

Joint construction and sealing will not be measured but the cost will be incidental to the Contract unit price for the pertinent Portland Cement Concrete Pavement item.

SECTION 524 THRU 548 — RESERVED

SECTION 549 — PERMANENT PAVEMENT MARKINGS

549.01 DESCRIPTION. This work shall consist of furnishing and applying permanent pavement markings to various surfaces at locations and patterns as specified in the Contract Documents or as directed by the Engineer. This includes line markings, letters, numbers, arrows, and symbols.

549.02 MATERIALS.

Permanent Pavement Markings Refer to Contract Documents

All pavement marking material shall be evaluated on the National Transportation Product Evaluation Program (NTPEP) North Regional Facility test deck. The Contractor shall provide the Engineer with a printed copy of the manufacturer's recommendations for use and installation of pavement markings. All pertinent material safety data sheets (MSDS) shall also be included with the manufacturer's information sheets.

549.03 CONSTRUCTION.

549.03.01 Quality Assurance/Quality Control. The Contractor shall submit in writing, a proposed Quality Control Plan, conforming to the Quality Control Plan requirements. This plan shall be submitted to the Engineer for approval before the prestriping meeting and at least two weeks prior to the start of work. The plan shall contain procedures for random sampling as specified in MSMT 729, and shall show how the Contractor proposes to control the equipment and material to ensure conformance with the Specifications. The plan shall contain personnel certifications, inspection, and record keeping procedures, and minimum frequencies of sampling and testing as specified in MSMT 729. The plan shall also detail when and how corrective action will be taken for unsatisfactory construction practices and deviations from the Specifications. Any deviation from the Quality Control Plan shall be cause for immediate suspension of the marking operation and a meeting

between the Contractor and the Administration will be required prior to restarting of pavement marking.

- (a) **Placement.** Permanent pavement marking placement operations shall not begin until the Engineer has approved the Contractor's Quality Control Plan.
- (b) **Certified Technicians.** Quality control technicians shall have a current Administration certification document to be presented to the Engineer.
- (c) **Records.** The Contractor shall maintain complete records of quality control inspection results, including any action taken to correct problems, and shall submit copies to the Engineer daily. The Contractor shall identify where the quality control tests were performed.
- (d) **Quality Assurance.** The Administration will provide quality assurance by:
 - (1) Conducting independent sampling and testing separate from the Contractor.
 - (2) Periodically observing testing performed by the Contractor.
 - (3) Directing the Contractor to take additional samples and perform additional tests at any time and at any location.
 - (4) Monitoring the Contractor's conformance with the Quality Control Plan.

Certified Technicians. The Contractor shall provide Administration certified technicians to perform quality control testing and sampling. The technicians shall demonstrate to the Engineer that they have a thorough knowledge of sampling and testing procedures as specified in MSMT 729. Quality control shall be performed during the marking operations in conformance with the approved Quality Control Plan. The Contractor shall identify where quality control tests were performed. Quality control test results shall be submitted to the Engineer at the end of each work day for that day's work. Should a certified technician become delinquent in any of their duties (i.e., failed to have all the proper test equipment on the site, failed to perform tests, failed to submit documents to the Engineer at the end of the day, reported information that varies substantially from the Administration's results), then the technician's certification shall become invalid and a recertification shall be required. All pavement marking operations shall be suspended until the Contractor provides a certified replacement technician.

Evaluation of quality control results and testing performed by the Administration will provide the basis for final acceptance.

Independent assurance audits will be performed by the Administration to confirm and assure that both the quality control personnel's test methods and quality control test equipment are in reasonable conformity with Administration specifications.

549.03.02 Cleaning Pavement Surfaces. Pavement surfaces shall be dry and free of oil, dirt, grease, and other contaminants prior to application of pavement markings. Surfaces not in conformance shall be cleaned by the Contractor to a width 4 to 6 in. wider than the marking to be applied.

Existing pavement markings that conflict with new or altered traffic patterns shall be completely removed by the Contractor. The method used by the Contractor for removal shall not damage the pavement surface and shall be approved by the Engineer. Any pavement damaged shall be repaired or replaced as determined by the Engineer at no additional cost to the Administration.

549.03.03 Application. Before any pavement marking work is begun, a schedule of operations shall be submitted to and approved by the Engineer. All pavement markings shall be applied in conformance with the manufacturer's recommendations.

When permanent pavement markings are applied under traffic, the Contractor shall provide all traffic control necessary to maintain and protect traffic in conformance with the MUTCD and the Contract Documents. The Contractor shall secure the pavement marking operations and protect the markings until they are thoroughly set. All longitudinal pavement markings shall be applied in the direction of traffic. Placing pavement marking material over longitudinal joints is prohibited.

Pavement markings shall conform to the following:

- (a) **Temperature.** Material shall be applied as specified at the manufacturer's recommended ambient, surface and material temperatures.
- (b) **Thickness.** Refer to the Contract Documents for the type of material being applied.
- (c) **Glass Beads.** Refer to the Contract Documents.
- (d) **Color.** Refer to the Contract Documents for the proper color.

- (e) **Widths.** The traveled way lane widths and the width of longitudinal lines shall be as specified in the Contract Documents. Lane widths shall be measured from the center of the line to the center of the line once a control line is established for the lane configuration of the roadway. When measurements are taken from existing longitudinal lines, the point of reference shall be the center of the single line or the center of the space between dual lines. The traveled way lane widths shall be in compliance when they have an acceptable appearance and do not deviate more than 2 in. from the proposed lane width.
- (f) **Alignment.** Markings shall be placed in a straight and uniform manner. Lane lines shall be in compliance when they have an acceptable appearance, and are visually in alignment, with no more than a 3/8 in. variation in any 40 ft section of traveled way.
- Longitudinal alignment shall be maintained through all intersections and breaks, even though the lines themselves may discontinue.
- (g) **Curing.** Refer to the Contract Documents.
- (h) **Retroreflectance.** The minimum retroreflectance of the permanent pavement markings shall be the millicandelas/lux/square meter values specified in the Contract Documents. The retroreflectance of the pavement markings shall be determined using a calibrated 15 m or 30 m geometry retroreflectometer supplied by the Contractor and tested as specified in MSMT 729. An average of five readings shall be used at each site to determine conformance with the Contract Documents and as specified in MSMT 729. The retroreflectometer shall be calibrated annually by the manufacturer and a copy of the calibration certification shall be submitted to the Engineer for that project. The instrument shall be standardized daily in conformance with the manufacturer's recommendations.
- (i) **Layout Markings.** Any layout markings that detract from the overall appearance or function of the final markings as determined by the Engineer shall be removed at no additional cost to the Administration.
- (j) **Empty Containers.** The Contractor shall remove and dispose of all empty containers and other debris related to the pavement marking operation from the project site.

Noncompliance with the Contract Documents during the pavement marking operation shall be just cause to suspend the operation. A

meeting shall be held to review the Quality Control Plan to assure that continued operations will be in compliance. Areas of noncompliance will be identified by the Engineer and correction will be as defined in the Quality Control Plan. Any incorrect markings shall be completely removed by corrective actions.

549.03.04 Quality Control Test Strip. Before beginning work with each color, the Contractor shall place a 200 to 300 foot cumulative quality control test strip of pavement marking material that conforms to the Contract Documents at a location to be determined by the Engineer. Additional control strips may be required at the Engineer's discretion. Authorization to proceed will be given when the Contractor demonstrates to the Engineer that the quality control test strip conforms to the Contract Documents.

549.03.05 Curing. The Contractor shall protect the markings until dry or cured by placing warning devices as specified in the MUTCD and as approved by the Engineer. In the event that the uncured marking is damaged by a vehicle, the marking shall be reapplied, and marks left on the pavement by the vehicle shall be removed. This work shall be performed at no additional cost to the Administration.

549.03.06 Observation Period. The Contractor shall be responsible for any defects in materials and workmanship of the pavement markings for a period of 180 days for durable materials and 60 days for nondurable materials from the date the pavement is opened to traffic.

During the observation period, the permanent pavement marking material shall show no signs of failure due to blistering, excessive cracking, bleeding, staining, discoloration, oil content of the pavement materials, smearing or spreading under heat, deterioration due to contact with grease deposits, oil, diesel fuel, or gasoline drippings, chipping, spalling, poor adhesion to the pavement, or loss of reflective beads.

A minimum of 95 percent of the applied markings shall remain intact during the observation period as determined by the Engineer.

When required, removal of pavement markings shall be performed by the Contractor with no damage to the pavement surface. Any damage incurred shall be the responsibility of the Contractor to repair or replace the pavement surface as determined by the Engineer.

549.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all pavement preparation, furnishing and placing of markings, testing, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Permanent pavement markings and the removal of existing pavement markings will be measured and paid for at the Contract unit price for one or more of the following items:

- (a) Permanent Pavement Markings will be measured and paid for at the Contract unit price per linear foot for the color and width specified.
- (b) Permanent Pavement Marking Letters, Symbols, Arrows, and Numbers will be measured and paid for at the Contract unit price per each.
- (c) Removal of Existing Permanent Pavement Markings will be measured and paid for per stripe at the Contract unit price per linear foot, regardless of width.
- (d) Removal of Existing Permanent Pavement Marking Letters, Symbols, Arrows, and Numbers will be measured and paid for at the Contract unit price per each.

549.04.01 Removal, Replacement, or Corrective Actions. Any additional cost (including Maintenance of Traffic) for the removal of markings that are incorrectly or inaccurately installed or failed the observation period, shall be at no additional cost to the Administration. In addition, the current road users fee will be applied when traffic disruption occurs during corrective actions.