Reviewed by: R. F. Cauley
Robert F. Cauley, P.E.
Materials and Research Engineer

Prepared by: Theresa C. Gilman
Theresa C. Gilman
January 12, 2001

RESEARCH UPDATE U 2000-8

GLASPHALT PAVEMENT PERFORMANCE HARTLAND, VT ROUTE 12

REFERENCES:

Report WP 92-R-20, U92-4,U93-8, U97-1, U1999-8

INTRODUCTION:

This report describes the performance of waste crushed glass utilized as a portion of the coarse aggregate in a bituminous concrete pavement surface course placed on VT Route 12 in Hartland. This project is one of two state highways rehabilitated using this process. In 1972, the City of South Burlington incorporated glass in an upgrade of a 0.68 km section of VT Route 116, but due to the placement of a bituminous surface course over the section containing glass shortly thereafter, little data was obtained regarding its performance.

PROJECT DESCRIPTION:

Hartland project STP 9328(1)S began at the intersection of VT Route 12 and VT Route 5 at mile marker 0.000 and continued northerly, 0.97 km to mile marker 0.600. Constructed in 1992, the overlay design specified a 363 metric ton per mile leveling course of VT Type IV (9.5 mm maximum) bituminous concrete pavement and a 44 mm thick VT Type III (12.5 mm maximum) bituminous concrete pavement surface course. As a test of its performance, a 0.77 km section of VT Route 12 (mile marker 0.120 through mile marker 0.600) was paved with a glasphalt wearing course in the southbound lane. The northbound lane served as the control and was constructed with a standard bituminous pavement. Details on the production and placement of the experimental and control mixes are available in Research Update U92-4.

Two test sites, each 30 meters in length, were established on the project. Each year these sites are examined and measured for cracking, rutting and ride roughness.

PROJECT HISTORY:

In the spring of 1993, the project was inspected and revealed some loss of glass aggregate as evidenced by the existence of glass particles on the surface of the adjacent gravel shoulder. All the glass particles were free of any asphalt coating. Surface pitting was apparent only under close observation. The surface texture of the pavement was quite open between the wheel paths on both the glasphalt and standard pavement.

Locked wheel friction tests taken 50 days after paving indicated little or no difference in skid resistance between the standard mix and glasphalt, since the skid value for both treatments was 48.

COST:

At the time of construction, the price of the bituminous concrete pavement and the glasphalt mix were bid at the same price of $25.07 per metric ton in place. It should be noted however, that the cost to produce the glasphalt mix would typically be more expensive due to the need of an anti-strip additive and the higher cost of the glass aggregate.

PERFORMANCE:

The following table presents eight years of performance evaluations comparing a glasphalt pavement wearing course and a standard bituminous wearing course:

PAVEMENT PERFORMANCE COMPARISON

Year	Average Cracking (m/100m)				Average Rutting (mm)				Average IRI (m/km)	
	Test Site #1		Test Site #2		Test Site #1		Test Site #2			
	NB Control	SB Glasphalt	NB Control	SB Glasphalt	NB Control	SB Glasphalt	NB Control	SB Glasphalt	NB Control	SB Glasphalt
Pre Construction	93	68	117	190	9.5	10.6	7.1	11.6	3.88	3.35
1992	0	0	0	0	0	0	0	0	N/A	N/A
1993	0	0	0	0	0	0	0	0	1.59	1.36
1994	11	11	16	12	0	0	0	0	2.14	1.65
1995	11	11	16	14	0	0	0	0	2.10	1.23
1996	11	11	16	17	N/A	N/A	N/A	N/A	2.00	1.63
1997	11	18	20	43	0	0	0	1.1	2.03	1.83
1998	11	24	20	64	0	1.6	0	1.6	1.76	1.63
1999	N/A	N/A	20	78	N/A	N/A	2.1	2.6	N/A	N/A
2000	N/A	N/A	22	84	N/A	N/A	2.6	3.7	2.28	2.01

In 1999, the exact location of test site #1 was undetectable and an effort to reestablish the site in 2000 was rendered unsuccessful. Therefore, performance data for cracking and rutting these two years are based on test site #2 only.

Current performance relative to pre-construction values

	1998 (TS #1 & #2 average)	**2000** (TS #2 only)
Cracking		
Control	15 %	19 %
Glasphalt	23 %	44 %
Rutting		
Control	0 %	37 %
Glasphalt	14%	32 %
IRI		
Control	52 %	59 % (TS #1 & #2 avg)
Glasphalt	49 %	60 % (TS #1 & #2 avg)

SUMMARY:

During eight years of performance, under close examination, the glasphalt overlay has exhibited some popout of the glass aggregate (Figure 1). Although the distress is not severe, small voids in the surface treatment are visible. The presence of glass is still very noticeable and well intact, particularly in the shoulder area where less wear has occurred (Figure 2).

In 1999, ride roughness data was not collected for the project area due to the unavailability of equipment. Other data collected indicates the glasphalt overlay has continually provided a better ride quality than the standard bituminous overlay. However, a comparison of the percentage between current performance and pre-construction reveals that both sections are declining at the same rate; hence, the ride quality of the two may be summarized as performing equally. It is important to note that because the Mays meter, a device that measures the road roughness, is calibrated each year, data may not be consistent from year to year (as in 1995 and 1998), but are nonetheless relative within a given year.

Overall, the glasphalt pavement is performing well. The addition of glass as an aggregate increases the tendency for asphalt stripping. However, with the addition of an anti-strip agent, as was the case here, the problem seems to be minimal (Figure 3).

FOLLOW UP:

Performance monitoring will continue with emphasis on loss of glass aggregate, cracking, rutting and ride roughness. Prior to the completion of the monitoring, skid resistance tests will be considered as well as core samples to examine asphalt stripping.

Figure 1. **Glass aggregate popped out (between 7" – 7 ½" mark on rule).**
(Photo taken November, 2000 at test site #2)

Figure 2. **Green and brown glass aggregate remains visible.**
(Photo taken November, 2000 at test site #2)

Figure 3. **Glasphalt (left lane) / Standard Bituminous Pavement (right lane).**
(Photo taken November, 2000 at test site #2)