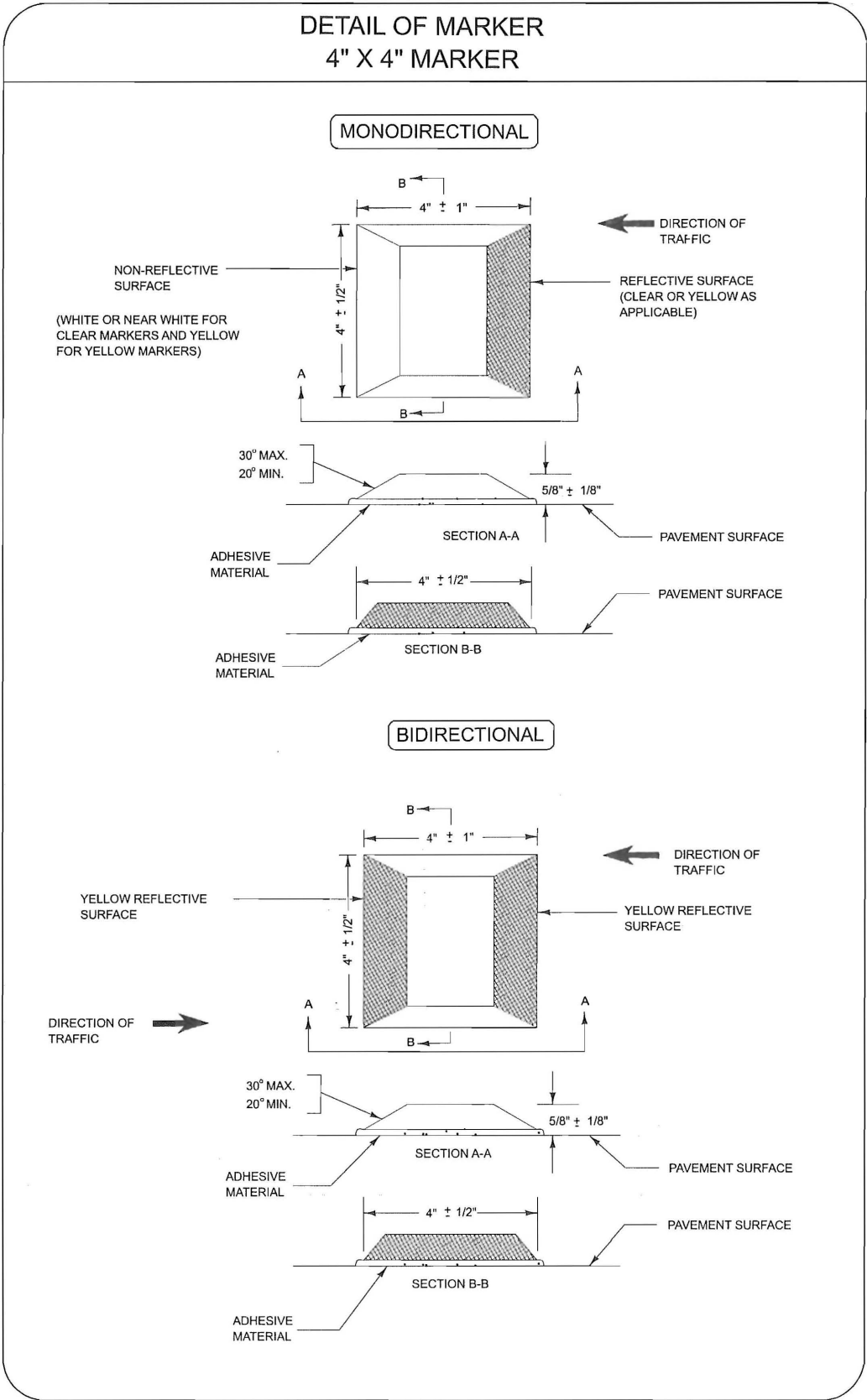
EFFECTIVE LETTING DATE

MAY 2008

THIS DRAWING IS NOT TO SCALE

PAVEMENT MARKING TYPICAL

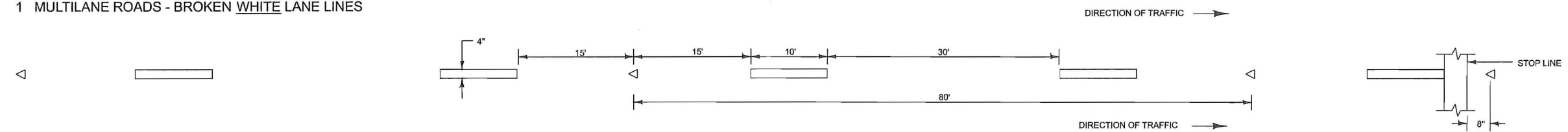
RAISED MARKER PLACEMENT & DETAIL



- NOTES
- ALL RAISED PAVEMENT MARKERS ARE TO BE SURFACE MOUNTED.
 - RAISED PAVEMENT MARKERS ARE USED TO SUPPLEMENT LINE OR SYMBOL PAVEMENT MARKINGS.
 - RAISED MARKERS ARE USED ONLY ON ROADWAYS SPECIFICALLY INDICATED ON THE PLANS. SOME ROADWAYS WILL HAVE LINE AND SYMBOL PAVEMENT MARKINGS, WITHOUT THE USE OF PAVEMENT MARKERS.
 - RAISED PAVEMENT MARKERS ARE THE SAME COLOR AS THE LINE THEY SUPPLEMENT. CLEAR PAVEMENT MARKERS ARE USED WITH WHITE LINES OR SYMBOLS, AND YELLOW, WITH YELLOW LINES. WHEN RED PAVEMENT MARKERS, OR COMBINATION RED AND CLEAR MARKERS ARE USED, THE RED COLOR IS TO INDICATE A WRONG WAY MOVEMENT.
 - RAISED MARKERS ARE USED TO SUPPLEMENT LANE LINES AND LEFT EDGE-LINES AGAINST NARROW (16' OR LESS AND NORMALLY PAVED) MEDIANS. THEY ARE NOT USED WITH RIGHT EDGE LINES OR LEFT EDGE LINES ADJACENT TO A WIDE (NORMALLY 30' OR MORE AND EARTH) MEDIANS.
 - RAISED MARKERS ARE NOT NORMALLY USED ADJACENT TO A RAISED CURBED MEDIAN WHERE THE MEDIAN IS ONE HALF MILE OR MORE IN LENGTH. RAISED MARKERS MAY, HOWEVER, BE USED ADJACENT TO A RAISED MEDIAN WHERE THE MEDIAN IS INTERMITTANT IN NATURE AND CONTINUITY OF GUIDANCE AT NIGHT IS ENHANCED BY CONTINUING THE RAISED MARKINGS. FOR SHORT RAISED MEDIANS THE RAISED PAVEMENT MARKERS ARE USED EVEN THOUGH THE YELLOW LINE THEY SUPPLEMENT IS TERMINATED WHERE THE MEDIAN BEGINS.
 - MARKERS SUPPLEMENTING SOLID LINES SHALL BE SPACED AT 40'.
 - RAISED PAVEMENT MARKERS ARE NOT USED ADJACENT TO CURB AND GUTTER EXCEPT WHERE SPECIFIED BY PLAN NOTES.
 - REFLECTIVE PORTION OF MARKERS MUST BE PLACED SO AS TO BE VIEWED BY THE INTENDED APPROACHING DRIVERS ON THE ROADWAY BEING MARKED.
 - THERE WILL BE A MINIMUM OF TWO RAISED MARKERS PER TURN LANE. IF ONLY TWO BROKEN LINES ARE USED, THERE WILL BE A RAISED MARKER AFTER EACH LINE. IF ONLY ONE BROKEN LINE IS USED, A RAISED MARKER WILL BE USED BEFORE AND AFTER THE LINE.
 - THERE WILL BE A MINIMUM REFLECTIVE AREA OF 2.5 sq. in.

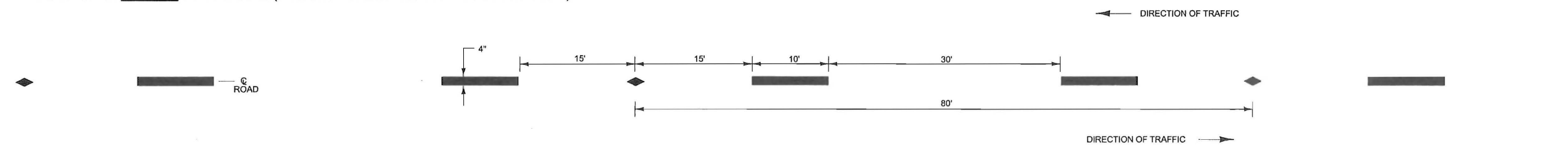
PAVEMENT MARKING TYPICAL LINE PATTERNS AND RAISED MARKER PLACEMENT

1 MULTILANE ROADS - BROKEN WHITE LANE LINES

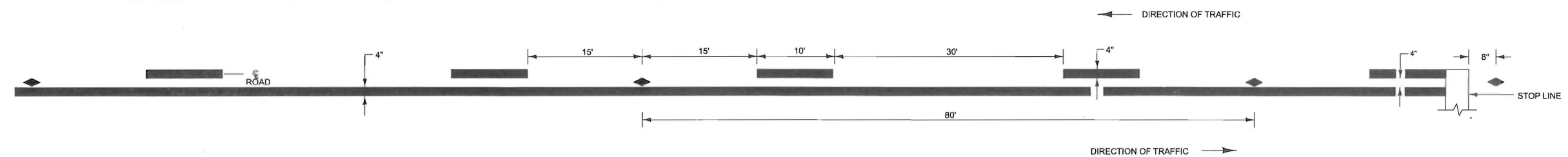


2 TWO LANE ROADS - CENTER LINES

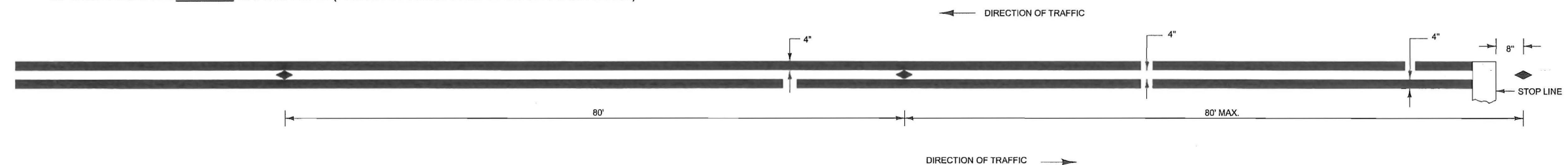
A. BROKEN YELLOW CENTERLINE (PASSING PERMITTED IN BOTH DIRECTIONS)



B. BROKEN YELLOW/SOLID YELLOW CENTERLINE (PASSING PERMITTED IN ONE DIRECTION)



C. SOLID DOUBLE YELLOW CENTER LINE (PASSING PROHIBITED IN BOTH DIRECTIONS)



IDENTIFICATION KEY FOR RAISED MARKERS:

- WHITE MONODIRECTIONAL
- YELLOW BI-DIRECTIONAL
- ALL MARKERS ARE TO BE SURFACE MOUNTED

REFERENCES

SIGNING AND MARKING ENGINEER



Mark H. Anthony
SIGNATURE

2-5-08
DATE

#	DATE	CHK	DESCRIPTION
6			
5			
4			
3			
2			
1			
0			



SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

PAVEMENT MARKING TYPICAL
LINE PATTERNS AND RAISED
MARKER PLACEMENT

630-205-00

EFFECTIVE LETTING DATE MAY 2008