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Date: January 27, 1998

RESEARCH UPDATE U97-8

Cold Recycled Bituminous Pavement
Chester-Springfield, VT 11

References

Work Plan 92-R-7, Research Report 94-1, Research Update U96-8

Introduction

This report is a yearly update on the performance of the cold recycled bituminous pavement (CRBP) which was placed on the Chester-Springfield rehabilitation project in the summer of 1993. The study was initiated by the Vermont Agency of Transportation as part of an ongoing research effort into the performance of CRBP. The focus of the study is whether the CRBP process can cost effectively increase the service life of bituminous wearing courses. The material is being examined for cracking, rutting, and ride quality in comparison with other pavement treatments.

Project Description

The project was completed in the summer of 1993 and covers 10.7 km of Vermont Route 11 from MM 5.116 in the Town of Chester to MM 3.528 in the Town of Springfield. The CRBP process that was used was modified from the usual in-place method. Rather than process the reclaimed material on-site with the recycle train, the reclaimed asphalt pavement was hauled off-site, ground and mixed for gradation, treated with asphalt emulsion, then returned to the site for placement. (See Research Report 94-1 for detailed description of the process). For purpose of comparison, one control test section of cold planed pavement and another with a standard overlay were incorporated into the project.

All units in metric except mile markers and supplier's costs

Metric

Project Pavement Treatments

Design	**Cold Recycled Bituminous Pavement**	Recycle depth of 90 mm and surfaced with 40 mm Type III wearing course
Control 1	**Cold Planing** Town of Chester MM 5.865 to MM 6.065	Cold planing to depth of 90 mm, replaced with a 50mm binder and 40mm Type III wearing course
Control 2	**Standard Overlay** Town of Chester MM 6.065 to MM 6.265	Type III leveling course and 40mm wearing course

Prior to construction, VAOT Research and Development personnel established test sites within each of the project's pavement treatments in which to measure cracking and rutting. Measurements are taken at these sites each summer in order to evaluate rates of deterioration. In addition, yearly Mays ride roughness values (IRI) are collected. Through these data, comparisons in performance are made between the various treatments.

Observations

Pavement Performance Values 1994 - 1997

Survey Year	MM 5.9 Cold Plane	MM 6.0 Cold Plane	Average Cold Plane	MM 6.1 Standard Overlay	MM 6.2 Standard Overlay	Average Standard Overlay	MM 7.2 CRBP	MM 1.0 CRBP	MM 2.2 CRBP	MM 3.4 CRBP	Average CRBP
1994 Cracking Mays	4 1800	0 1800	**2** **1800**	153 2000	203 2000	**178** **2000**	13 1900	11 2000	51 1800	51 2500	**32** **2100**
1995 Cracking Mays	4 1800	0 2000	**2** **1900**	190 1800	219 2000	**205** **1900**	17 2100	25 1800	65 2400	72 2500	**45** **2200**
1996 Cracking Mays	137 1400	31 1400	**84** **1400**	238 1500	253 1500	**246** **1500**	57 1700	34 1700	74 1700	128 2500	**73** **1700**
1997 Cracking Mays	205 1600	85 1600	**145** **1600**	260 1300	290 1300	**275** **1300**	134 1700	50 1500	173 1200	213 2000	**143** **1600**

Cracking = linear meters per 100 meters
Mays (IRI) = millimeters per kilometer

The table presents four years of collected data from the design and control sections. Wheel path rutting was not present until this year and values were minimal, averaging 3mm per test site. Consideration of this feature will be postponed until next year when values will, most probably, be more revealing.

Measurements show that both CRBP and cold planing are resisting cracking better than the standard overlay. The standard overlay test sites average 275 m/100m in cracking, compared to the CRBP and cold planed sections, which have 145 m/100m and 143 m/100m respectively. As expected, the standard overlay section is developing transverse reflective cracking, as evidenced by the development of shoulder-to-shoulder fissures in the same location as those found during the pre-construction pavement survey. By comparison, the cracking found in the CRBP and cold planed sections is predominantly longitudinal, with prominent patches of "alligator" cracking in the wheel paths.

Mays (IRI) values indicate acceptable ride quality after four years of service. After the first year of service, there was concern that the ride quality was deteriorating rapidly, as denoted by the unusually high Mays readings. End of service life is generally marked when ride roughness values approach 4000 mm/km, and year one readings were already 2200 mm/km for the CRBP. Since that initial examination, the ride roughness values have remained stable. It is important to note that because the Mays meter is calibrated each year, data may not be consistent from year to year, but are nonetheless relative within a given year. So far, the difference in ride quality between the various treatments is insignificant. Project wide, the Mays (IRI) values range from a low of 1600mm/km to a high of 2100mm/km, averaging on the low side, at 1600mm/km. The data extracted from the individual test sites appear to be consistent with the overall ride quality.

Cost Analysis

As noted in the initial report, the contractor- F.W. Whitcomb Company, bid the CRBP treatment at a considerable discount. Therefore, the actual cost paid for CRBP on this project is not appropriate for cost analysis. For purpose of comparison, an average cost per square yard for "in-place" CRBP was calculated from costs incurred on six prior recycle projects and found to be \$8.25/SY. Included in this average are the costs of wearing courses, having depths from 3/4" (20mm) to 3 1/2" (90mm).

Actual costs for the control features were more typical. The leveling course and 40mm standard overlay placed on the Chester-Springfield project was priced at \$3.19/SY. Cold planing with 50mm binder course and 40mm wearing course was priced at \$9.25/SY. Both of these figures appear reasonable and competitive.

Given these figures, rehabilitation through use of the CRBP process is roughly equal in cost to cold planing with binder and wearing course. Both treatments are approximately three times the cost of standard overlay.

Summary and Conclusion:

After four years of service, the CRBP and cold planed treatments are performing equally well in mitigating the problem of reflective cracking and resisting fatigue related distress. Length of cracking per test site and patterns of cracking are similar. The standard overlay control section has developed reflective cracking and shows signs of distress in the same areas as the pre-construction pavement. The poor condition of the standard overlay after relatively short service provides strong evidence that this section of Vermont Route 11 has an inherently weak substructure and that rehabilitative efforts to address reflective cracking were warranted.

After four years of service, both the CRBP and cold planed treatments are superior in performance to the standard overlay. As yet, the CRBP has not demonstrated a noticeable advantage in reducing fatigue cracking over the cold planed section. Although both the CRBP and cold planing are presently delaying the propagation of reflective cracking, it is anticipated that the weak substructure will, nonetheless, lead to pavement distress in these areas over time.

Follow up:

The design and control test sites will be surveyed again in the summer of 1998 and findings will be presented in an update report. We will be paying particular attention to evidence of fatigue cracking in the wheel paths of the CRBP sections.