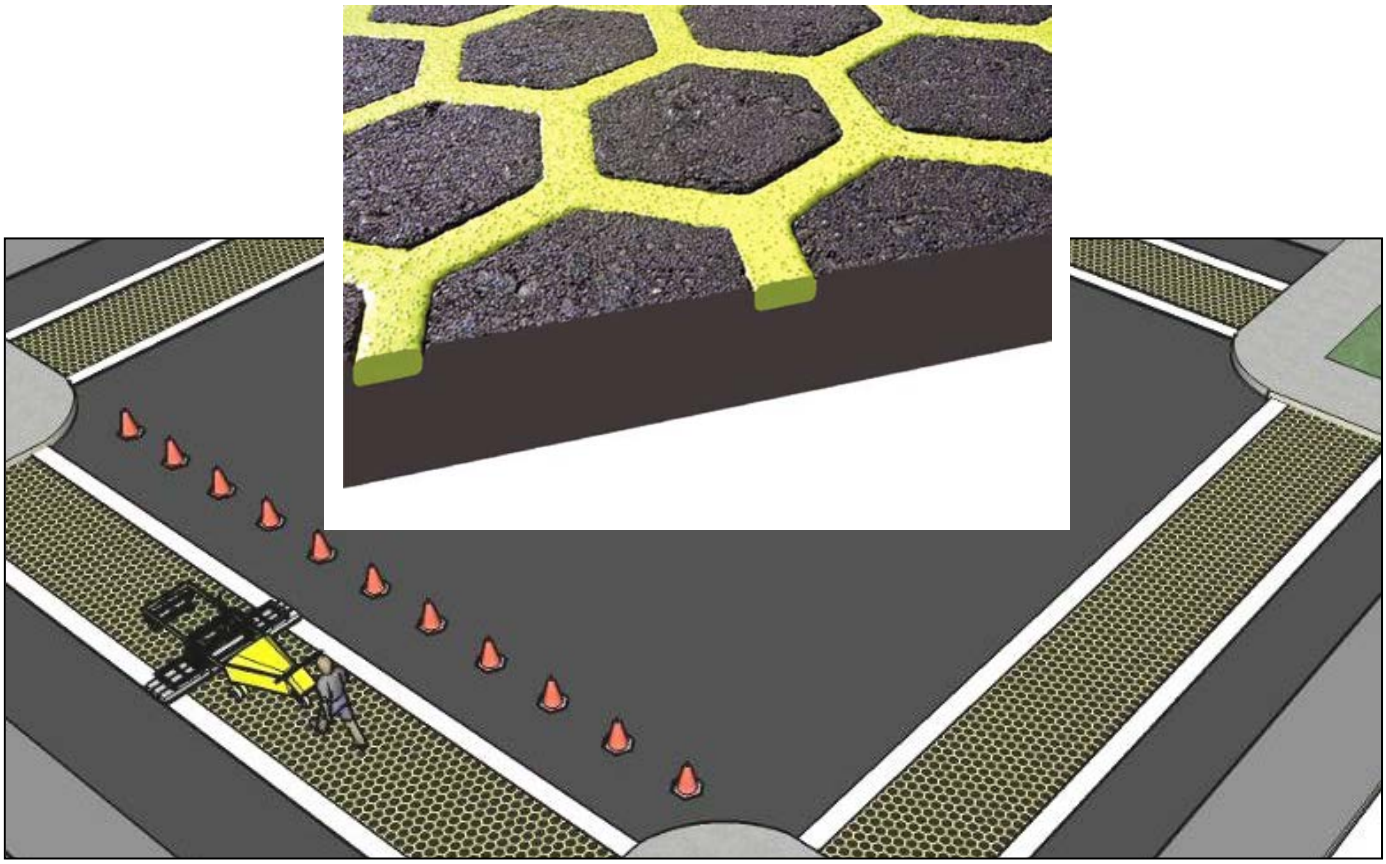
DuraTherm®
A TrafficScapes™ Solution by Ennis-Flint

SUBSTRATE GUIDE



This guide is intended to assist in evaluating existing asphalt pavements for DuraTherm® installation and to provide important tips on successful removal and replacement best practices.

May 2013

Inlaid preformed thermoplastic is a pavement marking system designed so that the asphalt pavement surrounding the marking absorbs the physical effects of the traffic. When applied in accordance with recommended application guidelines by an Accredited Applicator, the inlaid preformed thermoplastic will wear at a similar rate as the surrounding asphalt pavement. Therefore, the life of the inlaid preformed thermoplastic pavement marking system is dependent upon using a long lasting, durable and stable asphalt pavement that will not wear prematurely.

The following information is to be used as a guide towards achieving a high quality asphalt 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.

Prerequisites for new asphalt pavement:
- Stable sub-grade or base over which the asphalt pavement is laid.
- Proper mix design for the traffic loads.
- Proper placement and compaction practices.

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.

Guidelines for asphalt pavement mix design:
A durable, stable mix design is a prerequisite for all long-lasting asphalt pavement surfaces, especially those that will experience vehicle traffic. The application of inlaid preformed thermoplastic does not change this requirement. **Generally, the asphalt pavement mix design for roadways as prescribed by the local jurisdiction will be sufficient for the application of inlaid preformed thermoplastic**. Failure to use a stable mix design may lead to premature failure of the asphalt 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 asphalt pavement should not be less than 3/8 in. (9.5mm) or greater than 5/8 in.(1.6cm).
C. If a more stable mix design than is offered by the locally prescribed surface course is required, contact the asphalt producer or the Engineer of Record for suggestions as to how to increase stability.

Placement of New Asphalt Pavement

A. Successful placement of asphalt pavement includes compaction of the mix when it is hot and 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 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.

Prerequisites for existing pavement
Depending upon the condition and age, existing asphalt pavement may or may not be suitable for the successful application of inlaid preformed thermoplastic. The Accredited Applicator can advise whether the asphalt pavement is suitable or not.

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 preformed thermoplastic**. 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 the preformed thermoplastic. Work shall not proceed until this approval is granted.

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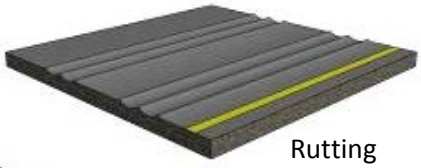
Evaluating Existing Substrate

The key to successful DuraTherm® application is a high-quality asphalt substrate. In many cases, existing pavements are suitable dependent on pavement defects and surface contamination.

PAVEMENT DEFECTS

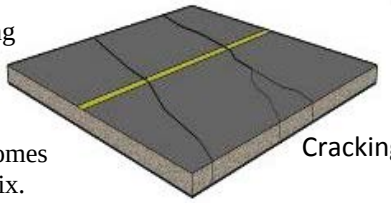
The best way to evaluate if pavement is suitable for DuraTherm® is by condition. If a pavement is not suitable it will show signs of visible degradation due to age or poor construction. Pavement over 5 years should not be considered for DuraTherm.

Do <u>not</u> apply DuraTherm® on pavements showing the following visible defects:



Rutting

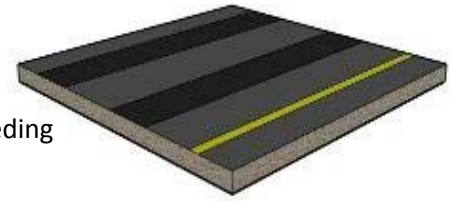
Rutting – a depression of the pavement in the wheel path.
It is a structural failure due to excessive loading of that pavement.



Cracking

Cracking – shrinkage of subgrade or asphalt, or excessive bending of the pavement surface under load.

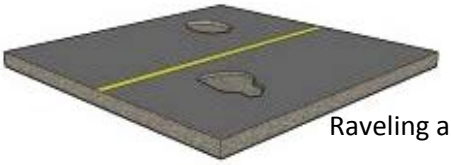
Bleeding/Flushing – through the action of vehicle tires, heat and migration of excessive asphalt to the surface. Surface texture becomes filled with liquid AC. May indicate an over asphalted, unstable mix.



Bleeding

Raveling – loss of aggregate from the surface as a result of an "abrading" action of vehicle tires. It will appear as a rough texture on the pavement surface as aggregate pops out.

Potholes – severe pavement fatigue cracking, which results in a total loss of asphalt in a localized area creating a hole in the road.



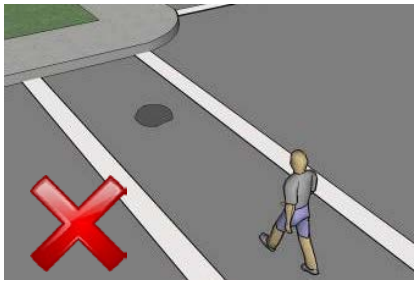
Raveling and Potholes

The examples above are the most common types of defects that would result in existing pavement to be deemed unsuitable. There may be other issues not list. ***Always inspect every site in advance****.*

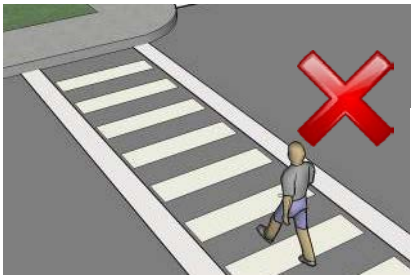
SURFACE CONTAMINATION

For DuraTherm® to have a pleasing appearance and adhere well to the pavement, it must be substantially free from surface contamination such as excessive oils spills or mid to heavy coverage of existing pavement markings.

Minor amounts of oil droplets (up to 10 small spots less than 2 inches in diameter per 300 sq. ft.) are acceptable and should evaporate during the heating process. If small spots are more frequent, power washing should be done prior to application.



If larger areas are contaminated by oil, then they must be removed by power washing. If the oil is soaked in and cannot be washed away, then the pavement must be removed and replaced.



If existing pavement markings such as linear stripes are present, it is mostlikely that the pavement will have to be removed and replaced. These heavy markings cannot be removed from the surface without leaving unsightly marks (ghost lines). One may consider applying DuraTherm over very faint markings.

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Removal and Replacement – Best Practices

When existing pavements are deemed not suitable for DuraTherm they must be removed with a milling machine and replaced with new pavement: the "mill and fill" process.

Single Crosswalks

The milled out area is often too small to use a paving machine and must be paved with a shovel and asphalt rake ("hand work"). There are certain challenges in achieving quality hand work:

• **Asphalt Mix Design:** The asphalt mix must be of suitable design for the traffic load, but also have the workability required for hand work. Mixes with a nominal (largest) aggregate size greater than 1/2 inch should not be used, as they will segregate when placed by hand. It is best to check with local consulting engineers if you are not sure of the mix to use in your area.

• **Asphalt Production**: Do not heat the asphalt above 325° F at the plant in an effort to provide hotter mix for hand work. It may burn the asphalt cement, resulting in raveling.

• **Asphalt Mix Transport**: Because hand work is slower, the mix may sit in the truck much longer, resulting in it cooling. Any mix in the truck that cools below 250°F should be discarded. Always tarp the load and keep tarp over it throughout the process.

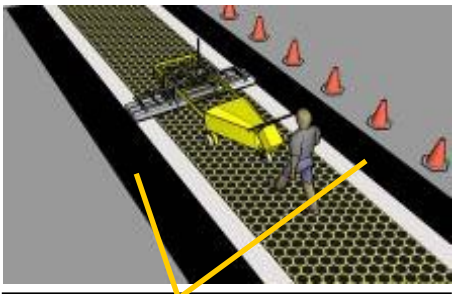
• **Mill and Fill**: Depth must be 2 in. minimum: Lack of compaction and pavement failure will result when less than 2 in. of asphalt is used. Asphalt will cool quicker if less material is placed and will not allow enough time for compaction. The deeper depth holds heat, even during hot weather. Width must be two feet wider than the DuraTherm crosswalk.

• **Segregation:** Larger stone becomes separated from smaller aggregates, resulting in a concentration of large aggregate or sand in one area of the mat that can lead to raveling. This segregation most commonly occurs during the raking process by:
- overworking the asphalt (raking too much)
- casting rocks brought to the surface back onto the mat prior to rolling

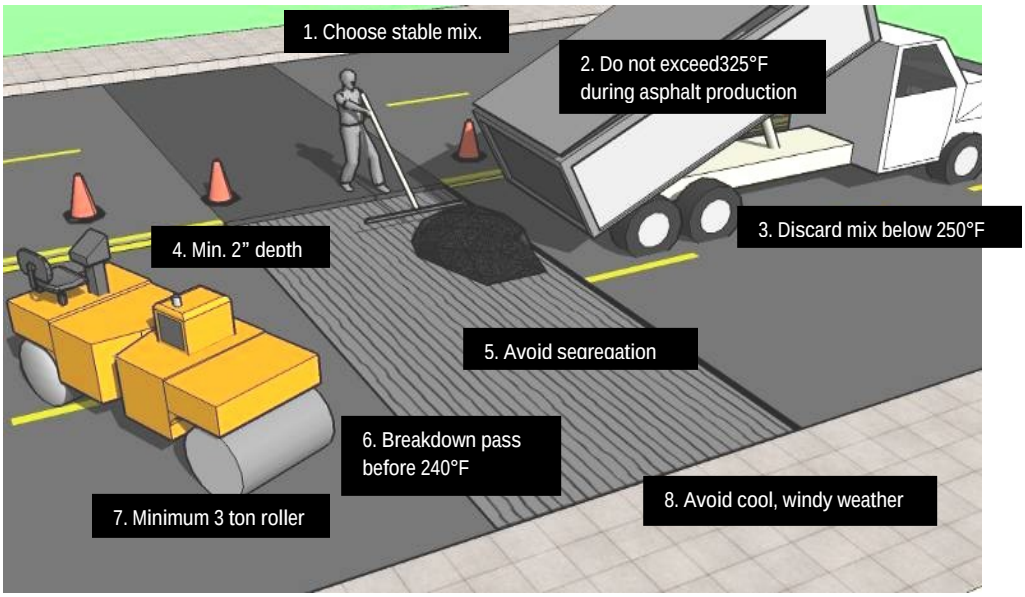
• **Compaction Temperature**: It is critical that the first roller pass (breakdown) occurs before any portion of the hand laid pavement cools below 240°F. Cooler breakdown temperatures will result in raveling which will cause DuraTherm failure.

• **Rolling:** The roller used must be a least in the 3 to 5 ton range with vibratory capability. Be careful not to let any area of the placed mix cool below 240°F prior to the first rolling pass.

• **Cold weather paving:** When paving in cooler temperatures, especially in the fall, one must be even more careful when placing pavement by hand. Ambient temperature should always be 50°F and rising. Avoid cool, windy weather, especially in the fall.



Mill and Fill should be two feet wider than the DuraTherm crosswalk



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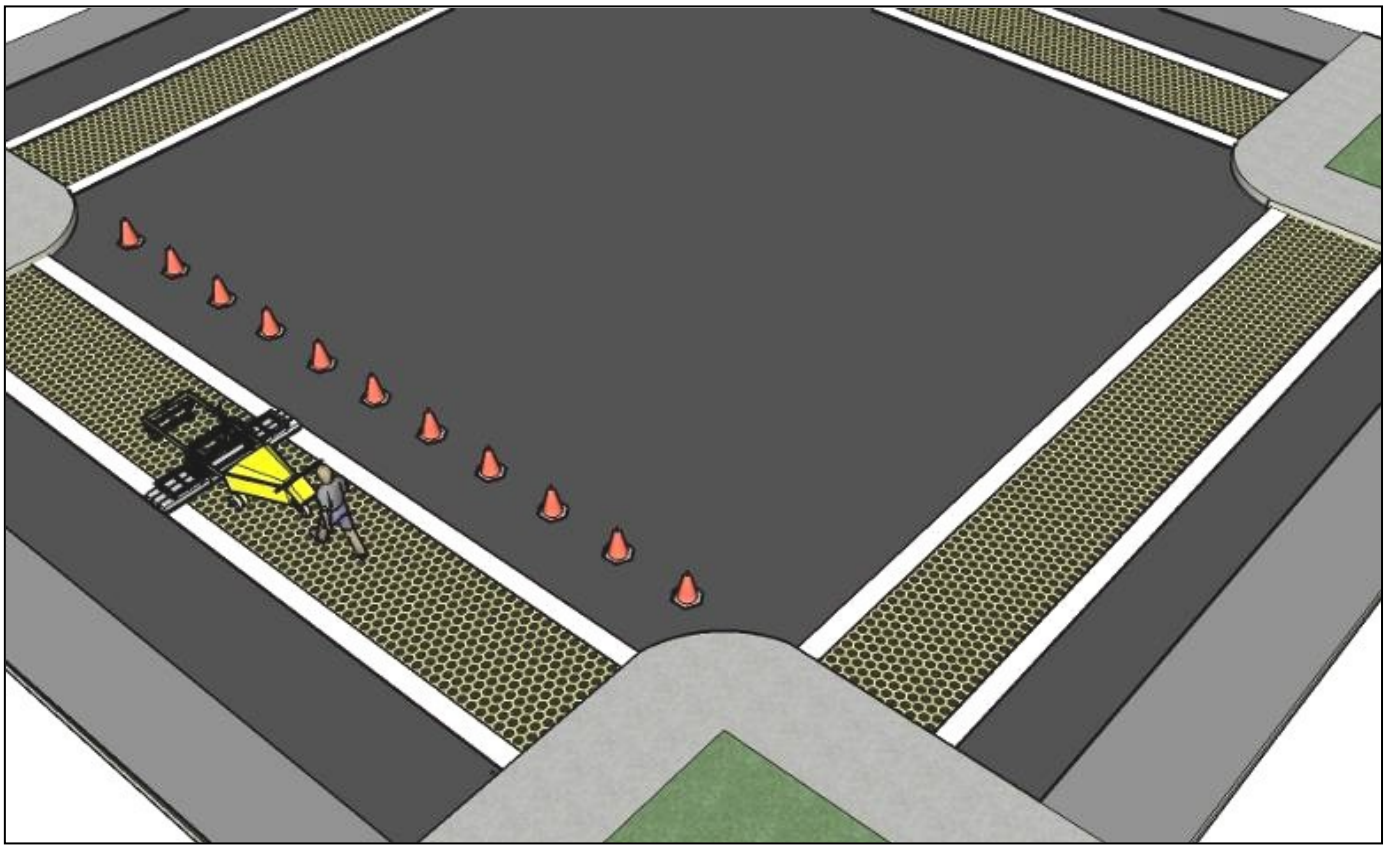
The Full Intersection Mill and Fill

Developed by the City of Los Angeles

Rather than focusing on just the crosswalks, the entire intersection is removed and replaced using a large milling and paving machine. Due to the use of large paving machines, a higher and more consistent level of pavement quality can be achieved.

The existing asphalt on the adjoining streets can be repaved with no disruption to the intersection and crosswalks, as they will be able to work away from the intersection. Another reason this strategy works well is that intersections often need treatment sooner than the rest of the street due to traffic turning, stopping, and starting.



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