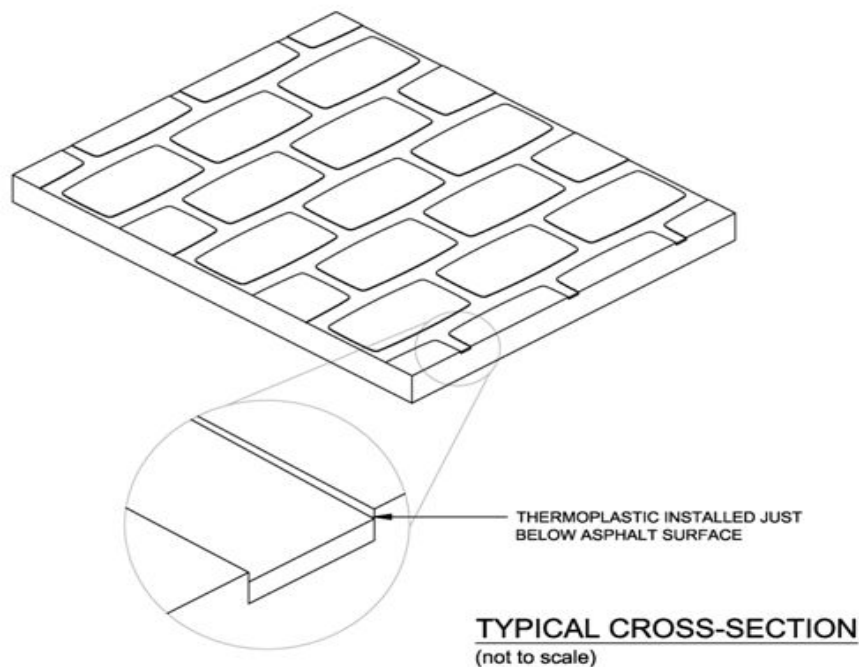


INLAID THERMOPLASTIC ASPHALT PAVEMENT MARKING SYSTEM SPECIFICATION

PART 1: GENERAL

1.1 DESCRIPTION

- A. An **Inlaid Thermoplastic Asphalt Pavement Marking System** is a highly suitable asphalt pavement marking system used for applications such as pedestrian cross-walks, bus stops, fire-lanes, store entrance-ways, intersections, malls and airports.
- B. **The system** is created by in-laying pre-cut thermoplastic panels into asphalt pavement by first pre-heating the pavement and then imprinting the heated asphalt pavement to create depressions to match the desired pattern. The thermoplastic is then installed within the depressions and melted into place to create the desired marking.
- C. The top of the installed thermoplastic must be installed slightly below the surface level of the surrounding asphalt pavement, thereby allowing the pavement to absorb the effects of the traffic as shown in the typical Cross-section shown below:



- D. It is important that the **Inlaid Thermoplastic Asphalt Pavement Marking System** chosen by the Owner has a published written specification and that there is a proven record of successful installations.
- E. The successful installation of this Work can only be completed by a qualified applicator that has proven experience working with **Inlaid Thermoplastic Asphalt Pavement Marking Systems**. Applicators with

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Accreditation by a qualified supplier are preferred. References must be provided.

- F. Only use asphalt pavement re-heat equipment that cycles the heat application and allows the equipment operator to check the pavement surface temperature during the heating process. The asphalt pavement re-heat equipment must have a proven track record of success in the application of an **Inlaid Thermoplastic Asphalt Pavement Marking System**.
- G. The thermoplastic used must be suitable for the intended purpose. Only use thermoplastic from a supplier who has a proven thermoplastic product in the application of an **Inlaid Thermoplastic Asphalt Pavement Marking System**. Reference sites will be required.
- H. The thermoplastic must be pre-cut by a die or other pattern cutting machine into thermoplastic panels in the desired pattern. This is to ensure quality is controlled and reduce the number of joints. Cutting thermoplastic strips on site to fit the pattern must not be used as the primary method to fit the thermoplastic to the pattern.
- I. The stamping templates are to be designed and constructed in the same shape and size as the pre-cut thermoplastic panels and must be created in a machine shop using CNC or equal equipment to ensure quality and consistency of the shape and size of these templates.
- J. The thermoplastic must be available either with impregnated glass beads (to provide retro-reflectivity) or without glass beads.

1.2 REFERENCES

- A. **ASTM D570** Standard Test Method for water absorption of plastics.
- B. **ASTM D36** ASTM D36-06 Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus).
- C. **AASHTO T250** Binder Content
- D. **ASTM D792** Standard Test method for density and specific gravity (relative density) and density of solid plastics.
- E. **AASHTO T250** Low Temperature Stress resistance
- F. **ASTM D 2240** Standard Test Method for Rubber property – Durometer hardness.
- G. **ASTM D256, Method A** Standard Test Method for determining the IZOD pendulum impact resistance of plastics.
- H. **ASTM D92** Test Method for Flash points.

1.3 DEFINITIONS

- A. **“Accredited Applicator”** is an applicator that is accredited and licensed for the current calendar year to install an **Inlaid Thermoplastic Asphalt Pavement Marking System**.

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- B. “**Owner**” means the Owner and refers to the representative person who has decision making authority for the implementation of the **Inlaid Thermoplastic Asphalt Pavement Marking System**.
- C. “**The Work**” is as outlined in the Scope of Work and includes the execution of the **Inlaid Thermoplastic HMA Pavement Marking System**.
- D. “**ASTM**” is American Society for Testing and Materials.

1.4 REQUIRED BID SUBMITTAL DOCUMENTS

The documents required as part of this bid submission are as follows:

- A. Name of the supplier of the thermoplastic material.
- B. Product Data Sheet for thermoplastic.
- C. Thermoplastic color sample(s).
- D. Typical cut sheets of the proposed pre-cut thermoplastic panels.
- E. A list of all equipment to be used in the execution of this Work including re-heat equipment, templates, compactors and finishing tools.
- F. At least 3 reference locations where the proposed **Inlaid Thermoplastic HMA Pavement Marking System** has been in use for 3 years or longer.
- G. A copy of the current year certificate of accreditation for the applicator that is to perform the Work. Failing that, at least 3 reference sites and written references from 3 previous customers for work performed by this applicator.

PART 2: PRODUCTS

2.1 MATERIALS

The thermoplastic shall be provided as pre-cut panels in sizes to conform to the specified pattern, widths and shapes. Cutting thermoplastic strips on site to fit the pattern must not be used as the primary method to fit the thermoplastic to the pattern. The thermoplastic shall be packaged in accordance with accepted commercial standards and must be protected before and during installation.

2.1.1 Typical properties of the thermoplastic

- A. The thermoplastic consists of homogeneously mixed pigments, fillers, resins, fibers, and, for applications requiring retro-reflectivity, glass beads. The pigments and fillers shall be uniformly dispersed in resin. The material shall be free from dirt and foreign objects.
- B. The thermoplastic shall be supplied preformed or precut at a standard thickness of 90 mils (+/- 10%).
- C. The thermoplastic can be provided either as non-reflective or as a retro-reflective pavement marking material through the use of glass beads homogeneously mixed in the thermoplastic.
- D. Upon heating to application temperature, the thermoplastic will flow and preserve the integrity of its properties including its color.

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- E. Environmental and Chemical Resistance:** The thermoplastic is resistant to deterioration when exposed to sunlight, gasoline, oil, salt, water or adverse weather conditions.
- F. Storage Life:** The thermoplastic can be stored for a period of two years if stored indoors in a cool, dry area at room temperature (21°C +/-3°C) (70°F +/-5°F).
- G. The thermoplastic is suitable for application on high quality, stable asphalt pavement both new and old.** Under normal conditions, bond strength on asphalt pavement surfaces shall be sufficient for the material to remain in place for a number of years.

2.1.2 Product Data: Typical properties of a suitable thermoplastic:

Property	Test Method	Typical Results of thermoplastic
Water Absorption	ASTM D570	0.27%
Binder Content	AASHTO T250	20.01% with d.o. beads
Softening point	ASTM D36	240°F
Low Temp. Resistance @ 15°F	AASHTO T250	No visual cracks
Specific Gravity	ASTM D792	2.00
Indentation resistance @ 110°F for 15 sec.	ASTM D 2240 (after flaming)	43 (Shore A)
Impact Resistance	ASTM D256, Mtd A	4.9+ N-m
Flash Point	ASTM D92	500°F

2.2 EQUIPMENT

The following equipment is recommended in the execution of this Work:

- A. Stamping templates** are used to provide the primary imprinting of the specified pattern into the asphalt pavement. Templates are thicker than the thermoplastic to enable the applicator to ensure the top of the inlaid thermoplastic is slightly lower than the surrounding asphalt pavement surface. Templates are to be designed and constructed in the same shape and size as the pre-cut thermoplastic panels and must be created in a machine shop using CNC or equal equipment to ensure quality and consistency of the shape and size of these templates.
- B. The primary asphalt pavement re-heat equipment** must cycle the heat application and must allow the equipment operator to check the pavement surface temperature during the heating process. These controls are necessary to enable the pavement temperature to be elevated gradually,

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giving the operator the ability to ensure that the pavement is not overheated or adversely affected. Heaters without these controls are strictly prohibited as the primary re-heat equipment.

- C. Asphalt pavement re-heat equipment must have a proven track record of success for the application of an **Inlaid Thermoplastic Asphalt Pavement Marking System**.
- D. Hand-held portable heating devices may be used only for areas where it is difficult to operate the re-heat machine. These may not be used as the primary pavement re-heating device.
- E. **Finishing tools** that are designed to enable the applicator to complete the imprinting of the asphalt pavement in areas which may be inaccessible to the template such as curbs and manhole covers are permitted.
- F. **Vibratory Plate Compactors** shall be used for pressing the stamping templates into the heated asphalt pavement to create the specified pattern.

PART 3: EXECUTION

3.1 GENERAL

The **Inlaid Thermoplastic Asphalt Pavement Marking System** shall be supplied and installed in accordance with the plans and specifications and only by an **Applicator** who is accredited or has proven ability in this type of Work. In any circumstance, do not begin installation without confirmation of Applicator accreditation or ability.

3.2 PRE-CONDITIONS

3.2.1 New Asphalt pavement

- A. The asphalt pavement must be stable, well compacted and generally in excellent condition for the application of the **Inlaid Thermoplastic Asphalt Pavement Marking System** to be successful. This is a pre-requisite for all long-lasting asphalt pavement surfaces, especially those that will experience vehicle traffic. The application of an **Inlaid Thermoplastic Asphalt Pavement Marking System** does not change this requirement.
- B. Generally, the asphalt pavement mix design for roadways as prescribed by the local jurisdiction will be sufficient for the application of this Work.
- C. If the pavement is not stable and well compacted, the pavement will likely wear prematurely, especially in a vehicle traffic environment and the in-laid thermoplastic will wear with it.

3.2.2 Existing pavement

Depending upon the condition and age, existing asphalt pavement may or may not be suitable for the successful application of **DuraTherm**.

- A. Generally, pavement over 3 years of age will likely be unsuitable.

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- B.** The pavement must be in excellent condition, free of defects such as pot-holes, cracks, rutting and raveling.
- C.** The Owner shall make the final determination as to the suitability of the existing asphalt pavement.

3.2.3 Mill & Fill: recommended guidelines.

Mill and filling is a common practice to replace worn asphalt pavement. It is particularly important to do this in a correct manner in preparation for the installation of an **Inlaid Thermoplastic Asphalt Pavement Marking System**.

- A.** A tack coat must be applied to ensure proper adhesion of the new asphalt material to the old pavement substrate.
- B.** A durable, stable mix design is a pre-requisite for all Mill & Fill applications - especially those that will experience vehicle traffic. The application of the **Inlaid Thermoplastic Asphalt Pavement Marking System** process does not change this requirement.
- C.** A minimum lift thickness of two inches is recommended. Due to the thin lift thickness placed over a cool substrate, it is especially critical to ensure that the asphalt concrete is compacted when it is hot.
- D.** It is generally recommended to not proceed with a Mill & Fill pavement application when the outside air temperature is less than 50°F (10°C).

3.2.4 Pavement Marking Removal.

Because the aesthetics of the final product depends largely upon the condition of the asphalt pavement, use of pavement marking removal methods is likely to produce a pavement surface that is unsatisfactory for the installation of **Inlaid Thermoplastic Asphalt Pavement Marking System**. A test area may be used to check if adequate or not. The Owner shall determine if the removal of the markings is satisfactory for the application of this Work. The Work shall not proceed until this approval is granted.

3.2.5 Surface Preparation.

The asphalt pavement surface shall be dry and free from all foreign matter, including but not limited to dirt, dust, de-icing materials, and chemical residue.

3.3 LAYOUT

Layout of the pattern for imprinting into the surface of the asphalt pavement shall be as per the drawings and specifications in conjunction with the **Owner**.

3.4 HEATING THE ASPHALT PAVEMENT

Primary heating of the asphalt pavement surface is accomplished using the equipment as outlined in Section 2.2 above.

- A. Pavement temperature.** The optimal pavement temperature for imprinting the template is dependent upon mix design, modifiers used in

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the mix, and the age of the pavement. Typically, the surface temperature of the pavement should not exceed 325°F as determined by an infra-red thermometer.

- B.** In order to achieve the proper depth of imprint it is important to elevate the asphalt pavement temperature to a minimum depth of 1/2 inch (12.5mm) without burning the pavement surface.

3.5 SURFACE IMPRINTING

- A.** Once the asphalt pavement has reached imprinting temperature, the templates shall be placed and held in position then pressed into the surface using vibratory plate compactors. Once the top of the template is level with the surrounding asphalt pavement, the template can be removed.
- B.** Areas that have an imprint depth less than the depth of the template shall be re-heated and re-stamped prior to installing the thermoplastic.
- C.** In areas difficult to get at with the template, or areas that have light print, the hand held finishing tool may be used to complete the imprint process.

3.6 INSTALLING THE THERMOPLASTIC

- A.** The asphalt pavement surface shall be dry and free from all foreign matter, including but not limited to dirt, dust, de-icing materials, and chemical residue. Cleaning of the asphalt pavement must be re-done to remove any loose materials that may appear after the imprinting process is completed.
- B.** The pre-cut thermoplastic shall be installed within the imprinted depressions, ensuring the appropriate overlap at the thermoplastic joints.
- C.** Heat shall be re-applied to the surface using the approved re-heat equipment.
- D.** The temperature shall be monitored to ensure the thermoplastic is not over-heated. The thermoplastic must be heated to its full depth in order for the thermoplastic material to melt and create a bond with the underlying asphalt pavement.
- E.** The joints between the thermoplastic pieces are to be melted together creating a seamless installation.
- F.** Once the thermoplastic has been liquefied to its full depth, the heat source shall be removed and the surface allowed to cool.
- G.** For low temperature applications, extra care must be taken to ensure the thermoplastic is thoroughly heated to assure a bond between it and the underlying asphalt pavement. It is generally recommended to not proceed with this Work process when the outside air temperature is below 40°F (5°C).
- H.** Do not install during periods of precipitation.

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3.7 PROTECTION AND OPENING TO TRAFFIC

- A. The melted thermoplastic is to be protected until it cools and hardens. Do not permit any debris such as dust, water, pollen etc to come in contact with the melted thermoplastic.
- B. Generally, the road may be opened to traffic once the thermoplastic has cooled to 140°F (60°C). Refer to supplier instructions.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

The measured area is the actual area of asphalt pavement that has received the **Inlaid Thermoplastic Asphalt Pavement Marking System**, measured in place. No deduction will be made for the area(s) occupied by manholes, inlets, drainage structures, bollards or by any public utility appurtenances within the area.

4.2 PAYMENT

Payment will be full compensation for all work completed as per conditions set out in the contract. For unit price contracts, the payment shall be calculated using the measured area as determined above.