

Paver Placed Surface Treatment – An ultra-thin hot mix surface treatment that’s the ideal preventive maintenance application

**Edward J. Kearney, P.E.
Chief Engineer
The Gorman Group**

As we begin the new millennium, the focus of highway officials has shifted from the construction of new roads to the preservation of our existing highway network. The demands on the system are greater than ever and will continue to grow in the future. Today’s traffic volumes and loadings far exceed design expectations and pavement deterioration is happening at an accelerated rate. The need for structural upgrades and capacity improvements will have to be met but at the same time a comprehensive pavement preventive maintenance program must be underway to keep the rest of our highway system from falling into a state of disrepair.

Preventive maintenance is defined as a planned strategy of cost-effective treatments to an existing roadway system that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system without substantially increasing structural capacity. It typically involves the application of one or more treatments to the surface of a structurally sound pavement that is in good condition. Crack sealing, fog seals, chip seals, slurry seals, microsurfacing, and thin HMA overlays are the most common preventive maintenance treatments. These pavement preservation techniques are aimed at protecting our investment in the Nation’s highway system, extending pavement life, enhancing pavement performance, ensuring cost-effectiveness, and reducing user delays. To get the maximum benefit from preventive maintenance applications it is very important that “the right treatment be applied to the right pavement at the right time.”

What is “Paver Placed Surface Treatment” ?

“Paver Placed Surface Treatment” is the latest high-tech weapon in the preventive maintenance arsenal of the highway superintendent. It’s a paving process that places a thin open-graded coarse aggregate HMA overlay in a membrane of polymer modified asphalt emulsion. It’s unique in that it is essentially a surface treatment that’s made in an asphalt hot mix plant and placed with a specialized paver. In some specifications, it’s called “paver placed surface treatment” or “ultra thin HMA wearing course”. The open texture of the mix gives the surface very high skid numbers, reduces water spray from tires and can lower tire noise. The heavy asphalt emulsion membrane (0.2 gal/SY – 0.9 L/m²), provides an excellent seal and tightly bonds the Paver Placed Surface Treatment mix to the old asphalt or concrete road surface - protecting it and extending its life by several years. Because it is paved so thin (about 5/8 in. – 16 mm), curb reveal is retained, guide rail and roadway irons do not have to be adjusted, transitions to side streets and driveways are easy, and overhead clearances are maintained. In addition to its use in preventive maintenance applications, it can be placed as a surface course on new construction and is suitable for all types of traffic. However because it is so thin, Paver Placed Surface Treatment has no structural value and is not a suitable overlay on pavements that are underdesigned or have failed structurally. The paving operation is very fast (up to 100 ft/min) and rolling is done right behind the paver so the road can be open to traffic almost immediately.

Paver Placed Surface Treatment Specifications

Three Paver Placed Surface Treatment mix gradations are shown in Table 1. The different mixes are produced by combining approximately 70% of a one size coarse aggregate with 30% manufactured fine aggregate. In some locations, mineral filler may have to be added in order to meet the 0.075 mm. requirement.

Table 1 – Mixture Requirements

Sieve Sizes (mm)	Type A		Type B		Type C	
	Design Limits % Passing	Prod. Tol. %	Design Limits % Passing	Prod. Tol. %	Design Limits % Passing	Prod. Tol. %
19.0					100	
12.5			100		85-100 ±4	
9.5	100		85-100 ±4		60-80 ±4	
6.3	85-100 ±4		30-50 ±4		30-50 ±4	
4.75	40-60 ±3		24-40 ±3		24-40 ±3	
2.36	21-32 ±3		21-32 ±3		21-32 ±3	
1.18	16-26 ±3		16-26 ±3		16-26 ±3	
0.60	12-20 ±2		12-20 ±2		12-20 ±2	
0.30	8-16 ±2		8-16 ±2		8-16 ±2	
0.15	5-10 ±2		5-10 ±2		5-10 ±2	
.075	5-7 ±2		5-7 ±2		5-7 ±2	
%PGB	4.9 – 5.3		4.8 – 5.2		4.8 – 5.2	
Moisture Sensitivity*	80% minimum					

*AASHTO T283

Table 2 shows the recommended coarse aggregate gradations for the various mix types and Table 3 is the recommended fine aggregate gradation.

Table 2 – Recommended Coarse Aggregate Gradation

Screen Size (mm)	Type A (% passing)	Type B (% passing)	Type C (% passing)
19.0			100
12.5		100	85-100
9.5	100	85-100	25-50
6.3	85-100	0-15	0-15
4.75	25-50	0-3	0-3
2.36	0-3	0	0

Table 3 – Recommend Fine Aggregate Gradation

Sieve Size (mm)	Percent Passing
4.75	100
2.36	90-100
1.18	60-80
0.600	45-60
0.300	30-40
0.150	20-30
0.075	15-25

The performance of the Paver Placed Surface Treatment pavement is dependent primarily on the physical properties of the coarse aggregate. Therefore, the very stringent requirements shown in Table 4 are necessary because in the ultra thin lift this larger stone alone carries the traffic load. It must be 100% crushed, one size, cubical, and hard / tough enough to withstand the wear and pounding of heavy traffic - especially large trucks.

It also must be a high friction aggregate able to resist the polishing effects of the design traffic volumes. In some geographical areas, the 25% maximum LA Abrasion loss precludes most aggregates from use in Paver Placed Surface Treatment and many engineers question the test's applicability. Research is currently underway to evaluate the Micro Deval abrasion test as an alternate test method for determining aggregate acceptability. An 18% maximum loss on this test is being considered as an additional coarse aggregate requirement.

Table 4 – Coarse Aggregate Properties

Test	Method	Requirement
LA Abrasion, max % loss	AASHTO T96	25
Flakiness Index, max %	NFP 18-561	20
Clay Lumps & Friable Particles, max %	ASTM C142	2
Soundness, max % loss	AASHTO T104 AASHTO T104	18 (MgSulfate) 12 (NaSulfate)

The membrane / tack coat is a CRS-1 asphalt emulsion that is polymer modified – minimum of 3% polymer by weight. It should be applied at a temperature of 60 to 80°C (140 - 175°F).

Construction Details

Surface preparation prior to paving the Paver Placed Surface Treatment shall consist of sealing all longitudinal and transverse cracks more than 6.2 mm wide (¼ inch), cleaning the entire surface to be overlaid, covering all catch basins, manholes and other roadway iron with plastic or building felt, and removing all standing water.

The Paver Placed Surface Treatment paver is specifically designed and built for application of this pavement course. It has an onboard heated tank for the asphalt emulsion tack material and augers to transfer the HMA from the hopper back to the screed. The tack/seal coat is sprayed on the pavement at the proper width and rate (0.9 L/m² or 0.2 gal/SY) and right in front of the HMA being spread ahead of the screed. As the 150°C (300°F) HMA contacts the tack coat, its heat drives off the emulsion's water. The tack coat can be applied at this heavy rate because it is covered by mix before there is any contact or disturbance by tires, tracks, etc.

Types B and C mixes are typically placed a minimum of 16mm thick - about 30 to 38 kg/m² (55 to 70 lb/SY). Surface temperature should be 7°C (45°F) and rising before paving starts.

Compaction begins immediately with two 8 to 10 ton steel wheel rollers operating in static mode only. Since Paver Placed Surface Treatment is an open graded mix, the rolling is not so much for compaction as it is for smoothing the surface plus aligning the mix aggregate particles and seating them in the tack coat. Traffic can be allowed on the mat after rolling is complete and the mix has cooled to 60°C (140°F). Usually this is approximately 100 meters behind the last roller or about five minutes behind the paver.

Summary

An effective pavement preservation program encompasses a full range of rehabilitation strategies in addition to several preventive maintenance techniques. Recently a new preventive maintenance treatment, an ultrathin bonded wearing course called Paver Placed Surface Treatment, has been added to the list. It's a paving process that uses a specialized paver to spray a polymer modified asphalt emulsion membrane and immediately pave a thin open-graded HMA overlay into it. The emulsion membrane seals the old pavement surface, protects it from the intrusion of water, inhibits further aging and tightly bonds the new mix to the roadway. The extremely high quality aggregates required for the open-graded ultrathin overlay are able to withstand the pounding of heavy traffic and retain excellent skid resistance over the pavement's life. In many situations, Paver Placed Surface Treatment will be the right treatment for the right road when applied at the right time.