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Maine Department of  
Transportation  
**Transportation Research  
Division**

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**Final Report 03-09**  
*Shoulder Rehabilitation Using Portland Cement and  
Recycled Asphalt Pavement  
Winslow, U.S. Route 201*

*April 2007*

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# Transportation Research Division

## *Shoulder Rehabilitation Using Portland Cement and Recycled Asphalt Pavement*

### Introduction

Maine has hundreds of miles of roadway originally constructed with Portland Cement Concrete that now are covered with Hot Mix Asphalt overlays. In 2001 the Maine Department of Transportation utilized an experimental construction technique on one of these PCC highways. The project was a rehabilitation and resurfacing project located in Winslow. In an effort to provide a more durable roadway, recycled materials were used in an innovative way. The project utilized Portland cement, together with reclaimed asphalt pavement (RAP) milled from the highway, together with new aggregate to reinforce and stabilize road shoulders adjacent to the existing old concrete slabs. The goal was to strengthen the shoulder adjacent to the existing concrete slabs and widen the travel lanes to prevent future premature deterioration in the shoulder. Figure 1 shows the project location. In this report the mixture of pavement grindings (RAP) and Portland cement material will be referred to as RAP/PC blend.

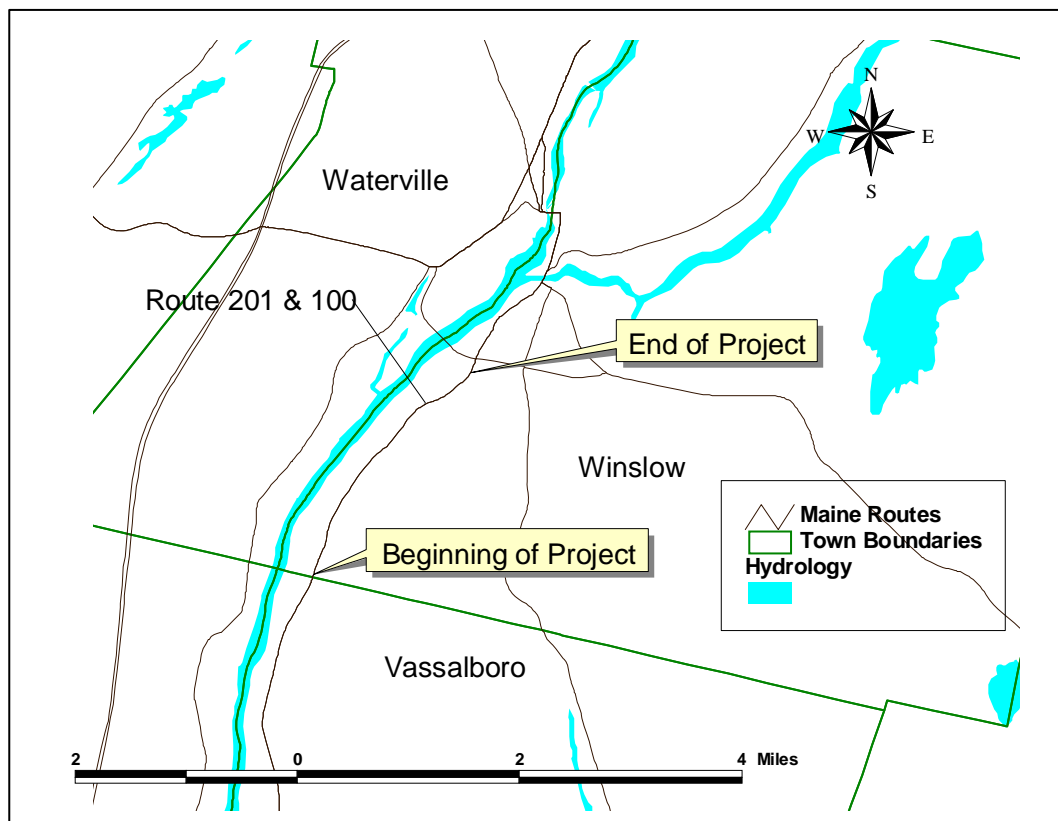


Figure 1. Location Map

This report is the final report on this project. Reference is hereby made to the construction report dated October 2003 for construction details and specifications that were used for the RAP/PC blend as well as photos of the construction process.

### **RAP/PC Material Quantity and Cost**

The project involved the placement of approximately 12,327 square meters of RAP/PC blend. The specified percentage of cement was  $4 \pm 1\%$ . The actual cement percentage achieved was 5.8%. Maximum RAP size was 37.5 mm. The mix was placed 1200 mm wide, in two lifts over a 300 mm gravel base. Total depth of the RAP/PC blend was 225 mm deep. The final average composition of the blend was: 62.1% RAP millings, 9.5% stone, 22.7% sand, and 5.8% cement. Anticipated core strengths were around 400 psi, however with the slightly higher cement content, cores tested at an average of 900 psi.

The total cost for this project was a little over \$1.2 million, for 3.11 miles of highway, or approximately \$389,400 per mile. The cost for the shoulder material was \$17 per square meter, which totaled \$209,559 for the whole project. The extra material cost per mile for this treatment was about \$69,382 or 18% of the project cost.

### **Performance**

The following photos show how the shoulders have held up over the last 6 years. The only pavement cracking in the shoulder area occurs near the old joints in the old concrete slabs. Almost no longitudinal cracking or fatigue cracking has occurred on the shoulder itself. This is in dramatic contrast with the section of U. S. Route 201 immediately south from this project. That section is a 4.5 mile section in the town of Vassalboro, which was paved in 1997 & 1998.











As a comparison the following photos were taken of the Vassalboro section of U.S. 201, immediately south of the Winslow project. The Vassalboro section was treated with a medium resurfacing of the travel way in 1997, and the shoulders were subject to a rehabilitation. The shoulders were paved the next year (1998) with a Level 2 repaving. There is three years difference, therefore, in the age of these shoulder pavements on the two projects. The photos below show that the shoulders on the Vassalboro project have areas where extensive cracking and breakouts have developed.



















## Conclusions and Recommendations

The experimental construction technique did successfully stabilize the shoulders. If shoulder preservation and stabilization is determined to be a major goal in the design of a project, and the extra cost is considered worthwhile, then RAP/PC should be considered a viable alternative. Consideration needs to be



given to the contractor's ability to produce the material, as this project required considerable ingenuity and resourcefulness on the contractor's part in order to mix and place the material successfully.

The total project cost for the Vassalboro section was a little more than \$625,000 for the 4.5 mile section. This translates into about \$139,000 per mile. The two projects contrasted in the photos above cannot realistically be compared on nominal cost basis due to escalation of pavement costs and different economic factors in the intervening 3-4 years between the project bids.

It is apparent, however that the Vassalboro section has deteriorated more rapidly than the section treated with RAP/PC. The shoulder treatment has outperformed the shoulders on the nearby section that was built 3 years earlier. From that standpoint, it has been a successful technique. It is likely that the few troublesome areas on this project could have been prevented with more extensive drainage work. In addition, methods to prevent longitudinal cracking, such as pavement reinforcing geo-synthetics may have helped deter the longitudinal and transverse cracking at the edges of the old concrete slabs. (See Research Report 99-11, **Innovative Solutions to Buried Portland Cement Concrete Roadways**, Final Report, March 2005, available on the Transportation Research Website at:

<http://www.maine.gov/mdot/transportation-research/completed-projects.php>

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