

DMS - 4200

PAVEMENT MARKERS (REFLECTORIZED)

EFFECTIVE DATE: JANUARY 2010

4200.1. Description. This Specification governs for the pre-qualification, testing, and field evaluation requirements for reflectORIZED pavement markers (RPMs).

4200.2. Units of Measurements. The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

4200.3. Material Producer List. The Materials and Pavements Section of the Construction Division (CST/M&P) maintains the Material Producer List (MPL) of all materials conforming to the requirements of this specification. Materials appearing on the MPL, entitled "[Jiggle Bar Tiles, Pavement Markers, and Traffic Buttons](#)," require no further testing, unless deemed necessary by the Project Engineer or CST/M&P.

4200.4. Bidders' and Suppliers' Requirements. Before any material is allowed for use on Department projects, it must be of manufacture and product code or designation shown on the MPL.

4200.5. Pre-Qualification Procedure. The pre-qualification procedure consists of several steps, listed below, which are described in more detail in the following subsections:

- Pre-qualification request,
- Laboratory testing,
- Field testing,
- Provisional qualification,
- Project evaluations,
- Full qualification,
- Periodic evaluation,
- Disqualification, and
- Re-Qualification.

CST/M&P will provide notification at the completion of each step and will require confirmation from the supplier's contact person before proceeding to the next step.

Costs of sampling and testing are normally borne by the Department; however, the costs to sample, test, and conduct field evaluations for materials failing to conform to the requirements of this specification are borne by the supplier. This cost will be assessed at the rate established by the Director of CST/M&P and in effect at the time of testing and will be billed directly to the Contractor or supplier.

- A. Pre-Qualification Request.** Prospective suppliers interested in submitting their product for evaluation must submit a written request to the Texas Department of Transportation, Construction Division, Materials & Pavements Section (CP51), 125 East 11th Street, Austin, TX 78701-2483.

Include the following items with the request:

- Name and contact information, including email address for the person who will be the primary contact during the qualification process;
- Laboratory test results, from the manufacturer's lab or an independent test laboratory, showing actual test results that meet the requirements of ASTM D 4280;
- Product data sheets;
- List of locations and applications dates where the product is being evaluated or is in current use; and
- Test results from the National Transportation Product Evaluation Program (NTPEP), if available.

- B. Laboratory Testing.** Provide CST/M&P with 350 RPMs of each color and type for laboratory and field testing. Submit materials for laboratory testing and field evaluations at no cost to the Department. CST/M&P will acknowledge receipt of materials and specify a tentative completion date for laboratory testing. CST/M&P will test RPMs in accordance with Article 4200.6 and will send notification of results once laboratory testing is complete.

If laboratory testing conducted by TxDOT or by NTPEP shows RPMs do not meet the requirements of this specification, evaluation will cease, and RPMs will not be qualified. Suppliers may resubmit materials for qualification after providing documentation identifying the cause and corrective action taken.

- C. Field Testing.** Upon satisfactory completion of laboratory testing, CST/M&P will specify the location of one or more roadways selected for the 12-month field test and suggested application dates. The roadways will include:

- a concrete surface,
- a hot-mix asphalt surface, and
- a Grade 3 sealcoat.

The concrete and asphalt roadways will be full-access controlled freeways with a minimum average daily traffic (ADT) count of 35,000 vehicles, a minimum of 20% average daily truck traffic volume, and a minimum posted speed limit of 65 mph. The Grade 3 road test will be conducted on a four-lane divided highway with a minimum ADT count of 4,000 vehicles per lane, a minimum of 20% average daily truck traffic volume, and a minimum posted speed limit of 50 mph.

Providing NTPEP test results meeting the requirements of this specification may replace the concrete and hot-mix asphalt field tests on a deck for deck basis.

If TxDOT or NTPEP field testing shows RPMs do not meet the requirements of this specification, evaluation will cease, and RPMs will not be qualified. Suppliers may

resubmit materials for qualification after providing documentation identifying the cause and corrective action taken.

1. **NTPEP Testing.** Submit NTPEP test data to CST/M&P for review if available. CST/M&P will acknowledge receipt of NTPEP data and will provide results of review within one month of receipt.

The 12-month NTPEP test results for the pre-qualification of RPMs must meet the following:

- all the requirements specified in ASTM D 4280 for the tests performed by NTPEP;
 - a retention rate equal or greater than 90 % of the placed RPMs (excluding the RPMs removed for testing);
 - a visual evaluation of 3 or greater, as defined by the most recent NTPEP Project Work Plan for Field Evaluations of Raised Pavement Markers and Marker Adhesives, for the marker case and marker lens for a minimum of 90 % of the placed RPMs (excluding the RPMs removed for testing); and
 - the minimum retroreflectivity values required after 12 months on the roadway listed in Table 1.
2. **Application.** Provide the name of the contractor, the traffic control plan, and the manufacturer and product code for the adhesive at least two weeks prior to the application for CST/M&P review and approval. CST/M&P will confirm the date and location of the field evaluation installation and resolve any problems as necessary.

CST/M&P will provide between fifty and one hundred RPMs of each submitted type for application from the samples submitted for laboratory testing. Testing of submitted markers occurs concurrently with a set of control RPMs, for compliance with the requirements of this specification. Control markers are those RPMs currently listed on the MPL; if the MPL is reorganized and no marker exists to act as a control, an RPM that has undergone the most recent NTPEP testing on both asphalt and concrete will be used. Supplier is responsible for application of the RPMs in the presence of CST/M&P. Application must meet all Department specifications for RPM application and traffic control as well as the manufacturer's recommendations.

Notify CST/M&P of any problems or concerns with the installation within one week of application and request a re-installation, if necessary.
 3. **Evaluation.** CST/M&P will notify supplier of a suggested date for field testing evaluation at least one month prior to completion of the 12-month field trial. Provide the name of the contractor and traffic control plan for the evaluation at least 2 weeks prior to the scheduled evaluation date.

Materials must meet the following requirements:
 - a. **Retention Rate.** The retention rate of the test RPMs must be no less than 5% below that of the control RPMs.

- b. Body Damage.** The test RPMs must not exhibit discoloration or body damage exceeding that of the control RPMs. They must not exhibit a repetitive form of damage or mode of failure (indicative of a design flaw) in a large percentage of the test RPMs. Body damage will be visually assessed according to NTPEP criteria.
- c. Functionality.** Four RPMs placed at 80 foot spacing or eight RPMs placed at 40 foot spacing must be functional when viewed at night from a vehicle using the low beam headlight setting. They must be functional when viewed at a minimum distance of approximately 400 ft. in the daytime. A functional marker is both visible and conspicuous.
- d. Retroreflectivity.** CST/M&P will remove twenty test RPMs from the pavement to undergo laboratory testing for retroreflectivity in accordance with Tex-842-B. Fifteen of the twenty RPMs pulled must pass the minimum reflective values shown in Table 1 (measured at 0.2° observation angle and 0° horizontal entrance angle).

Table 1
Minimum Retroreflectivity (cd/fc) After 12 Months on the Roadway

Face	12 Mo.
Crystal	1.0
Amber	0.7
Red	0.2

- D. Provisional Qualification.** CST/M&P will grant provisional qualification after successful completion of the laboratory and field evaluations including NTPEP testing, when applicable. CST/M&P will send notification of provisional qualification, including the date of placement on the MPL, within one month after completion of the field evaluations. Failure to complete all project evaluation requirements successfully is grounds for cancellation of provisional qualification.
- E. Project Evaluation.** Once the material is provisionally qualified and listed on the MPL, provide CST/M&P with project information for the first three jobs supplied with the RPMs and additional projects if requested. RPMs must meet the same performance criteria as for the field evaluation to receive full qualification. CST/M&P will return the project evaluation results after the 12-month evaluation of each project.

- 1. Full Qualification.** CST/M&P will grant full pre-qualification and continue to list materials meeting all requirements of this specification on the MPL.

Pre-qualification requires extensive field evaluations. It is critical that no significant changes are made to the RPMs' composition, manufacturing process, or design during or after pre-qualification without notifying CST/M&P. It is also critical that the RPMs provided be uniform, with minimum variations from marker to marker. Significant changes not reported by the manufacturer or variations in product, as determined by the Director of CST/M&P, may be cause for removal from the MPL.

- 2. Failure.** CST/M&P will revoke provisional qualification for RPMs that do not meet the performance criteria and will remove the RPMs from the MPL.

Producers not qualified under this Specification may not furnish materials for Department projects and must show evidence of correction of all deficiencies before reconsideration for qualification.

- F. Periodic Evaluation.** Periodic evaluation consists of random department-initiated laboratory testing, audits, and periodic required submittals or field testing.

- 1. Department-Initiated Laboratory Testing and Audits.** The Department may conduct random sampling (per Tex-729-I) and testing on pre-qualified RPMs to identify changes in the material or nonconformity in production and to perform random audits of test reports.

- 2. Required Submittals or Field Testing.** Every 5 years, provide NTPEP data showing continued compliance with the requirements of this specification.

- G. Disqualification.** Causes for disqualification and removal from the MPL include, but are not limited to, the following:

- material fails to meet the requirements stated in this specification;
- the producer fails to report changes in the composition, manufacturing process, or design to CST/M&P;
- the producer has unpaid charges for failing samples; or
- qualified RPMs demonstrate repeated and large-scale performance problems in the field.

- H. Re-Qualification.** Suppliers disqualified and removed from the MPL may submit materials for requalification after submitting documentation identifying the cause of the problem and corrective action taken.

4200.6. Material Requirements. All RPMs must meet all requirements, except for requirements specified for a specific type.

A. Reflectorized Types.

- Type I-A must contain one face that reflects amber light. The body, other than the reflective face, must be yellow.
- Type I-C must contain one face that reflects white light. The body, other than the reflective face, must be white or silver-white.
- Type I-R must contain one face that reflects red light. The body, other than the reflective face, must be white or silver-white.
- Type II-A-A must contain two reflective faces oriented 180° to each other, each of which must reflect amber light. The body, other than the reflective faces, must be yellow.

- Type II-C-R must contain two reflective faces oriented 180° to each other, one of which must reflect white light and one of which must reflect red light. The body, other than the reflective faces, must be white or silver-white.

B. Appearance Requirements. The outer surface of the RPMs must be smooth except for the molding or stamping of the manufacturer's unique imprint. All corners and edges exposed to traffic must be rounded.

C. Optical Requirements. The RPMs must be capable of providing amber, red, or white light reflection as required by the requisition or plans.

The reflected light of each reflective face must conform to the minimum reflective specific intensity (SI) requirements listed in Table 2, measured in candelas per foot-candle (cd/fc).

Table 2
Minimum SI per Reflective Face at 0.2° Observation Angle (cd/fc)

Horizontal Entrance Angle	Crystal	Amber	Red
0°	3.00	2.00	0.75
20°	1.50	1.00	0.30

D. Physical Requirements. When tested in accordance with Tex-434-A, the minimum strength of five markers must be 2,000 lb. with none exhibiting a deformation of more than 0.125 in. before achieving the minimum strength.

A random sample of five markers will be tested in accordance with Tex-434-A.

The average compression results must have a quality index value equal to or greater than 1.23. The quality index value will be calculated from the lower specification limit of 2,000 lb. load. The following equation is used to determine the quality index value:

$$Q_L = (X - LSL) / s$$

Where:

Q_L = quality index value

X = average result from test

LSL = lower specification limit

s = standard deviation from test.

E. Heat Resistance. The RPMs must show no change in physical or optical properties when subjected to the requirements of Tex-846-B. The temperature will be 140°F with the marker in a vertical position.

The SI of the pavement marker must not be less than 80% of its initial value after being subjected to the heat test.

F. Impact Test. The RPMs will be impact tested during the pre-qualification process. They will be impacted with a 20-lb. weight in the form of a 2-in. solid right-circular cylinder with a flat impact face having rounded edges falling freely through a vertical guide. The RPMs will be impacted while resting on a solid, flat, steel plate that is at least 1/2 in. thick. The RPMs will be tested at increasing heights until failure occurs. Failure will occur when the lens or body cracks. The height at which failure occurs -6 in. will be the acceptance threshold for RPMs supplied after pre-qualification.

4200.7. Archived Versions. Archived versions are available.