

Section 84 Markings

4-8401 General

4-8402 Before Work Begins

4-8402A Traffic Stripes and Pavement Markings

4-8403 During the Course of Work

4-8403A Traffic Stripes and Pavement Markings

4-8403B Rumble Strips

4-8403C Existing Markings

4-8403C (1) Removal of Traffic Stripes and Pavement Markings

4-8403C (2) Removal of Latent Traffic Stripes and Pavement Markings

4-8404 Level of Inspection

4-8405 Quality Control

4-8406 Payment

Section 84 Markings

4-8401 General

This section provides guidelines for inspecting markings for work specified under Section 84, "Markings," of the *Standard Specifications*. The work consists of applying painted and thermoplastic traffic stripes and pavement markings, constructing rumble strips, and removing existing markings. The special provisions may also allow the contractor to substitute traffic striping and pavement marking tape. Review the bid item list, special provisions, and the contract plans to determine where paint or thermoplastic is required.

4-8402 Before Work Begins

Before work begins, discuss the operation with the Maintenance striping superintendent or supervisor. Ask if there are any particular striping or marking concerns or requests that should be addressed.

Discuss materials to be used with the contractor. If the contractor plans to use solvent-borne or acetone-based paint, verify that its use conforms to the regulations of the local agency for air pollution control.

Review striping and marking plans, standard details, and any special requirements.

Review existing field conditions. Consult with district traffic operations personnel if any changes appear to be necessary.

Verify that Form DOT CEM-3101, "Notice of Materials to Be Used," includes striping tape, paint, thermoplastic material, and glass beads. All materials listed on Form DOT CEM-3101 must be on the Authorized Materials List for signing and delineation materials. Refer to Section 6-202, "Responsibilities for Acceptance of Manufactured or Fabricated Materials and Products," of this manual for additional information.

4-8402A Traffic Stripes and Pavement Markings

Discuss the thermoplastic testing requirements at the preconstruction meeting.

Obtain a copy of the manufacturer's thermoplastic certificate of compliance and quality control test data from an independent testing laboratory.

Verify that the manufacturer submitted to Caltrans' Chemical Testing Branch a copy of the certificate of compliance and a single split 6,000 gram representative sample of the thermoplastic lot.

Obtain the safety data sheet for thermoplastic primer.

Obtain the certificate of compliance, Materials Engineering and Testing Services notification letter, and safety data sheet for each lot or batch of paint, and glass beads. Make sure that test results for beads used in drop-on applications include the EPA test method and that it can be traced to the specific test sample. Verify that the test for arsenic and lead content was performed by an independent laboratory.

Verify large-gradation glass beads are on the Authorized Materials List for two-component traffic striping paints and large-gradation retroreflective glass beads.

Read the manufacturer's instructions for striping tape and thermoplastic materials. When primer is required, determine the type the manufacturer recommends. Also determine the application temperature range for the thermoplastic material.

Discuss with the contractor the methods that will be used to remove existing markings to assure there will be no "ghost line" left behind.

Inspect the contractor's equipment for specification compliance either in the contractor's or subcontractor's yard or on another project.

Examine the contractor's methods for:

- Checking spread rates of paint and glass beads.
- Measuring application temperatures of thermoplastic material.
- Measuring maximum temperatures of paint.
- Assuring that their stencils will produce correctly dimensioned pavement markings.

4-8403 During the Course of Work

4-8403A Traffic Stripes and Pavement Markings

Check the contractor's layout work. Determine that traffic stripes and pavement markings will be correctly located. Where necessary, assist the contractor in matching existing striping cycles.

Make sure employees working around thermoplastic material wear suitable personal safety equipment, long-sleeved shirts, and eye protection.

Verify the pavement is dry, clean, and the surface temperature is as specified before the contractor applies striping or markings.

Before the contractor applies thermoplastic check:

- Thermoplastic material is heated to the specified temperature range. Thermoplastic material heated to excessive temperatures can flash and splatter when exposed to air. Check the temperature gauges mounted on heating equipment for accuracy.
- The contractor applies primer to all surface substrates except for asphalt pavement less than 6 months old and follows the manufacturer's recommendation for application rate and how long it needs to dry.
- The pavement temperature and document the readings.

Check that recesses for double traffic stripes are constructed in a single pass, are primed, and are kept dry and free of debris. Verify that the thermoplastic traffic stripes and pavement markings are applied before the end of the same work shift.

Before the contractor applies paint, check and document the atmospheric temperature and expected weather conditions. Never allow the contractor to apply paint when rain, fog, or condensation could damage the freshly painted surface.

Verify that the paint temperatures do not exceed the specified maximums for solvent-borne or water-borne paints.

Verify that each coat of paint is applied in one pass of the striping machine.

When two coats of paint are required, verify that the first coat of paint is dry before the second coat of paint is applied. The second coat of paint for centerline striping on 2-lane highways must be applied in the opposite direction of the first coat of paint.

Make sure the contractor uses two layers of glass beads for thermoplastic traffic stripes and pavement markings with enhanced wet-night visibility. The first layer must be high-performance glass beads and the second layer must be Type 2 glass beads.

Check traffic stripes for the correct width and edge definitions, lengths of gaps and individual stripes, alignment, direction of application, and correct superimposition of second coats.

Require the contractor to remove drips, overspray, improper markings, and material tracked by traffic.

Check that the applied thermoplastic material complies with thickness requirements.

Check application rates for glass beads and paint. Inspect the stripes to verify that glass beads are spread uniformly and properly embedded. Verify that paint and glass beads are applied in the order specified for two-component painted traffic stripes and pavement markings. Assure the striping machine does not travel faster than 10 miles per hour during the application.

Check thermoplastic markings for acceptability as the markings are applied. Do not permit bumps resulting from overlaps in extruded materials. Check complete thermoplastic traffic stripe or thermoplastic pavement marking to make sure it is free of runs, bubbles, craters, drag marks, stretch marks, and debris.

After application, look for any damage to striping or marking and document any rejections. Ask the contractor to remove and replace existing retroreflective pavement markers coated or damaged by work activities.

Conduct and document a nighttime drive-through visual inspection to verify the retroreflectivity of the installed material. Notify the contractor immediately of any areas with deficient retroreflectivity. Require the contractor to measure the retroreflectivity of those areas using a retroreflectometer and correct any deficiencies. Obtain a copy of the measured retroreflectivity readings from the contractor.

4-8403B Rumble Strips

Verify that rumble strips are not constructed:

- On structures, approach slabs, or concrete weigh-in-motion slabs.

- At intersections.
- Bordering two-way left turn lanes, driveways, or other high-volume turning areas.
- Within 6 inches of any concrete pavement joint.

Verify rumble strips comply with the dimension requirements and are within 2 inches of the alignment shown on the plans. If not compliant, have the contractor replace them.

Make sure rumble strips in concrete pavement are constructed after the specified requirements for the concrete pavement are met.

Verify rumble strips in asphalt concrete pavement are constructed on the top layer and a fog seal coat is applied to ground areas.

Check that residue is removed from the roadbed.

4-8403C Existing Markings

Make sure existing markings are removed:

- Without removing pavement to depth of more than 1/8 inch.
- Such that the old message cannot be identified.
- In rectangular areas if the grinding method is used.

Verify all residue is swept or vacuumed. Yellow marking residue must be handled, removed, and disposed of according to the lead compliance plan.

Make sure the contractor repairs, at no cost, any damage to the pavement and surfacing that results from removing traffic stripes and pavement markings, in accordance with Section 5-1.36, "Property and Facility Preservation," of the *Standard Specifications*.

4-8403C (1) Removal of Traffic Stripes and Pavement Markings

Yellow striping generally contains lead, so verify special handling for removal and disposal. Usually, if this striping was identified in the contract, the special provisions would cover removal and disposal. However, if the special provisions do not identify special handling for removal of yellow striping, contact the district hazardous waste coordinator to determine if the striping needs to be tested.

Observe areas where traffic stripes or pavement markings have been removed. If conditions after contractual requirements for removal have been met, but the resulting areas present a traffic hazard, order additional work to eliminate the hazard. Make your observations in the same conditions that public traffic will experience, such as driving during the night, on wet pavement, or in low sun angles.

4-8403C (2) Removal of Latent Traffic Stripes and Pavement Markings

In the past, removal of existing traffic stripes and pavement markings was not always required on projects before placement of new pavement surfacing. Thus, on some stretches of highway, old traffic stripes and pavement markings exist under layers of pavement. On pavement rehabilitation projects, underlying latent stripes and

markings may become exposed as the contractor removes layers of pavement by grinding or during cold planing of the existing surface.

If latent traffic stripes or pavement markings are exposed during removal of the existing pavement, consider those latent traffic stripes or pavement markings a differing site condition. Review Section 4-1.06, "Differing Site Conditions (23 CFR 635.109)," of the *Standard Specifications*.

Verify that the contractor repairs any pavement damage and depressions in the existing pavement caused by the removal of latent traffic stripes and pavement markings.

Removal of the latent stripes and markings and the repair of the pavement damaged by their removal will be paid as extra work in accordance with Section 4-1.05, "Changes and Extra Work," of the *Standard Specifications*. When the depressions are smaller than 0.05 foot and are filled with overlay material during its placement, pay for the additional material at contract unit price for the overlay material.

4-8404 Level of Inspection

Suggested levels of inspection for pavement markings:

- Benchmark inspection of layouts, temperatures, and equipment during placement of pavement markings.
- Immediate nighttime visual inspection of pavement marking retroreflectivity.

4-8405 Quality Control

Guidance for quality control activities included in this section is summarized as follows:

- Verify the contractor's testing of glass beads for arsenic and lead.
- Require that the contractor measure traffic stripe retroreflectivity for deficient areas identified during nighttime drive-through.
- Make sure the contractor calibrates the equipment for compliance with application rates for glass beads and paint.
- Witness the contractor's test section of two-component paint, 50-foot test stripe, and verify for homogeneous mixing of the two components, uniform bead distribution, wet film thickness, and curing time.
- Witness the contractor's 1-foot test section of thermoplastic stripe. Collect the test sample and submit it, with Form TL-0101, "Sample Identification Card," to the Chemical Testing Branch, Translab, 5900 Folsom Blvd., Sacramento, California 95819.

4-8406 Payment

Measure the striping and markings according to the units and method specified in the *Standard Specifications* and the special provisions. Record the measurements in the daily reports and calculation sheets to support partial and final payments.

Measure the striping along the line of the traffic stripe without deductions for gaps. Use a measuring wheel or a vehicle-mounted electronic measuring device for these measurements.

Areas of the standard pavement markings shown in the *Standard Plans* may be used in the calculations to determine pay quantities. Make field measurements where the areas are variable, such as for limit lines of different lengths.

Rumble strips are paid by the length measured by the station along the length of the rumble strip without deductions for gaps between indentations.

Removal of traffic stripes is paid by the length with deductions for the gaps in broken traffic stripes and multiplied by a factor in accordance with Section 84-9.04, "Payment," of the *Standard Specifications*.