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RESEARCH UPDATE

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COLD RECYCLED BITUMINOUS PAVEMENT CHESTER-SPRINGFIELD, VT 11

REFERENCES:

Work Plan 92-R-7, Research Report 94-1

INTRODUCTION:

A 10.71 km section of VT Route 11 in the towns of Chester and Springfield was rehabilitated in 1993 using a modified version of the cold recycled bituminous pavement (CRBP) technique. The modification was necessary because in-place recycling equipment was not available. Instead, the excavated pavement was taken off-site where it was sized and coated with emulsified asphalt. It was then hauled back to the construction site, placed, compacted, and then overlaid with bituminous concrete pavement.

Vermont Agency of Transportation Research & Development personnel began pavement studies on the Chester-Springfield project during the spring of 1994. The purpose of this study is to evaluate the performance of CRBP when compared with cold planing and standard overlays. This project is part of an on going effort to determine if CRBP will resist reflective cracking and increase pavement service life.

PROJECT DESCRIPTION:

The Chester-Spingfield research project is an examination of pavement rehabilitations performed during the summer of 1993. The project is located between MM 5.116 (intersection of VT Route 11 and VT Route 103 in Chester) and MM 3.528, the westerly FAU limit of Springfield. Project design included cold recycling and placement of a wearing course. Two control sections were placed for purpose of comparison. A cold planed control section was placed from MM 5.865 to MM 6.065 in Chester. Also in Chester, a standard overlay control section was placed between MM 6.065 and MM 6.265.

All units in metric except mile markers/mileage references for project location and supplier's costs.

Metric

The treatments used on the Chester-Springfield project are summarized below:

DESIGN	Cold Recycled Bituminous Pavement-	Recycled to a depth of 90 mm and paved with a 40 mm Type III wearing course
CONTROL 1	Cold Planing-	Cold planed to 90 mm, replaced with 50 mm binder and 40 mm Type III wearing course
CONTROL 2	Standard Overlay-	Type III leveling course and 40 mm wearing course

Test sites were established in each treatment area prior to construction. The sites are 30 m in length and are examined each summer by Research and Development personnel. Measurements are made for rutting, cracking, and Mays ride roughness. The test site data will demonstrate how well the various treatments have performed under similar levels of fatigue and environmental distress.

'ollected data are expressed in the following units:

Rutting	millimeters
Cracking	meters/100 meters
Mays Values	meters/kilometer

Test sites were established at the following locations:

	Chester	Springfield
Cold Recycled	MM 7.2	MM 1.0 MM 2.2 MM 3.4
Cold Planed	MM 5.9 MM 6.0	
Standard Overlay	MM 6.1 MM 6.2	

OBSERVATIONS:

Pavement Survey Data

SURV. YEAR	MM 5.9 CP	MM 6.0 CP	AVG CP	MM 6.1 OVLY	MM 6.2 OVLY	AVG OVLY	MM 7.2 CRBP	MM 1.0 CRBP	MM 2.2 CRBP	MM 3.4 CRBP	AVG CRBP
1994 CRCKS MAYS	4 1.8	0 1.8	**2** **1.8**	153 2.0	203 2.0	**178** **2.0**	13 1.9	11 2.0	51 1.8	51 2.5	**32** **2.1**
1995 CRCKS MAYS	4 1.8	0 2.0	**2** **1.9**	190 1.8	219 2.0	**205** **1.9**	17 2.1	25 1.8	65 2.4	72 2.5	**45** **2.2**
1996 CRCKS MAYS	137 1.4	31 1.4	**84** **1.4**	238 1.5	253 1.5	**246** **1.5**	57 1.7	34 1.7	74 1.7	128 1.7	**73** **1.7**

The 1994 pavement survey showed early cracking in the CRBP which was surprisingly greater than in the cold planed section. The trend continued in 1995, but by 1996 the rate of cracking had stabilized and CRBP was cracking less than the control sections.

The standard overlay section developed reflective cracking after one year and has deteriorated steadily.

MAYS ride roughness values were relatively high when measured in 1994. The apparent improvement of the values from year to year has been attributed to the annual calibration of the Mays meter. Nonetheless, the values are consistent within any given year. It should be noted that pavement is considered to be at the end of service life when Mays readings reach 200 in./mile. The metric equivalent of this ratio is 3 m/ km.

Rutting was minimal in all test sections; therefore, it has been excluded from this evaluation.

1996 SUMMARY OF PAVEMENT CONDITION:

- **Standard Overlay** control test sections are extensively cracked, with an average of 246 m/100 m. As seen on previous projects, virtually all of the cracks seem to be reflective in nature.

- **Cold Planed** control test sections had substantially less cracking, averaging 84 m/100 m.

- **Cold Recycled** had average cracking of 73 m/100 m. This value is approximately equal to the average crack rate in the cold planed section and less than one third of the cracking in the standard overlay.

It is significant that after three years in service, the Chester-Springfield project's recycle sections are performing equally or slightly better than either of the two other CRBP projects being studied, Troy-Newport and Groton-Peacham. The difference in performance is most likely due to the superior substructure at Chester-Springfield Although it is far too early to forecast a final service life of the project, the performance of the Chester-Springfield project is promising enough to consider off-site cold recycling a viable rehabilitation method.

COST ANALYSIS:

Conducting a cost comparison on the Chester-Springfield rehabiliation is not possible with the available data. Pay items for the CRBP process were bid extremely low, resulting in pay items that are not typical of the market. For example, emulsified asphalt was bid at $1.00 per CWT. The two other bids were $9.60 per CWT. On a similar project emulsified asphalt was priced at $18.00 per CWT. Since no consistent data are available, cost comparison of the project treatments has not been attempted.

In general, other CRBP projects have shown CRBP to be at least 40% more expensive than standard overlay. Based on the additional equipment and materials required for cold recycling, this figure appears reasonable. As this estimate is based solely on three projects it should be considered only a rough approximation.

SUMMARY AND CONCLUSIONS:

The effectiveness of the cold recycle process in retarding reflective cracking has been successfully demonstrated by the Chester-Springfield project. The 90 mm cold recycled pavement with a 40 mm Type III wearing course showed a marked improvement over simple standard overlays and cold planing. The cost effectiveness and long term durability of the process will require further investigation, though there is sufficient evidence to suggest that cold recycling is a viable rehabilitative method.

Experience thus far on the Chester-Springfield project indicates that when cold recycling is used to rehabilitate pavements on a sound existing pavement structure, the required overlay thickness is no greater than that required for standard overlay. If confirmed through further research, the cost competitiveness of the recycle option would be significantly enhanced.

It is widely believed that cold recycled layers are inherently pliant and therefore require a thick wearing course, typically 65 mm. Given the successful performance of a 40 mm wearing course on the Chester-Springfield project this assumption is questionable. If further research confirms the effectiveness of the thinner surface course, the cost of CRBP could be significantly reduced. Since 65 mm courses cost approximately $\$4/m^2$ more than 40 mm, the cost savings would be considerable.

The cold recycle option is worthy of further investigation as a pavement rehabilitation. However, the process should only be considered after careful consideration of roadbed conditions and pavement design.

Follow Up:

Pavement testing will continue on the Chester-Springfield project in hopes of learning more about the long term performance of cold recycled bituminous pavement.