



Transportation Research Division



Technical Report 05-07

*Utilizing a Hot Applied Snowmobile Crossing
Mat to Eliminate HMA Abrasion*

Second and Third Interim, December, 2008

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Introduction

Maine has 13,200 miles of picturesque snowmobile trails that cover the entire state from Aroostook County in the north to York County in the south. Tourists have been traveling to the state to enjoy the well groomed trails and warm greetings for many years. During the winter season, the number of snowmobile registrations range between 122,000 and 77,000 dependent on the amount of snowfall and length of season. The Interconnected Trail System (ITS) and connecting trails represent roughly 3,000 miles of the states trail system. An additional 10,000+ miles of trails crisscross the ITS connecting the more than 285 snowmobile clubs around the state. The ITS was created by utilizing discontinued rail road beds and timber logging roads and a number of trails follow existing power lines. In addition, many trails are cut through the woods by the more than 30,000 Maine Snowmobile Association members and individual club members who also maintain the entire trail system to ensure that all who use the trails have a safe and enjoyable ride.

Problem Statement

Many snowmobile trails intersect with Maine State Highways. The number of snowmobiles that cross a State Highway is dependent on the type of trail. ITS trails have the majority of snowmobile traffic followed by connecting trails. When a snowmobile crosses the highway the carbide blades on the skis abrade a portion of the pavement. The amount of abrasion is proportional to the number of snowmobiles crossing the highway. A typical Hot Mix Asphalt wearing surface layer is between 1.25 and 1.5 inches in depth and snowmobiles at high traffic intersections can scour thru the wearing surface in as little as three years. In an effort to reduce or eliminate pavement wear the Department of Transportation resurfaced three high volume snowmobile crossings with Cleanosol E4190-35 Thermoplastic Snowmobile Crossing Material.

Location

Three snowmobile crossings in Aroostook County were selected to apply the snowmobile crossing material. Figure 1 contains a map of two experimental snowmobile crossing locations, one in the city of Bridgewater at the intersection of US Route 1 and ITS 83 and another in the city of Mars Hill at the intersection of US Route 1 and ITS 83A. The third crossing and a Control Section is displayed in Figure 2 and are located in the city of Presque Isle. The experimental crossing is at the intersection of State Route 167 and Connector 47. The Control Section is located at the intersection of State Street and Connector 47. All three experimental crossings and the Control Section have a high volume of snowmobile traffic.

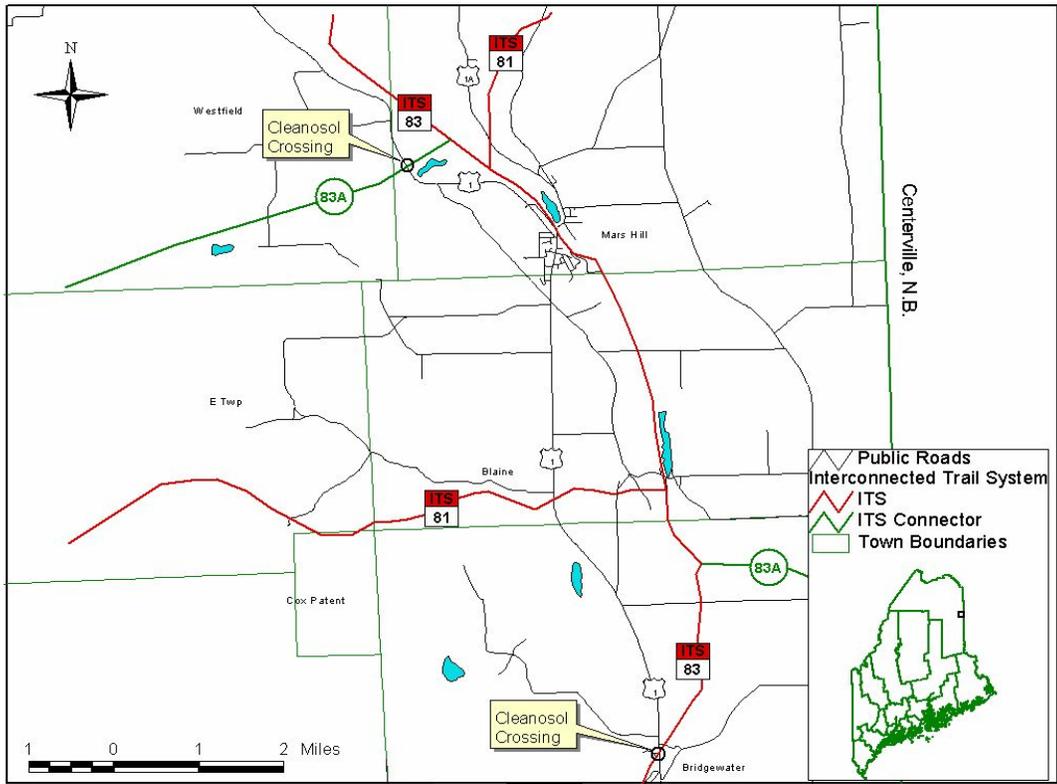


Figure 1. Bridgewater and Mars Hill Snowmobile Crossings

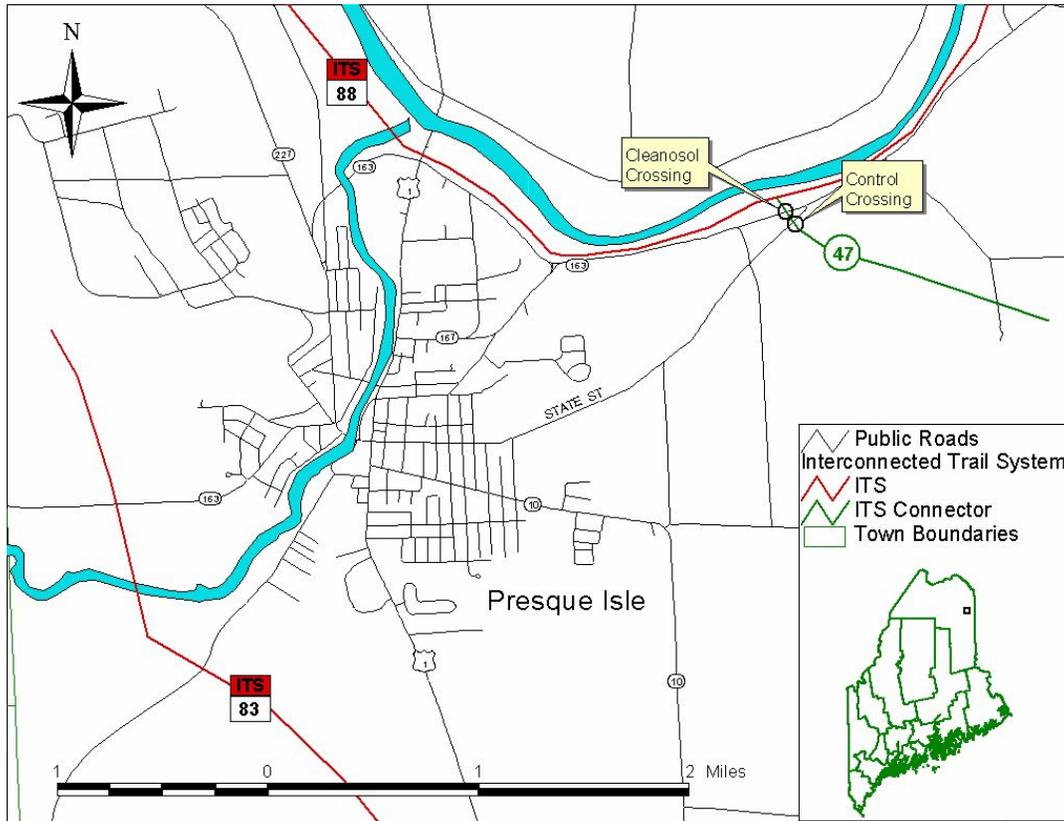


Figure 2. Presque Isle Snowmobile Crossings

Materials

Cleanosol E4190-35 Thermoplastic Snowmobile Crossing Material was utilized to protect the pavement from abrasion. Clark Highway Services from Lake City, Michigan were contracted to place the material. Material Safety Data Sheets state that at normal use E4190-35 is not classified as health hazardous is not combustible and is not considered harmful to the environment. The material is applied in three layers at a minimum depth of 0.09 inches per layer and at a temperature between 380° F and 420° F. Silica sand is spread on the surface of the hot mat to improve traction and bonding between layers. The material is colored gray to blend in with the surrounding pavement.

Construction

For Construction information, please refer to the Construction and First Interim Report dated August, 2007.

Evaluation

The experimental snowmobile crossings and control crossing were inspected on August 21, 2007 and October 8, 2008.

Presque Isle, State Route 167 Crossing

The State Route 167 crossing in Presque Isle began showing significant signs of wear in the 2007 evaluation and those signs were even more pronounced during the 2008 inspection.

In 2007, the leading edge of the mat in both directions had been worn approximately nine inches into the mat between wheel paths and at the center of the roadway (Photo 1). This wear is the result of snow plowing. In 2008, this wear had extended more than 12 inches into the Cleanosol material (Photo 2).



Photo 1: 2007 Leading Edge Wear



Photo 2: 2008 Leading Edge Wear

Six small areas where the Cleanosol mat had worn down to the Hot Mix Asphalt (HMA) surface were identified in 2007. These areas were approximately the size of tennis balls. It is possible these areas originated as bubbles at the time of placement and were sheared off from plow wear (Photo 3).

Areas of exposed HMA became much more prevalent in 2008. The north end of the crossing is worn most significantly and this wear may be from snowmobiles accelerating on the uphill grade to quickly cross the highway (Photo 4).

Photos 3 and 4 show these conditions.



Photo 3: 2007 Mat Deterioration



Photo 4: 2008 Mat Wear at North End of Crossing

Overall, this section is not performing as well as the other two sections. Approximately 15 to 20 percent of the crossing surface area has been eroded to the HMA. The uphill orientation of the north approach to the crossing appears to be a cause for this excessive wear. Additionally, the shoulders at this site are not as wide as the other sites; limiting site distance for crossing snowmobiles and prompting operators to inch into the roadway or accelerate quickly to cross. Photo 5 provides a south to north view depicting the additional wear at the north end of the crossing.

Anecdotal information gathered from area residents indicates this crossing may be subjected to significantly higher snowmobile traffic volumes than the other two crossings.



Photo 5: 2008 South to North view.

Presque Isle, State Street Control Crossing

As stated in the Construction and First year Interim report; it is unfortunate this control section was not provided a new wearing surface at the inception of this research.

The 2007 inspection indicated that most, if not all of the crossing appeared to have been patched with HMA. A small, softball size area was identified as being worn down to the HMA binder (Photo 6).

Rutting, throughout the center of the crossing and in the direction of snowmobile travel has been patched (Photo 7). Additional slices, cut into the surface by snowmobile skis are visible in Photo 8.



Photo 6: 2007 Softball Sized Worn Area



Photo 7: 2007 View North to South



Photo 8: 2007 Pavement Slices/Deformation

The 2008 evaluation found several patched areas and areas in need of patch. As with the Route 167 experimental crossing, the north end of this crossing has an uphill approach and appears to be sustaining the most damage. Patched areas at the north end of the crossing are visible in Photo 9. Areas in need of patch are visible in Photo 10.



Photo 9: 2008 Patched area at North End



Photo 10: 2008 Areas in Need of Patch

The Control section continues to sustain damage from snowmobile traffic. Each year, more and more wearing surface is eroded requiring additional patch material. Damage near the pavement edge, caused by accelerating snowmobiles is an on-going problem. To date, it appears maintenance crews patch this section at least once annually.

Mars Hill, US Route 1 Crossing

The 2007 evaluation found this section to be in generally good condition. As with the other sections, leading edge plow wear has progressed as much as 12 to 15 inches into the Cleanosol mat between wheel paths and at the center of the roadway (Photo 11). Photo 12 shows the progression of leading edge wear at the time of the 2008 inspection. This wear had extended 30 to 36 inches into the mat area.



Photo 11: 2007 Leading Edge Wear



Photo 12: 2008 leading Edge Wear

Small pit holes and gouges were identified throughout the crossing area in both the 2007 and 2008 inspections. It is believed this damage is being caused by the snowmobile track spikes or studs and the carbide inserts attached to the snowmobile skis for steering control. When the mat area warms from traffic and sunshine, the material becomes more pliable, allowing the studs to penetrate the mat area and carbide inserts to gouge the mat. Photos 13 and 14 show this damage.



Photo 13: 2007 Pit Hole Damage



Photo 14: 2008 Pit Hole and Gouge Damage

Photo 15 shows three typical track studs. An average track has between 96 and 144 studs. Photo 16 shows the carbide inserts attached to the snowmobile skis.

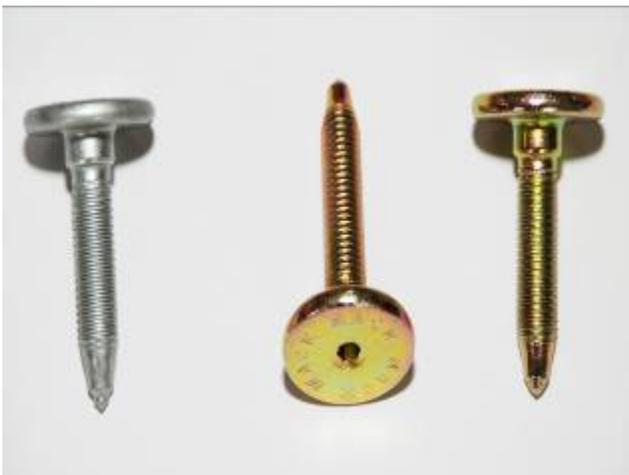


Photo 15: Track Studs (1.25 to 1.50 inches)



Photo 16: Carbide Inserts

After three years of exposure, this section continues to perform quite well. The Cleansol product remains mostly intact in the areas of primary snowmobile travel. It is uncertain how the snowmobile traffic volume of this section compares to the other sections. Photo 17 is an overall view of the section, looking in the easterly direction.



Photo 17: 2008 View Looking East

Bridgewater, US Route 1 Crossing

For the 2007 and 2008 inspections, this section was found to be in good condition. Leading edge wear at centerline and between wheel paths in 2007 was approximately 6 inches (Photo 18) and extended to 12 to 15 inches in 2008 (Photo 19). This crossing is skewed at a 45 degree angle across the roadway. This may account for the minimal leading edge wear compared to the other two sections.

This section also had pit holes and gouges similar to the other sections (Photo 20). Numerous bubbling areas were identified in both evaluations. In 2008, several of these areas had been sheared off, leaving the HMA surface exposed (Photo 21).



Photo 18: 2007 Leading Edge Wear



Photo 19: 2008 Leading Edge Wear



Photo 20: 2007 Pit Holes and Gouged Areas



Photo 21: 2008 Sheared Bubble Areas

This section is performing well, with little or no visible wear to the Cleanosol mat. The experimental material is continuing to protect the HMA wearing surface. Snowmobile traffic volumes on this section are believed to be the second highest, with only the Presque Isle crossing seeing more traffic. Photo 22 shows a 2008 south to north view of the section.



Photo 22: 2008 South to North View

Summary

The experimental crossing mats in Mars Hill and Bridgewater are performing relatively well after three years of service. The experimental mat located in Presque Isle is not performing as well.

All three areas are showing signs of leading edge wear believed to be the result of snow plowing practices. Each section has visible pit holes and gouged areas believed to be caused by snowmobile track studs and carbide inserts attached to the snowmobile skis. These areas are more prevalent at each end of the crossing and less significant near the center of the roadway. This appears to be a result of snowmobiles accelerating from a stand still, to quickly cross the roadway.

The Presque Isle experimental crossing is showing significantly more wear than the other two sections. Approximately 15 to 20 percent of the mat has been eroded to the HMA wearing surface. This damage

may be attributed to high snowmobile traffic volume, narrow shoulders causing limited site distance and an elevated approach at the north end of the crossing. These conditions make quick accelerations necessary to safely cross the highway, contributing to the premature wear of the mat.

Unfortunately, no snowmobile traffic volume data is available for either of these sites. It is theorized that the Presque Isle experimental crossing is subjected to the most traffic because of the cities destination status for snowmobilers. The Bridgewater crossing is believed to have the second highest volumes because of its location directly on ITS 83.

The Presque Isle control site sustains annual damage that requires maintenance each spring. In the 2008 evaluation, it was noted that most of the HMA wearing surface had been replaced by patch material. As with the three experimental sites, the majority of damage is occurring at either end of the crossing where snowmobiles accelerate from a stopped position, to cross the highway.

For future installations of the Cleanosol product, a preliminary review should be completed at each crossing site to determine site specific features that may influence the wear life of the product. Criteria such as snowmobile traffic volumes, approach elevations, shoulder width and general site distance should be considered. The presence of these criteria may dictate the need to increase mat depth at certain areas within the crossing, including the approaches to enhance the life of the crossing material.

A visual evaluation will be completed on each of the crossings in 2009, with the Fourth Year Interim Report to follow.

Prepared by:

Brian Marquis
Transportation Planning Specialist
Maine Department of Transportation
219 Hogan Road
P.O. Box 1208
Bangor, Maine 04402-1208
Tel. 207-941-4067
e-mail: brian.marquis@maine.gov

Reviewed By:

Dale Peabody
Transportation Research Division Director
Maine Department of Transportation
16 State House Station
Augusta, Maine 04333-0016
Tel. 207-624-3305
e-mail: dale.peabody@maine.gov

With Assistance from:

Maine Snowmobile Association
PO Box 80, Augusta ME 04332
Tel. 207-622-6983
Fax. 207-622-7669
Web Site. <http://www.mesnow.com/>

Aroostook County Tourism
11 West Presque Isle Road
P.O. Box 779
Caribou, Maine 04736
Tel. 1-888-216-2463
Web Site. <http://www.visitaroostook.com/>