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RESEARCH UPDATE

U 1999-6

RECLAIMED BASE COURSE STABILIZED WITH CALCIUM CHLORIDE BRANDON-GOSHEN, VT ROUTE 73

REFERENCES:

Report WP 93-R-6, Research Report 95-3, U96-24, U97-13

INTRODUCTION:

This report describes the performance of a reclaimed base course stabilized with calcium chloride that was placed on VT Route 73 in the towns of Brandon and Goshen. This project is one of two state highways constructed using this process. An analysis of pavement performance based on collected data is presented herein.

PROJECT DESCRIPTION:

Brandon-Goshen project STP 9405(1)S began at the intersection of VT Route 53 and VT Route 73 in Brandon and continued westerly along VT Route 73, 8.307 km to MM 3.610 in the town of Goshen. Constructed in 1994, the existing 75 mm to 140 mm of bituminous material was pulverized along with some gravel subbase to an average depth of 150 mm. A 30% solution of calcium chloride (CaCl) was sprayed onto and mixed with the pulverized material at an application rate of 3.4 L/m^2. After rolling the base course, an additional 1.3 L/m^2 of CaCl solution was sprayed over the surface before the placement of a 50 mm binder course of Type II bituminous concrete. The project surface course was 45 mm Type III bituminous concrete pavement.

Two sections of roadway, each 320 m in length, were selected for analysis. Three full width test sites, each 30 m in length, were established in each of the two sections. Each test site was constructed to have one lane with CaCl base stabilization and one lane without any chemical stabilization to enable a quick comparison. Each year these sites are examined and measured for cracking, rutting and ride roughness.

COSTS:

The cost for the reclamation process on this project was $\$1.07/m^2$, with additional costs of $\$5.28/m^2$ for the bituminous concrete and $\$0.50/m^2$ for the CaCl stabilizer. This resulted in a total cost of $\$6.85/m^2$ for the road rehabilitation.

PERFORMANCE;

The following table presents five years of performance evaluations comparing reclaimed base (RCB) stabilized with calcium chloride and reclaimed base without chemical stabilization.

BRANDON-GOSHEN PERFORMANCE COMPARISON					
		RCB STABILIZED BASE WITH CaCl		RCB BASE ONLY	
1994	CRACKING	0		0	
	RUTTING	WB - 0	EB - 0	WB - 0	EB - 0
	ROUGHNESS	1.7		1.6	
1995	CRACKING	0		0	
	RUTTING	WB - 0.5	EB - 0.2	WB - 1.1	EB - 0
	ROUGHNESS	1.5		1.5	
1996	CRACKING	3		0	
	RUTTING	WB - 1.4	EB - 0.7	WB - 1.9	EB - 0
	ROUGHNESS	1.7		2.1	
1997	CRACKING	23		18	
	RUTTING	WB - 1.4	EB - 1.8	WB - 2.3	EB - 0
	ROUGHNESS	1.5		1.5	
1998	CRACKING	34		38	
	RUTTING	WB - 3.0	EB - 1.9	WB - 3.9	EB - 1.2
	ROUGHNESS	1.4		1.5	
1999	CRACKING	47		45	
	RUTTING	WB - 4.9	EB - 4.4	WB - 6.7	EB - 3.9
	ROUGHNESS	N/A		N/A	

Units: Cracking ..... m/100m (average of longitudinal and transverse cracks, excluding center line cracks)
Rutting ..... mm (average of inner and outer wheel paths)
Roughness (IRI) ... m/km (average for both lanes)

WB ..... average for westbound lane
EB ..... average for eastbound lane

SUMMARY:

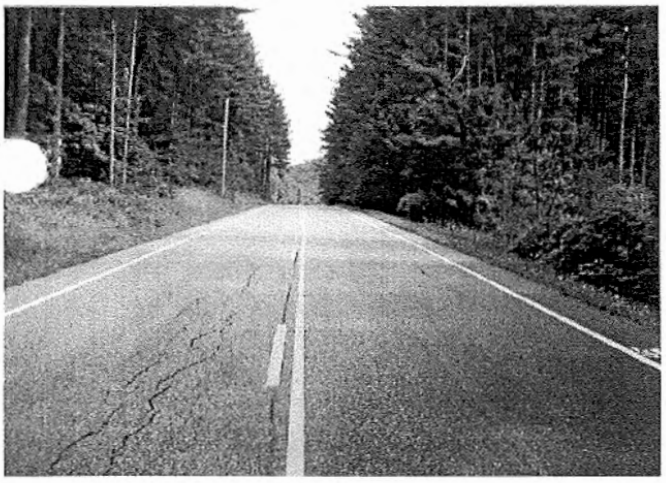
In 1994, three months after construction, personnel from the Materials and Research Section visited the project to conduct a post construction survey. During this survey, no cracks or ruts were noticed throughout the project area. In addition, the Pavement Management Section collected follow-up IRI readings. These showed that the reclaimed base stabilized with CaCl and the untreated section were performing nearly equal. After five years of service, the treated and untreated areas are continuing to perform reasonably equal both in cracking and ride roughness. Due to the unavailability of equipment, however, IRI values were not gathered for 1999.

An examination of the table shows that rutting has increased significantly in the past year in both the untreated section and stabilized CaCl section, with the untreated section showing higher levels of deformation. A comparison between the two travel lanes indicates deeper rutting in the westbound lane. Since the sections were set up to have one with a treated section in the eastbound lane and one in the westbound lane, it may be assumed that the deformation is not related to the treatment or lack thereof, but may rather be due to the road terrain. Vermont Route 73 is an east-west highway that travels over a mountainous area, with the westbound lane of the project being the descending lane. Due to vehicles breaking on the downhill grade, distress, such as shoving, may be introduced in the westbound lane more frequently than in the eastbound lane.

During a visual inspection of the project area it became evident that the primary type of cracking is longitudinal. In the outer wheel paths of both the westbound lane and eastbound lane, some of the longitudinal cracks are as deep as one inch. Two of the test sites show minimal longitudinal cracking, located in areas with less gradient.

Longitudinal cracking is occurring along the centerline. Two sites have significant centerline cracks with one being 1" deep x 1" wide. Faint centerline cracking is beginning to appear at a third test site. This type of crack is likely due to construction practices and pavement joint construction.

Although two of the three performance factors are comparable, the cost difference between RCB with CaCl and RCB without any chemical stabilization is not. Based on the increased unit costs for the addition of CaCl, there would need to be an 8% increase in the service life of the RCB with CaCl in order to be equal in value to the RCB without chemical stabilization. This would equate to at least one additional year of service based on a 12 year pavement design. The RCB with CaCl on the Brandon-Goshen project has yet to show superior performance when compared to RCB without chemical stabilization.



Brandon-Goshen VT Route 73
Test Site #2 @ MM 1.65
Traveling East to West

Brandon-Goshen VT Route 73
Test Site #6 @ MM 2.37
Traveling West to East

Brandon-Goshen VT Route 73
Test Site #3 @ MM 1.72
Traveling West to East

FOLLOW UP:

Current practice for pavement design is based on the estimated number of ESALS for the project area. In this case, the service life estimated for this type of improvement is 12 years. Next year will mark the design half life. At this time a falling weight deflectometer (FWD) test will be performed to determine the structural number and it will be compared with the design number for the roadway. Pavement surveys will continue on an annual basis until firm conclusions can be drawn as to the anticipated service life of the RCB with CaCl and its relative cost effectiveness.