ENERGY-SECTOR BRIEF

Maintenance Division, Roadway Asset Management

16-01 LARGE AGGREGATE SURFACE TREATMENT

A variety of roadway maintenance repair techniques and materials are used by TxDOT Districts to extend pavement life. This energy sector brief documents a surface treatment process using large-sized aggregate and is based on practices performed in the Odessa District. Other energy sector briefs and an implementation report provide details associated with other repair practices.

This report and related documents are available on the TxDOT Maintenance Division (MNT) SharePoint site at https://txdot.sharepoint.com/sites/division-mnt/SitePages/Home.aspx.

DESCRIPTION

This construction/maintenance operation consists of multiple (two or three) applications of a combined process involving a sprayed layer of asphalt binder followed by the distribution of a single layer of aggregate with compaction or rolling.

These applications are typically applied to primed flexible base courses and are sometimes referred to as “double” and “triple” surface treatments depending on the number of applications of the combination of sprayed asphalt binder and distributed aggregate.

INTRODUCTION

Surface treatments are seal coats/chip seals applied to the top of primed flexible base course. Surface treatments are a pavement surfacing layer constructed by the spray application of an asphalt binder followed by the distribution and rolling of a nearly one sized aggregate. Single or multiple layers of the combination of sprayed asphalt binder and distributed and rolled aggregate are widely used in Texas.

The Odessa District in West Texas has a long history with the use of surface treatments on relatively high traffic volume roadways. Portions of IH 10 and IH 20 were originally constructed in the 1960’s and 1970’s with flexible bases and 2-course surface treatments (“doubles”) or 3-course surface treatments (“triples”). These pavements carried Interstate Highway traffic for a number of years.

With the rapid development of the energy sector in the early and mid-2010’s, the Odessa District elected to repair a number of roadways damaged by this heavy traffic with 3-course surface treatments with large sized aggregates as the first layer of the multiple layered surface treatment. The large aggregate had a nominal maximum size 5/8 inch (Grade 2).

Surface treatments and seal coats have higher asphalt binder contents than traditional hot mix asphalt mixtures and are more tolerant to high strains caused by heavy trucks and somewhat more resistant to cracks reflecting from layers of the pavement located below the surface treatment or seal coat.

Thin layers of hot mix asphalt experience high strains and often premature distress when placed on flexible base materials and subjected to heavy traffic. Under heavy traffic, pavements containing thick layers of hot mix asphalt should be considered. Multiple surface treatments provide a relatively low cost surfacing material for roadways with moderate and low traffic volumes. Note that performance problems can be experienced with multiple surface treatments. A summary of this surfacing technique is provided in below.

CONDITIONS FAVORING USE

The Odessa District has used "triple" surface treatments with large size aggregates as the first layer on energy sector roadways that have a relatively high percent of truck traffic. The use of the large aggregate size allows for high asphalt binder application rates which help seal the base while providing a more flexible wearing surface to the roadway. The use of the large aggregate also "holds up" better (less bleeding, raveling and de-bonding) under heavy traffic loads associated with the energy sector traffic as compared to conventional surface treatments.

PROCEDURE

The procedure involves the placement of spray applications of an asphalt binder followed by the distribution of a nearly one sized aggregate and rolling with a pneumatic tired roller to "seat" the aggregate into the asphalt binder. Brooming of loose aggregate after rolling is common. The combination of the spray application of the asphalt binder and distribution of the aggregate is repeated in successive layers. Materials and application rates are shown below for these treatments.

TYPE OF SURFACE TREATMENT	LAYER	ASPHALT BINDER		AGGREGATE	
		Type	Quantity, gallons/sq. yd.	Gradation Grade	Quantity, sq., yds./cu. yds.
3-Course Surface Treatment	1	AC-20XP, AC-15P or AC-20-5TR	0.45 to 0.50	2	72 to 80
	2	AC-20XP, AC-15P or AC-20-5TR	0.40 to 0.45	3	95 to 105
	3	AC-20XP, AC-15P or AC-20-5TR	0.35 to 0.40	4	110 to 120
2-Course Surface Treatment	1	AC-20XP, AC-15P or AC-20-5TR	0.45 to 0.50	2	72 to 80
	2	AC-20XP, AC-15P or AC-20-5TR	0.35 to 0.40	4	110 to 120
2-Course Surface Treatment	1	AC-20XP, AC-15P or AC-20-5TR	0.40 to 0.45	3	95 to 105
	2	AC-20XP, AC-15P or AC-20-5TR	0.35 to 0.40	4	110 to 120

P = *Polymer Modified* **TR** = *Tire Rubber* **XP** = *Polymer Modified*

Typically the aggregate or rock rates in the second and third layers are selected to "stack" the rock so that the smaller aggregates in the successive layers completely fill the voids of the previous layer. For some "double" surface treatments, the Grade 2 aggregate was placed with large voids and allow the Grade 4 aggregate to fill the voids in the Grade 2 first layer.

SCHEDULING

1. Best to schedule in warm or hot/dry weather
2. Avoid wet weather at time of construction and within 24 to 48 hours after construction if possible
3. Avoid allowing traffic on the Grade 2 layer if possible as flying stone may cause vehicle damage

PERFORMANCE

The performance of the "triple" surface treatments in the energy sector has shown good performance. Intersection areas have experienced distress typical of that experienced with other types of surface treatments and chip seals.

COMMENTS

1. Traffic is typically not allowed to travel on the Grade 2 first surface treatment. The second course is usually applied prior to allowing traffic on the pavement. If the large aggregate is dislodged and picked-up by tires, vehicle damage can occur.
2. When applying the Grade 2 aggregate, surface voids should be apparent between the aggregate particles. Care must be taken to prevent construction equipment (chip spreader and pneumatic rollers) from "picking-up" the asphalt on their rubber tires during construction. If "pick-up" does occur, increase the aggregate distribution rate.
3. Aggregate loss and bleeding is a problem at higher traffic volume intersections. Accelerating, deceleration and turning traffic dislodge stone and/or push the aggregate into the base course.

MATERIALS/EQUIPMENT/CREW SIZE/PRODUCTION

Special construction equipment is not required. Asphalt distributors, aggregate or chip spreader, pneumatic tired rollers and brooms are utilized for construction. Note that the Odessa District requires 4 rollers (medium weight pneumatic tires) that cover the mat with a minimum of 5 passes. Crew size and production rates are typical to those for conventional surface treatments and seal coats.

Typical asphalt binders used are AC-20XP, AC-15P and AC-20-5TR. AC-20XP is a SBS polymer modified asphalt with minimum G*/ sin delta at 64 C of 1.0 and with a minimum viscosity at 140 F of 2,000 poises. The binder penetration requirement is between 75 and 115 at 77 F. A minimum elastic recovery of 55 percent and a minimum softening point of 120 F are required. This is a relatively stiff binder with elasticity and a relatively high softening point and is intended for use in relatively hot climates.

AC-15P is a SBS polymer modified asphalt with a minimum viscosity at 140 F of 1500 poises. The binder penetration requirement is between 100 and 150. The minimum elastic recovery is 55 percent. A minimum of 3 percent SBS polymer is required. This is a relatively stiff binder with elasticity provided by the polymer.

AC-20-5TR contains a minimum of 5 percent crumb rubber with a minimum G*/ sin delta at 64 C of 1.0 a minimum viscosity of 2,000 poises at 140 F. The penetration at 77 F is between 75 and 115 with a minimum elastic recovery of 55 and a Softening Point minimum of 120 F. This is a relatively stiff binder with elasticity and relatively high softening point.

Aggregate Gradation Requirements (Cumulative Percent Retained)

SIEVE SIZE	AGGREGATE GRADE						
	2	3S	3	4S	4	5S	5
⅞	0						
¾	0-2	0	0				
⅝	20-40	0-5	0-5	0	0		
½	80-100	55-85	20-40	0-5	0-5	0	0
⅜	95-100	95-100	80-100	60-85	20-40	0-5	0-5
¼			95-100			65-85	
No. 4				95-100	95-100	95-100	50-80
No. 8	99-100	99-100	99-100	98-100	98-100	98-100	98-100

S-designates a more one sized aggregate

Aggregates designated as SAC A aggregates (Surface Aggregate Classification for Wet Surface Crash Reduction Program) are being specified on energy sector roadway experiencing heavy truck traffic. Depending on the aggregate source some SAC B aggregates can “break-down” and crush under truck loading. SAC A aggregates typically have a higher friction value over the life of the pavement and are more durable.

Pre-coated aggregates are used with the hot applied asphalt binders identified above. A PG 64-16 asphalt binder is used to pre-coat at an asphalt binder content of about 1 percent by dry weight of aggregate.

Emulsified asphalts have been used with some “double” treatments. If emulsions are utilized, the aggregate is not pre-coated.

Contacts

Mark McDaniel
Transportation Engineer
Texas Department of Transportation
(512) 416-3113
mark.mcdaniel@txdot.gov

John Bilyeu
Transportation Engineer
Texas Department of Transportation
(512) 416-3291
john.bilyeu@txdot.gov

Jon Epps
Research Engineer
Texas A&M Transportation Institute
(979) 458-5709
j-epps@tamu.edu

Chad Windham
Director of Operations
Texas Department of Transportation
Odessa District
(432) 498-4740
chad.windham@txdot.gov

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Texas A&M Transportation Institute