

STATE

OF

TENNESSEE

October 12, 2020  
(Rev. 2/13/23)

January 1, 2021

SPECIAL PROVISION

REGARDING

PROFILED THERMOPLASTIC PAVEMENT MARKING

AUDIBLE SYSTEM

Description

This work shall consist of the placement of a raised or inverted Profiled Thermoplastic Pavement Marking Audible System that is hot applied to the pavement surface. (See Details 716PTA-1, & 2) All work shall be performed in accordance with **716** and **919** of the Standard Specifications. The pavement marking material shall be formed during application with a profile that will create an audible effect when driven over.

The raised or inverted Profiled Thermoplastic Pavement Marking Audible System shall be composed of one of the following:

A. Raised Profiled System

Materials

Use thermoplastic pavement marking material meeting the requirements of **919.01** and in accordance with the Department's Sampling and Testing Guide. The glass beads drop-on rate shall meet or exceed **716.03** and **919.01** as specified by the manufacturer.

Equipment

Use equipment meeting **716.03** for extruded or ribbon-dispensed thermoplastic material that will produce a consistent pattern of transverse raised bumps positioned at regular and predetermined intervals for raised profiled pavement marking audible system.

**Application**

Apply thermoplastic pavement marking material meeting **716.03** for extruded or ribbon-dispersed thermoplastic material, except as noted.

When applying the pavement marking material over existing markings, ensure that not more than 2 inches on either end and not more than 1 inch on either side of the existing line is visible.

Apply thermoplastic pavement marking flat base marking line and the thermoplastic pavement marking audible raised bumps as a system. The audible raised bumps shall have a profile with the leading and trailing edges being sloped at a sufficient angle to produce an audible and vibratory warning. The audible raised bumps shall meet the dimension and spacing requirements as noted. The audible raised bumps shall be placed in the center of the pavement marking flat base line.

For profiled thermoplastic pavement marking audible skip lines, apply four audible raised bumps per skip line uniformly.

**Dimensions of Raised Profiled System**

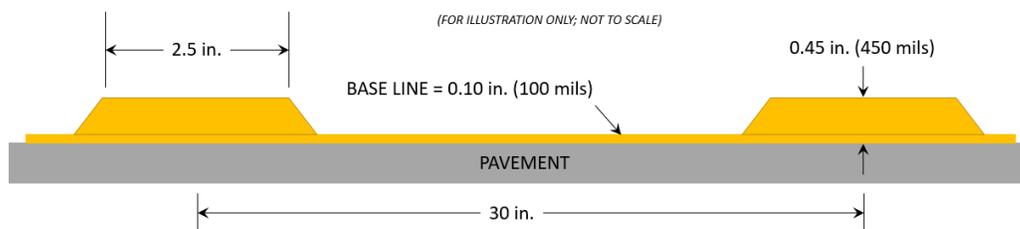
The dimensions of the raised profiled thermoplastic pavement marking audible system shall have a minimum thickness of 450 mils measured from the pavement surface.

The thermoplastic pavement marking material for the flat base shall have a minimum thickness of 100 mils and the thermoplastic pavement marking audible raised bumps shall have a minimum thickness of 350 mils measured from the flat base.

The thermoplastic audible raised bumps shall have a minimum dimension of 2.5 inches in both transverse and longitudinal directions. The audible raised bumps should be spaced approximately 30 inches center to center longitudinally along the pavement marking base line.

The height of the profiled shall be measured after application of the double drop glass beads.

**Detail: 716PTA-1 Raised Profiled Thermoplastic Pavement Marking Audible System**



**B. Inverted Profiled System**

**Materials**

Use thermoplastic pavement marking material meeting the requirements of **919.01**, except as specified, and in accordance with the Department’s Sampling and Testing Guide.

**1. Composition**

Thermoplastic pavement marking material composition shall meet the following requirements:

<b>Component</b>	<b>White</b>	<b>Yellow</b>
Binder, % minimum	19	19
TiO <sub>2</sub> Pigment, % minimum	10	N/A
Yellow Pigment % minimum	N/A	5
Intermix Glass Beads, % minimum	40	40
Calcium Carbonate/Fillers, % maximum	31 <sup>(1)</sup>	41 <sup>(1)</sup>

<sup>(1)</sup> The amount of Calcium Carbonate and inert fillers shall be as recommended by the manufacturer, provided all other specifications are met.

**2. Glass Beads**

Use retroreflective glass beads shall meet the requirements of **919.03** and in accordance with the Department’s Sampling and Testing Guide.

**3. Intermix Glass Beads**

Intermix glass beads shall make up a minimum of 40% by weight of the thermoplastic formulation. These beads shall meet all requirements of AASHTO M247 Type 1 and 3 with a minimum of 80% true spheres.

**4. Double Drop System**

The double drop system shall be capable of applying glass beads at the specified application as specified in **919.01.E**. The retroreflective element drop-on rate shall meet or exceed **716** as specified by the manufacturer.

Use Type 3 drop on beads that are dual coated for moisture resistance and adhesion that meet the requirements of AASHTO M247 Type 3, and the beads shall be with 80% true spheres.

Use Type 1 drop on glass beads that are dual coated for moisture resistance and adhesion that meet the requirements of AASHTO M247 Type 1, and the beads shall be with 80% true spheres.

### Equipment

Use equipment meeting **716.03** for extruded or ribbon-dispensed thermoplastic material, except as specified in Application, that will produce a consistent pattern for inverted profiled thermoplastic pavement marking audible system. The use of rollers to place grooves in the pavement marking material utilizing a separate vehicle or grooves that are not pressed within 1 second of thermoplastic pavement marking material application will not be allowed.

Use equipment based on manufacturer's recommendations.

### Application

Use equipment specially designed for placing hot thermoplastic pavement marking material in a hot molten state on the pavement surface utilizing a pressure type application method. An inverted profiled thermoplastic pavement marking die that can travel along in proximity with the road surface shall form the hot inverted profiled thermoplastic pavement markings. The die is pulled forward by a special linkage that will allow it to automatically level itself as to float and remain parallel with the road surface. The top of the die shall be enclosed and provide entry means for the hot molten thermoplastic to enter the die cavity. The bottom of the die shall contain a movable door that is remote controlled so as to start or stop the flow of thermoplastic on to the pavement surface. When the movable door is open, thermoplastic can flow through the die and will apply thermoplastic material that will be formed rearward of the advancing die. The road surface shall be at the bottom of the die enclosure. Thermoplastic material shall be fed to the die under pressure through flexible oil-jacketed stainless steel hoses. The die shall be formed from a single solid block of steel that is oil-jacketed on 4 sides to keep the die hot at all times.

The inverted profiled thermoplastic pavement marking system consists of a low-pressure drop-on type glass bead dispenser, moisture resistance bead coat. The glass beads shall be dispensed onto the hot thermoplastic material from a height of approximately 1 inch, above the road surface. The point at which the glass beads strike the surface of the pavement marking shall be approximately 3 inches, behind the strike point of the thermoplastic. The glass bead coat shall utilize Type 3 glass beads and shall provide a surface coating of 50% of the thermoplastic pavement marking surface, and at least 50% of the beads will be embedded to a depth of 60% of their diameter.

A second low-pressure drop-on glass bead dispenser capable of applying a continuous coating of glass beads shall follow approximately 10 inches behind the first bead dispenser. This second glass bead dispenser shall apply adhesion bead coat which will form a continuous drop-on coat of Type 1 glass beads immediately in front of the profile thermoplastic pavement marking die. The second coat of glass beads shall be applied with low impact so that they are not forced into the pavement marking under pressure.

The rotatable wheel for inverted profiled thermoplastic pavement marking die shall be located approximately 8 inches, behind the second bead dispenser. The inverted profiled pavement marking die shall be approximately 7 inches in diameter and shall have a plurality of spaced projections located around its circumference. The inverted profiled pavement marking die shall

be wider than the pavement marking material being applied to ensure adequate coverage. The projections on the inverted profiled pavement marking die shall have an angular profiling surface set at an angle to the pavement surface. The inverted profiled pavement marking die shall be mounted with an automatic leveling device to the same carriage assembly as the thermoplastic dispenser. To ensure that no hot thermoplastic material adheres to the die as it rotates and invert profiles the pavement marking, a small air atomized water jet shall apply a thin mist of water to the rotatable die. No water droplets greater than 1/4 inch in diameter shall be allowed to accumulate on the pavement surface in proximity to the freshly placed pavement marking.

All parts of the thermoplastic holding tank including manifolds, hoses, pipes, dies, etc., shall be oil-jacketed to insure accurate temperature control. The thermoplastic material shall be preheated in kettles designed specifically for that purpose. Each kettle of preheated thermoplastic material shall be properly mixed and heated to the correct application temperature. The preheated material shall then be fed to the thermoplastic gun for application.

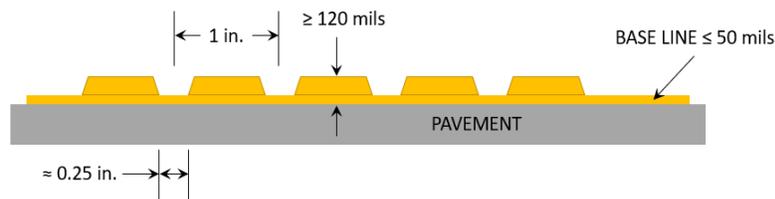
When placing inverted profiled thermoplastic pavement marking material on existing asphalt or concrete pavement that has more than one existing pavement marking material, the existing material shall be removed to the point that 80 percent of the pavement surface is visible.

**Dimensions of Inverted Profiled System**

The dimensions of the inverted profiled thermoplastic pavement marking audible system shall have a minimum thickness of 120 mils measured from the pavement surface. The thermoplastic pavement marking material in the bottom of the inverted profiles shall have a thickness of up to 50 mils.

The individual inverted profiles shall be located transversely across the entire pavement marking surface at intervals of approximately 1 inch. The bottoms of these intervals shall be between 3/32 inch and 5/16 inch wide. It is acceptable for the top surface of the inverted profiles to be slightly irregular.

**Detail: 716PTA-2 Inverted Profiled Thermoplastic Pavement Marking Audible System**



**Notification**

Notify the Engineer prior to the placement of profiled thermoplastic pavement marking. Furnish the Engineer with the manufacturer’s name and batch numbers of the thermoplastic materials and glass beads to be used. Ensure that the batch numbers appear on the thermoplastic materials and retroreflective elements packages.

**Protection of Pavement Markings**

Do not allow traffic onto or permit vehicles to cross newly applied pavement marking materials until they are sufficiently dry. Remove and replace any portion of the pavement markings damaged by passing traffic or from any other cause.

**Deficiencies**

As determined by the Engineer, remove, and replace any unsatisfactory raised or inverted profiled thermoplastic pavement markings. The removal and replacement of the unsatisfactory pavement marking material shall be at no additional cost to the Department.

**Method of Measurement**

The Department will measure by the linear mile, complete in place and accepted, raised, or inverted Profiled Thermoplastic Pavement Marking Audible in accordance with **716.08**.

**Basis of Payment**

The Department will pay for accepted quantities, complete in place, at the contract prices as follows:

Item No.	Description	Unit
716-14.01	PROFILED THERMO PVMT MRKNG AUDIBLE (4IN)	LINEAR MILE
716-14.02	PROFILED THERMO PVMT MRKNG AUDIBLE (6IN)	LINEAR MILE

Such payments will be full compensation for all work specified, including, all cleaning and preparing of surfaces, furnishing of all materials, application, curing and protection of all items, protection of traffic, furnishing of all tools, machines and equipment, and all incidentals necessary to complete the work. Final payment will be withheld until all deficiencies are corrected.