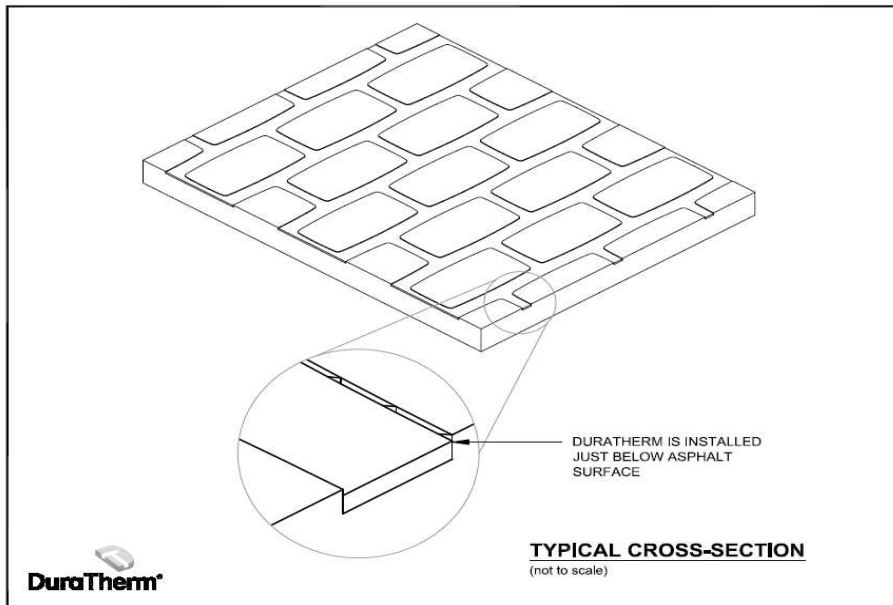


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PART 1: GENERAL

1.1 DESCRIPTION

- A. **DuraTherm®** is a proprietary decorative HMA pavement marking system that uses specialized pre-formed thermoplastic inlaid into HMA pavement to create virtually any desired pavement marking.
- B. **DuraTherm®** is a highly suitable HMA pavement marking system for high traffic areas such as pedestrian cross-walks, bus stops, fire-lanes, store entrance-ways, intersections, malls and airports.
- C. **DuraTherm®** thermoplastic is embedded into HMA pavement by using proprietary infrared heating equipment designed specifically to elevate the temperature of the pavement without adversely affecting it and then imprinting into the heated HMA pavement a specialized plastic template to create depressions to match the desired pattern. The **DuraTherm®** thermoplastic, pre-cut to match the pattern, is then installed within the depressions and melted in place.
- D. As shown in the typical Cross-section shown below, the top of the **DuraTherm®** thermoplastic is installed slightly below the surface level of the surrounding HMA pavement thereby allowing the pavement to absorb the effects of the traffic:



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E. DuraTherm® is a pavement marking system designed so that the HMA pavement surrounding the **DuraTherm®** thermoplastic absorbs the physical effects of the traffic. When installed in accordance with recommended installation guidelines by an **Accredited DuraTherm® Applicator**, the installed **DuraTherm®** thermoplastic will wear at a similar rate as the surrounding HMA pavement. Therefore the life of the **DuraTherm®** pavement marking system is dependent upon using a long lasting, durable and stable HMA pavement that will not wear prematurely.

F. DuraTherm® thermoplastic is available in a variety of standard patterns and colors which can be viewed at www.integratedpaving.com. Custom patterns and decorative designs are also available. Please contact Integrated Paving Concepts (Tel. 800-688-5652) for further information.

G. DuraTherm® thermoplastic is available either with impregnated glass beads (to provide retro-reflectivity) or without glass beads.

H. DuraTherm® is a registered Trade-mark product.

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.
- I. California Skid test method 342** completed by Skidtest Enterprises, Inc. report date September 19, 2005.

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1.3 DEFINITIONS

- A. “HMA Pavement”** is Hot Mix Asphalt pavement.
- B. “Accredited DuraTherm® Applicator”** is an applicator that is accredited and licensed for the current calendar year by Integrated Paving Concepts Inc. (Tel. 800-688-5652) to install **DuraTherm®**.
- C. “Imprinting HMA pavement”** is defined as pressing a flexible plastic template into re-heated, fully compacted HMA pavement to produce a depression for the installation of the **DuraTherm®** thermoplastic.

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- D. “**Owner**” means the Owner and refers to the representative person who has decision making authority for the implementation of the **DuraTherm®** system.
- E. “**The Work**” is as outlined in the Scope of Work and includes the execution of the **DuraTherm®** process.
- F. “**ASTM**” American Society for Testing and Materials.
- G. “**AASHTO**” American Association of State Highway and Transportation Officials.

1.4 REQUIRED BID SUBMITTAL DOCUMENTS

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

- A. Product Data Sheet for **DuraTherm®** thermoplastic.
- B. **DuraTherm®** thermoplastic samples.
- C. A copy of the current year certificate of accreditation as provided by Integrated Paving Concepts, Inc. to the **Accredited DuraTherm® applicator** or written verification from Integrated Paving Concepts that the bid applicator is qualified to perform this Work.

PART 2: PRODUCTS

2.1 MATERIALS

DuraTherm® thermoplastic shall be provided as pre-cut panels in sizes to conform to the specified pattern, widths and shapes. **DuraTherm®** thermoplastic shall be packaged in accordance with accepted commercial standards and if stored, placed indoors in a cool dry area.

2.1.1 Characteristics of **DuraTherm®** thermoplastic.

- A. **DuraTherm®** thermoplastic consists of homogeneously mixed non-hazardous polymer resins, pigments, fillers consisting of TiO_2 and $CaCO_3$, fibers, and, for applications requiring retro-reflectivity, glass beads. No solvents or volatiles are used in the formulation.
- B. **DuraTherm®** thermoplastic shall be supplied preformed or precut at a standard thickness of 90 mils (2.30 mm).
- C. **DuraTherm®** 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 **DuraTherm®** thermoplastic will flow and preserve the integrity of its properties including its color.
- E. Environmental and Chemical Resistance: **DuraTherm®** thermoplastic is resistant to deterioration when exposed to sunlight, gasoline, oil, salt, water or adverse weather conditions.
- F. Professional independent testing using California Skid Test Method 342 concluded that there is no reduction in the skid factor where the **DuraTherm®**

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thermoplastic is inlaid into the HMA pavement. Refer to References Section. This report is available from Integrated Paving Concepts Inc. upon request.

- G. Storage Life:** **DuraTherm®** thermoplastic can be stored for a period of two years if stored indoors at room temperature (21°C +/-3°C) (70°F +/-5°F).
- H. DuraTherm®** thermoplastic is suitable for application on high quality, stable HMA pavement both new and old. Under normal conditions, bond strength on HMA pavement surfaces shall be sufficient for the material to remain in place for a number of years.

2.1.2 Product Data Sheet (tests under Florida DOT Specification 971-5-2006 and 523 for Thermoplastic Materials for Traffic Striping.)

Characteristic	Test Method	Typical Results of DuraTherm® 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

A copy of the product data sheet is available from Integrated Paving Concepts Inc. upon request.

2.2 EQUIPMENT

The following equipment is proprietary and is an integral part of the proper execution of the **DuraTherm®** process. This equipment is available only from Integrated Paving Concepts Inc. and can only be used by **Accredited DuraTherm® applicators** or an applicator authorized by Integrated Paving Concepts Inc.

- A. Plastic Templates** are used for imprinting the specified pattern into the HMA pavement. Templates are thicker than the **DuraTherm®** thermoplastic to enable the applicator to ensure the top of the inlaid thermoplastic is slightly lower than the surrounding HMA pavement surface. Templates shall be supplied by Integrated Paving Concepts Inc.

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- B. Re-Heat Equipment.** Integrated Paving Concepts offers three mobile, proprietary pieces of equipment designed specifically to elevate the temperature of the HMA pavement without adversely affecting it. Two of these, the **SR-120 and SR-60 Reciprocating Infra-Red Heaters (SR-120, SR-60)** each employ a bank of propane-fired heaters mounted on a track device such that these can reciprocate back and forth over a designated area thereby allowing the operator to monitor the temperature of the HMA pavement and the thermoplastic at all times during the pavement re-heating process.
- C.** The third mobile re-heat device is the **SR-20 Infrared Heater (SR-20)**. The **SR-20** is designed specifically to heat areas such as borders and narrow areas that are inaccessible to the **SR-120 and SR-60** heaters. Similar to the **SR-120 and SR-60**, the **SR-20** allows the operator to monitor the temperature of the HMA pavement and the thermoplastic at all times during the heating process.
- D.** The **StreetHeat Portable Jet Heater** is a hand-held portable heating device to be used to heat isolated areas of the HMA pavement or **DuraTherm®** thermoplastic.
- E.** The **DuraTherm® Hand Held finishing tool (DT-HHFT)** enables the applicator to complete the imprinting of the HMA pavement in areas around permanent structures such as curbs and manholes covers which may be inaccessible to the template.
- F.** Vibratory Plate Compactors shall be used for pressing the plastic templates into the heated asphalt to create the specified pattern. Please note that Integrated Paving Concepts does not supply Vibratory Plate Compactors.

PART 3: EXECUTION

3.1 GENERAL

DuraTherm® shall be supplied and installed only by an **Accredited DuraTherm® Applicator** or an applicator authorized by Integrated Paving Concepts Inc. in accordance with the plans and specifications or as directed by the Owner. In any circumstance, do not begin installation without confirmation of Applicator accreditation or authorization.

3.2 PRE-CONDITIONS – HMA PAVEMENT

DuraTherm® is a pavement marking system designed so that the HMA pavement surrounding the **DuraTherm®** thermoplastic absorbs the physical effects of the traffic. When installed in accordance with recommended installation guidelines by an **Accredited DuraTherm® Applicator**, the installed **DuraTherm®** thermoplastic will wear at a similar rate as the surrounding HMA pavement. Therefore the life of the **DuraTherm®** pavement marking system is

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dependent upon using a long lasting, durable and stable HMA pavement that will not wear prematurely.

This Section 3.2 is to be used as a guide towards achieving a high quality HMA pavement. It does not supersede other specifications pertaining to this Work, nor does it replace recommendations made by the engineer of record for this Work.

3.2.1 Pre-requisites for new HMA pavement:

- stable sub-grade or base over which the HMA pavement is laid.
- proper mix design for the traffic loads.
- proper placement and compaction practices.

3.2.1.1 Sub-grade: The sub-grade must be stable and should be inspected to identify any areas of soft or yielding soil that are too weak to properly support the paving equipment. These soft spots must be over-excavated and re-compacted to meet the engineer's requirements. Prior to paving, the sub-grade and base courses must be thoroughly and uniformly compacted, properly graded and constructed in accordance with the engineer's specifications. Please refer to the related sections for more exact requirements of this work.

3.2.1.2 Guidelines for HMA pavement mix design.

A durable, stable mix design is a pre-requisite for all long-lasting HMA pavement surfaces, especially those that will experience vehicle traffic. The application of **DuraTherm®** does not change this requirement. **Generally, the HMA pavement mix design for roadways as prescribed by the local jurisdiction will be sufficient for the application of DuraTherm®.** Failure to use a stable mix design may lead to premature failure of the HMA pavement such as raveling, rutting or segregation. The appropriate pavement structure is not within the scope of this specification; however, this specification can offer some general guidelines as follows:

- A. Stability** is a good general guide: generally, if the surface course design has a minimum Marshall Stability of 10 KN (about 2250 lbs) and design densities are achieved during compaction, the pavement should perform adequately.
- B.** The nominal aggregate size for the HMA pavement should not be less than 3/8" or greater than 5/8".
- C.** If a more stable mix design than is offered by the locally prescribed surface course is required, contact the HMA producer, the engineer of record or Integrated Paving Concepts Inc. for suggestions as to how to increase stability.

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3.2.1.3 Placement of New HMA Pavement

- A. Successful placement of HMA pavement includes compaction of the mix when it is hot and compaction of the mix to the minimum densities required for the specified air voids. Generally, the first pass of the rollers is to be done when the asphalt mixture is at minimum 230°F (110°C); the compaction process must be **completed** before the **in-place** temperature of the mixture cools to 185°F (85°C) or higher depending on the type of asphalt and/or modifiers used. For applications that will experience vehicle traffic and wherever it is possible, compaction is to be completed using a paving machine and a self-propelled roller.
- B. **Handwork**, which includes placing and spreading by hand and the use of hand operated compaction equipment, should be restricted to areas that cannot be accessed by the paving machine or the self propelled rollers. Compaction must be completed when the pavement is hot as described above. Handwork is to be done carefully and the material distributed uniformly so there will be no segregation.
- C. The pavement must be smooth, without seams and graded to achieve proper drainage.

3.2.2 Pre-requisites for existing pavement

Depending upon the condition and age, existing HMA pavement may or may not be suitable for the successful application of **DuraTherm**®. The **Accredited DuraTherm**® **Applicator** can advise whether the HMA pavement is suitable or not.

3.2.3 Recommended guidelines for Mill & Fill applications.

A tack coat must be applied to ensure proper adhesion of the new HMA material to the old pavement substrate. 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 **DuraTherm**® process does not change this requirement. A minimum lift thickness of two inches is recommended. Due to the thin lift thickness, it is especially critical to ensure that the HMA concrete is compacted when it is hot. 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 HMA pavement, use of pavement marking removal methods is likely to produce a pavement surface that is unsatisfactory for the installation of **DuraTherm**®. 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 **DuraTherm**®. Work shall not proceed until this approval is granted.

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3.2.5 Surface Preparation.

The HMA 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 HMA pavement shall be as per the drawings and specifications and in accordance to the methods prescribed by the **DuraTherm**® applicator in conjunction with the **Owner**.

3.4 HEATING THE HMA PAVEMENT

The Applicator shall follow the latest Recommended Application Procedure Guidelines as provided by Integrated Paving Concepts Inc. Primary heating of the pavement surface is accomplished with the **SR-120** or **SR-60** reciprocating infrared heaters.

- A. Pavement temperature.** The optimal pavement temperature for imprinting the template is dependent upon mix design, modifiers used in 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 HMA pavement temperature to a minimum depth of 1/2 inch (12.5mm) without burning the pavement surface.

3.5 SURFACE IMPRINTING

Once the HMA 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 HMA pavement, the template can be removed. Areas that have an imprint depth less than the depth of the template shall be re-heated and re-stamped prior to installing the **DuraTherm**® thermoplastic.

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 DURATHERM THERMOPLASTIC

- A.** The HMA pavement surface shall be dry and free from all foreign matter, including but not limited to dirt, dust, de-icing materials, and chemical residue.
- B.** The pre-cut **DuraTherm**® thermoplastic panels shall be installed within the imprinted depressions, ensuring the appropriate overlap at the thermoplastic joints.
- C.** Heat shall be re-applied to the HMA pavement surface using the **SR-60** or **SR-120**, slowly raising the surface temperature until the thermoplastic panels

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start to liquefy and flow. The **SR-20** and/or the **Portable jet heater** may also be used to raise the surface temperature, typically in areas that are difficult to heat using the **SR-60** or **SR-120**. The temperature shall be monitored to ensure the thermoplastic is not over-heated. The thermoplastic panel must be heated to its full depth in order for the thermoplastic material to melt and create a bond with the underlying HMA pavement.

- D. The joints between the thermoplastic pieces are to be melted together creating a seamless installation.
- E. Once the thermoplastic panel has been liquefied to its full depth, the heat source shall be removed and the surface allowed to cool.
- F. For applications when the outside air temperature is low, care must be taken to ensure the thermoplastic is thoroughly heated to assure a bond between it and the underlying HMA pavement. It is generally recommended to not proceed with the **DuraTherm**® process when the outside air temperature is below 40°F (5° C).
- G. Do not install during periods of precipitation.
- H. Do not install when there is frost in the designated area.

3.7 PROTECTION AND OPENING TO TRAFFIC

- A. The melted **DuraTherm**® 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. The road may be opened to traffic once the thermoplastic has cooled to 140°F (60° C).

PART 4 – MEASUREMENT AND PAYMENT

4.1 Measurement

The measured area is the actual area of HMA pavement that has received the **DuraTherm**® thermoplastic 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.