MATERIALS & RESEARCH SECTION
Research & Technology Implementation

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Assessment of 40" Wide Paving Skid Box

References – [Work Plan 2012-R-3]

INTRODUCTION

Bituminous concrete pavements deteriorate over time due to several distress factors including water infiltration, temperature extremes, inadequate structural layers, construction quality, temperature susceptibility including freeze thaw cycles, aging characteristics of the asphalt cement, and vehicular loading (*1*). Experience within the Vermont Agency of Transportation (VTrans) has shown that water infiltration is one of the most common factors that lead to accelerated deterioration. This can cause cracking, raveling, oxidation, stripping, and softening or weakening of the substrate; leading to a loss of structural support and subsequently a shorter life span of the asphalt pavements. Studies have shown that an increase in moisture from 16 to 18 percent in silty clay can cause a 75 to 100 percent reduction in strength, as measured by the California bearing ratio. Free water in granular base courses can easily reduce their strength by 25 percent or more under dynamic load (*2*).

Increasing construction costs combined with tighter constructon and maintenance budgets and a rapidly deteriorating highway infrastructure has prompted State Agencies to seek cost effective methods for increasing the service life of pavements. Pavement preservation, according to the American Association of State Highway and Transportation Officials (AASHTO), is a planned strategy of cost-effective treatments to an existing roadway system that preserves the system, retards future deterioration and maintains or improves the functional condition of the system without significantly increasing structural capacity. The application of a preventative maintenance treatment at the proper time provides a cost effective alternative that typically extends the serviceability of the pavement until the time when a corrective (or rehabilitative) treatment is needed. Studies have shown that any delay in preventative maintenance directly increases the quantity and severity of pavement defects, consequently resulting in higher costs over time (*3*).

Typically VTrans has employed common preventative maintenance treatments (PMTs) such as bituminous crack fill sealant, chip seal, micro-surfacing, slurry seal, cape seal, fog seal, paver placed surface seal, ultra-thin bituminous overlay, cold milling and bituminous overlays, and hot-in-place bituminous overlays. These treatments although have proven to be fairly effective, their cost can be fairly expensive depending on the treatment and roadway type. The average winning bid price was approximately $1.6 million to treat an approximate average of 12 miles of state maintained highways from 2009 to 2011. State transportation maintenance operations are investigating ways to repair deteriorated roadways at lower costs.

VTrans Operations Division contracted with ST Paving located in Waterbury, VT through a Category II Maintenance Rental Agreement (CAT II MRA) to address several distresses along four sections of roadway in central Vermont in a cost-effective manner. The goal of the project using the CAT II MRA was to eliminate water penetration and stop further failures, repair and improve the ride, and extend the service life of the existing pavement. These goals are intended to improve safety in these areas by:

- Eliminating water retention and hydroplaning;
- Reducing roughness for cars and bicyclists; and
- Eliminating snow retention thus reducing the amount of salt needed for winter maintenance to clear the roadways.

This update summarizes all surveillance and testing methods, data collection results, and associated findings to date.

LOCATION

The maintenance techniques was utilized at the following locations:

- US Route 2 – Beginning at the Middlesex Maintenance Garage at MM 0.0 in Middlesex and extending easterly 3.2 miles.
  - 114,580 linear feet of cracks and ruts.
- US Route 2 – Beginning at the intersection of VT Route 100 and extending easterly approximately 2.8 miles.
  - 14,113 linear feet of cracks and ruts.

COST

Material, labor, and equipment costs incurred were paid for under the District paving program funds. According VTrans Operatons, the total repair was not to exceed $250,000.00. Final costs totaled $244,000.

CONSTRUCTION

The repair was implemented between May 21st, 2012 to May 25th, 2012. Research personnel were onsite to document the process in each test site location.

Repair crews used the following process in a continuous The work was completed through a continuous process where the:

- Cold-planed at variable depths at a width of 40 inches;
- Swept;
- Applied a rapid setting (RS-1(h)) emulsion tack coat;
- Paved 40 inches at variable depths using a paving skid box and then
- Rolled for compaction.

MONITORING

Pre-Construction

Sections of US Route 2 have a concrete base underneath the pavement layers. To accurately evaluate the repair process, four two hundred foot test sections were chosen along US Route 2 to quantify existing distresses including cracking and rutting. Preexisting site conditions are shown in Figures 2 and 3 below.

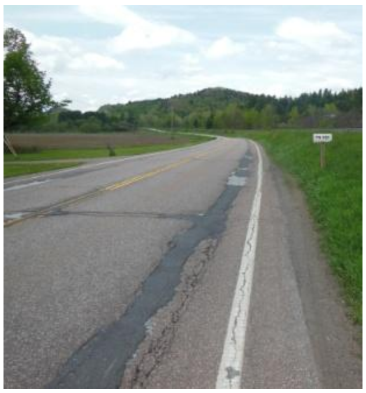

Figure 2: Test Site 2 looking WB.

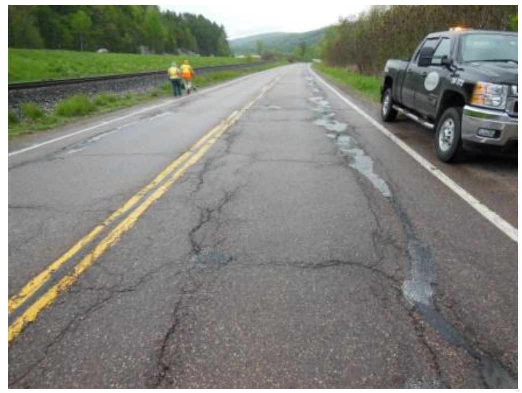

Figure 3: Test Site 3, looking EB.

Construction

During construction Research personnel was onsite during the rehabilation of each test site. Site conditions and construction activities were monitored and documented. Ruts were measured in between the cold planing and paving processes. The cold-planing and repaving process was free of any troubles. The pavement type used was a 50 blow Marshall hot mix asphalt. The repair process is shown in Figures 4-11 below.

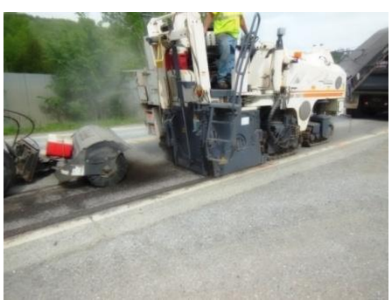

Figure 4: Cold planing and sweeping.

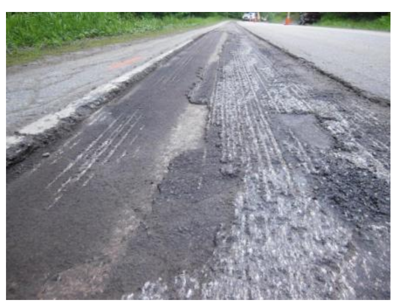

Figure 5: After cold planing.

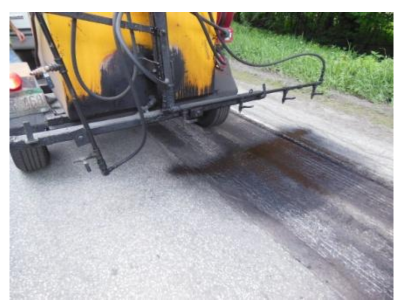

Figure 6: Spraying emulsion tack coat.

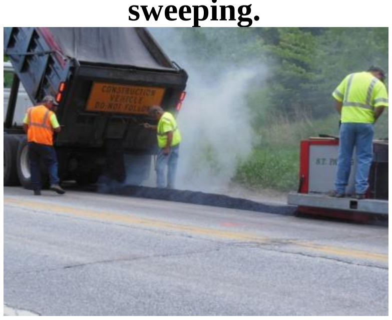

Figure 7: Paving.

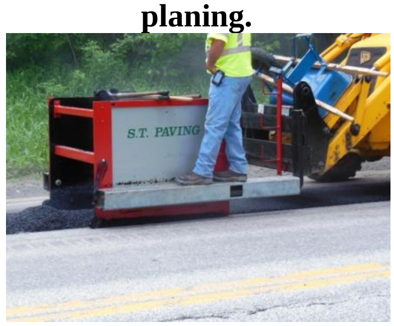

Figure 8: Paving Skid Box.

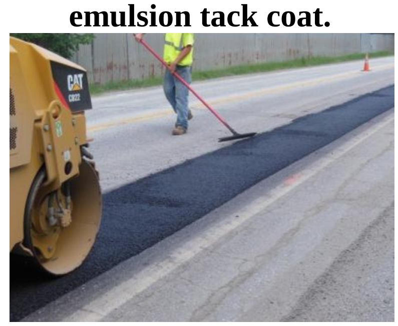

Figure 9: Squeegee and Compaction.

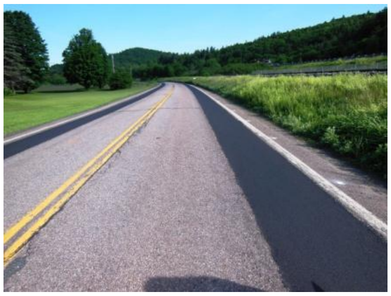

Figure 10: TS 2, Looking WB.

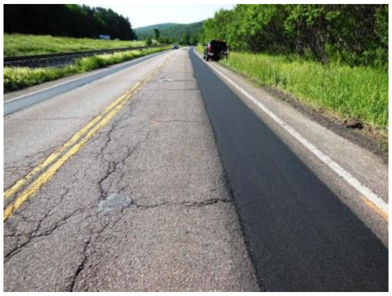

Figure 11: TS 3, Looking EB.

1st Annual Site Visits

The site was visited in March 2013 and July 2013 to evaluate the repair and measure rutting in each test site. Photographs and general observations were made at each visit. Test sites 2 and 3 are shown in Figures 12-15 below. Figures 12 and 13 depict each test site in March 2013 and Figures 14 and 15 show each in July 2013.

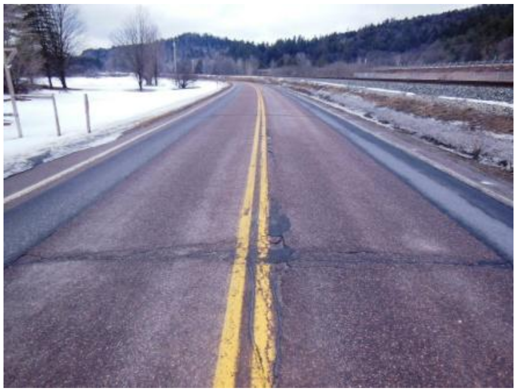

Figure 12: Test Site 2, looking WB.

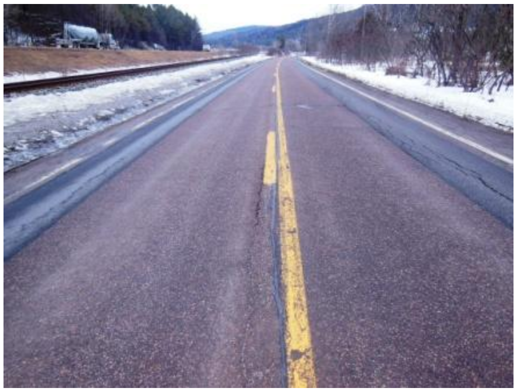

Figure 13: Test Site 3, looking EB.

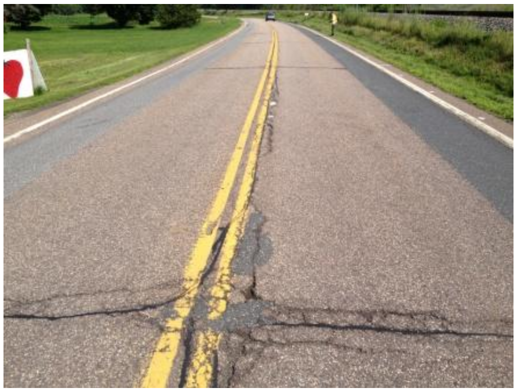

Figure 14: Test Site 2, looking WB.

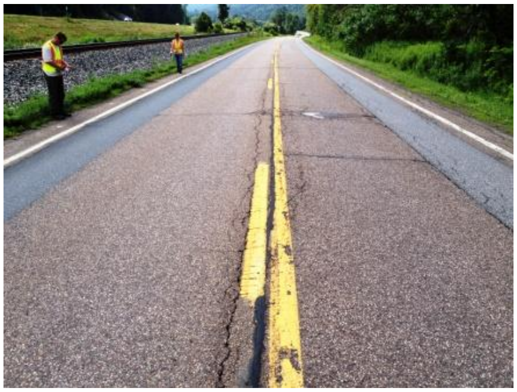

Figure 15: Test Site 3, looking EB.

DATA ANALYSIS

When comparing pre-treated measurements to those after the rebilitation, one could see that there was a varying degree of effectiveness. In some of the measurements which were taken in 50 foot increments, there did not seem to be a direct initial improvement in rutting after rehabilitation. Mostly, this was due to the repair being completed in the most distressed area in each lane and the preexisting data was collected using the standard method of measuring ruts in the middle of each wheel path. The initial rutting in places exceeded 40 inches in width. When averaged over the length of the test site; however, the data did show that the treatment was effective overall. Table 1 below shows the average readings for each test site at the following intervals: prior to repair, after paving, in March 2013, and July 2013.

Table 1 Average rutting results.

Test Section Locations			Pre-Treatment		After Paving, 6/1/12		3/1/2013		7/18/2013	
Test Site	Begin MM	End MM	EB R WP	WB R WP	EB R WP	WB R WP	EB R WP	WB R WP	EB R WP	WB R WP
TS 1	2.78	2.82	0.6	0.55	0.375	0.3	0.425	0.275	0.35	0.275
TS 2	2.2	2.34	1.025	0.7875	0.375	0.0125	0.175	0.275	0.65	0.2
TS 3	2.35	2.39	1.05	0.7625	0.2875	0.0625	0.4	0.2	0.375	0.2
TS 4	2.96	3	0.1125	2.1375	0.1875	0.0125	0.2	0.275	0.25	0.325

FOLLOW UP

The test sites will be evaluated on a biannual basis in the summer and winter months until the summer of 2015. Photographs, cracking and rutting data, and general observations will be recorded. Pavement Management Unit will collect IRI and Rutting data annually.

REFERENCES

1. SHRP (1993). "Distress Identification Manual for the Long-Term Pavement Performance Project." SHRP-P-338. Strategic Highway Research Program. National Research Council. Washington D.C.

2. Ponniah, Joseph E. and Kennepohl, Gerhard J. "Crack Sealing in Flexible Pavements: A Life-Cycle Cost Analysis." Transportation Research Record 1529. pp. 86-94.

3. Galehouse, Larry P.E., L.S. "A Pavement Preservation Maintenance Program." AASHTO Innovative Highway Technologies. 2/22/2007. http://leadstates.transportation.org/pp/PP_maintenance.stm.