**Reclaimed Base Course** 

Stabilized with Calcium Chloride

Brandon/Goshen, VT 73

Report 95-3

State of Vermont Agency of Transportation Materials and Research Division

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This report desc Course with Calcium C	ribes the process for sta hloride as performed on t	bilizing a Reclaimed Base he Brandon/Goshen STP 9405		
project.				
To Competion incl	when the initial readway	conditions including crack		
counts, rut readings	and roughness values.			
Percommendations	will be provided after fu	rther observations determine		
the life cycle costs of the experimental treatment.				
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# Reclaimed Base Course Stabilized with Calcium Chloride

## INTRODUCTION:

The Agency of Transportation is evaluating various pavement rehabilitation techniques from the perspective of performance and life-cycle costs. This report describes a project done with a technique involving a reclaimed base stabilized with calcium chloride (CaCl<sub>2</sub>).

A base reclamation technique commonly used includes pulverizing the existing pavement and mixing the re-sized asphaltic concrete material with a portion of the base. The addition of an additive during the mixing process, such as calcium chloride, is reported to improve performance.

A section of Vermont Route 73, in the towns of Brandon and Goshen, was selected for a reclaimed base stabilization treatment with a stabilizing agent of calcium chloride (CaCl<sub>2</sub>). This report describes the initial selection, testing and construction of this project, Brandon/Goshen STP 9405.

## PROJECT DESCRIPTION & ROADWAY CONDITION:

Located in the towns of Brandon and Goshen, the project begins in Brandon at the intersection of VT 53 and VT 73 and extends 5.162 miles to MM 3.610 in Goshen (Goshen/Rochester Town line). The existing roadway is 24 feet wide and includes shoulders two feet wide.

Previous treatments included a 1" plant mix applied over the entire project area in 1978 and bituminous seals in both 1984 (MM 7.0 in Brandon to 3.61 in Goshen) and in 1988 (MM 6.12 to 7.0 in Brandon). A thin leveling course was placed from MM 5.887 to 6.12 in Brandon in 1989. The subbase thickness varied from 13" to 16" on the Brandon side, to 15" to 18" in Goshen. In 1992, the annual average daily traffic (AADT) was 1630 from MM 5.88 in Brandon to MM 0.5 in Goshen, and 510 from MM 0.5 to 3.61 in Goshen.

## PRECONSTRUCTION:

During early 1994, personnel from the Materials and Research Division visited the project site and selected two areas for test sites. Both of these areas have one lane with CaCl<sub>2</sub> base stabilization and one lane without any stabilization. These areas are located in the town of Goshen at the following locations:

MM 1.6	to 1.8	WB Lane Stabilized with $CaCl_2$	EB Control (No CaCl <sub>2</sub> )
MM 2.2	to 2.4	WB Control (No CaCl <sub>2</sub> )	EB Stabilized with CaCl <sub>2</sub>

Three full width test sites, each 100 feet long, were established in each of the two areas. This method of leaving one side of the road untreated and treating the other side with stabilization agent will enable a quick comparison to be made between both the  $CaCl_2$  lane and the untreated lane within the individual 100 foot test sites.

The six sites were surveyed for cracking and rutting, prior to the initiation of the project, on June 10, 1994. The results of the survey revealed that the ten year old pavement had significant distress. On average there was an excess of 1300 linear feet/100 feet of pavement cracking. Most of the cracks were classified as either longitudinal or map (alligator) cracking. At the same time, 1/3" to 1/2" of rutting was also observed in these same sections. The Pavement Management Division did not conduct a preconstruction roughness survey; however, International Roughness Index (IRI) results, taken with a trailer mounted Mays meter in 1991, indicated an average of 232 in/mi over the entire project area.

MM	Cracks (Ft/100 Linear Ft)	Ruts (1/16")
1.6	1240	7/16
1.65	1790	9/16
1.72	1470	6/16
2.24	1070	9/16
2.33	. 1115	6/16
2.37	1215	9/16

#### INITIAL SURVEY RESULTS -- 6/10/94

# PRODUCT INFORMATION:

The calcium chloride additive is intended for use in full depth reclamation to improve the performance of a base receiving new bituminous concrete paving surfaces. Suppliers claim that the use of CaCl<sub>2</sub> in reclaimed base material will result in an increased service life, resulting in significant cost savings. Results of data gathered from testing granular fill show the resilient modulus of materials treated in this way increases by 30% compared to untreated material. AASHTO'S guide for design of pavement structures equates this to an increase in service life of three years.

The CaCl<sub>2</sub> utilized on this project was manufactured by General Chemical. The recommended concentration of the CaCl<sub>2</sub> stabilizer is 35% in water, and the recommended application is as follows:

- a. Pulverize existing bituminous concrete, mixing it with a predetermined amount of underlying base materials.
- b. Apply CaCl<sub>2</sub> at the rate of 0.75 gal/sy.
- c. Pulverize a second time to thoroughly mix the additive and base.
- d. Grade the roadbed.
- e. Compact the surface using a vibratory roller.

f. Seal the surface with a second application of CaCl<sub>2</sub>, applied at a rate of 0.25 gal/sy. This surface application may require multiple passes to ensure the liquid CaCl<sub>2</sub> does not run off. This additional treatment combined with the previous applications serves to hold moisture securely within the base. This moisture causes fines to adhere to each other and to other reclaimed aggregates.

# CONSTRUCTION:

Pike Industries of Tilton, N.H. was awarded the contract for the Brandon/Goshen STP 9405 project and construction operations began on July 8, 1994. The reclaiming process started on the east end of the project, and was completed on August 3, 1994, four weeks later. During this time, 80,000 square yards of material was reclaimed to an average depth of 6". 76,500 square yards of this material was stabilized with 7480 hundredweight of liquid calcium chloride. The stabilizing agent was used on all sections of the project with the exception of the two, 0.2 mile control sections that were previously discussed.

As the roadway base was reclaimed and stabilized, tests to determine the compaction effects on the reclaimed material were performed. Initially the readings obtained in certain areas on the project were lower than the acceptable standard ( $\geq$  95% of the moisture density curve). The reclaiming process was stopped on July 12, 1994 by the project Resident Engineer. He requested an updated moisture density curve in order to check the quality of the compaction effort of the reclaimed stabilized base material. Once this problem was rectified, the project was restarted on July 14, 1994 with only 2 days lost. The problem areas that were found were regraded and recompacted until they achieved the minimum percentage of density. The reclaiming portion of the project then continued without any significant problems.

After the entire length of the project was reclaimed and stabilized, the paving operations commenced. From August 4 to September 20, 1994, the project was paved with 3.5 inches of bituminous concrete pavement in lifts of 2 and 1.5 inches. Only 3 days were lost due to inclement weather.

#### PROJECT TESTING AND OBSERVATIONS:

The contract under which the Brandon-Goshen project was constructed included three other projects, Sudbury-Brandon STP 9407 (1)S, and two in Castleton, STP 9408 and STP 9406. A total of 40 bituminous concrete pavement (BCP) samples were taken from all four of the projects comprising the contract. BCP sampling from the Brandon-Goshen project yielded good results in general, with only two samples, representing 275 tons of product, failing. The failures were due to poor gradation, and a high percentage of air voids. Price penalties were imposed on account of these failures.

Aggregate from the reclaimed base was tested at the project site on June 22, 1994. This material passed all sieves, although the percentage passing the #200 sieve was at the upper limit. As has been already mentioned, compaction had been a problem, with not only the contractor but also with state personnel

obtaining low readings. After regrading and recompacting the material, this problem was solved.

# COST INFORMATION:

The contracted unit prices for items used in the full depth reclamation were as follows:

- a. CaCl<sub>2</sub> \$0.60/sy.
- b. Reclaiming \$1.28/sy.
- c. Bituminous concrete \$32.50/tn This translates to a cost of \$6.32/sy.
- d. The total unit cost for the rehabilitation was \$8.20/sy.

#### POST CONSTRUCTION OBSERVATIONS:

Three months after construction, on October 12, 1994, personnel from the Materials and Research Division revisited the project to conduct a post construction survey. During this survey, no cracks or ruts were noticed throughout the entire project area. In addition, the Pavement Management Division collected follow-up IRI readings. These indicated that the reclaimed base stabilized with CaCl<sub>2</sub> had an average on 108 in/mi while the untreated section averaged 100 in/mi.

A follow-up survey was conducted on May 2, 1995. No cracks were evident in the six test sites or the road as a whole. A small amount of rutting was noticeable, mostly in the left wheel path of the westbound lane. Further surveys will be accomplished in the future.

The Pavement Management Division conducted falling weight deflectometer (FWD) testing during June and July, 1995. The process entailed testing one spot in each test site in the eastbound lane and then repeating the procedure for the westbound lane. All of the structural numbers obtained during this testing were well above the original design structural number. No significant difference was noted between the existing (present) structural numbers between the sections stabilized with  $CaCl_2$  and those without a stabilization agent. These test will be repeated in the upcoming years along with the annual pavement survey already mentioned.

## SUMMARY:

At this time, very little can be determined from the observations and the test results. Prior to this project, the only other job to have CaCl<sub>2</sub> as a stabilizing agent was Richford STP 9272(1)S, constructed in 1992, which is also part of the Pavement Life and Annualized Cost Survey. As of December 30, 1994, the areas on that project that were treated with CaCl<sub>2</sub> have maintained a smoother ride, while the cracking and rutting values reveal no early trends, either positive or negative. It may be expected that the Brandon/Goshen project will show similar results over a similar length of time.

# FOLLOW - UP:

Since this project is a part of the Pavement Life and Annualized Cost Study, field observation and testing will continue until the life-cycle cost of each treatment can be determined. At that time a report will be issued comparing all types of treatments, including reclaimed base course stabilized with calcium chloride.

# RECLAIMED BASE STABILIZATION BRANDON-GOSHEN Vt ROUTE 73 CONSTRUCTION 1994





VT AOT MATS & RES

Original Road Condition, Test Site 1.65 in Goshen

5/19/94





Test Site 1.65 in Goshen After One Winter

5/2/95

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/19/94





Test Site 2.24 in Goshen After One Winter

5/2/95