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MaineDOT

Transportation Research Division

Technical Report (09 – 2)

Evaluation of the Assaloni Plow and Material Spreader

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Introduction

In the fall of 2007, the Maine Department of Transportation (MaineDOT) entered into an agreement with Mog Implements, LLC of Charleston, South Carolina to evaluate the Assaloni Telescoping Plow (Model E9040/49) and the Assaloni Material Spreader (Model AV30). Mog Implements, LLC is a supplier of these products which are manufactured by Assaloni.Com S.P.A., located in Bologna, Italy.

The MaineDOT agreed to evaluate the equipment for one winter season and in turn provide information and feedback to Assaloni.Com relative to the Department's experience with the plow and spreader.

This was the first time Assaloni equipment would be installed on a truck other than a Mercedes Benz Unimog vehicle, in North America.

Several issues with both the plow and spreader during the 2007-2008 winter season made it practical to extend the evaluation period to include the winter of 2008-2009.

The general scope of this evaluation was to determine if the Telescoping Plow and Material Spreader might be valuable additions to MaineDOT's snow fighting fleet.

Potential Benefits/Features

It was speculated that the telescoping plow might perform in such a way as to eliminate the wing assembly currently in use on the Departments larger snow plow vehicles. With the extension fully deployed and the plow properly angled, the telescoping plow can clear approximately 13 feet 6 inches. Existing plows and wings in use by MaineDOT clear an identical width. The ability to switch the plow from left to right and the self-contained hydraulic system on the plow were also interesting features identified by MaineDOT staff.

Features of the material spreader MaineDOT personnel found intriguing included the 70 percent granular/30 percent liquid application capability and the auger material delivery system. MaineDOT has been applying material using the 70/30 combination on a limited basis since the winter of 2003-2004. The Department was introduced to the 70/30 method when evaluating a Schmidt-Stratos material spreader. MaineDOT has since purchased four Schmidt units and has also modified six of its existing hoppers to enable them to apply the 70/30 mixture. MaineDOT's existing equipment applies 70 percent of the requested application in granular form and 30 percent in prewetting liquid form. For example: a 300 pound application would include 210 pounds of granular material and 90 pounds of liquid prewetting material, typically salt brine. The Assaloni material spreader applies the 70/30 combination a bit

differently. For a requested application of 300 pounds, the Assaloni dispenses 300 pounds of granular material, complimented by approximately 90 pounds of liquid material.

Table I compares the different application options available with the Departments existing equipment and the Assaloni spreader.

Material Applied (Pounds)	Conventional Spreader Using 10 Gals./Ton	Modified Units and Schmidt Spreaders Using 30% Liquid	Assaloni Spreader Using 30% Liquid
Granular Salt	**300**	**210**	**300**
Gals. of Salt Brine	**1.5**	**8.6**	**8.6**
* Salt From Brine	**3.3**	**18.9**	**18.9**
Total Salt	**303.3**	**228.9**	**318.9**

Table I: 300 Pound per Lane Mile Application Breakdown

* Calculation Based on a 23 Percent Salt Brine Solution (Approximately 2.3 Pounds of Salt per Gallon)

A significant majority of MaineDOT's existing fleet utilize a chain system to deliver material to the back of the hopper. Approximately 20 units deliver material using a belt system. The uniqueness of the auger delivery system made it a very interesting feature.

The Assaloni spreader also has the option of applying material on a per mile basis, or as an area spreader. Area spreading is simply applying material on a square foot or square meter basis (ounces per square foot or grams per square meter), instead of linear distance (pounds per mile). Area spreading is used primarily in Europe, but some areas within North America are beginning to use this feature.

Equipment Installation

Installation of the plow and hopper was completed Monday, December 10th and Tuesday December 11th, 2007. Two MaineDOT Fleet Services Technicians and 1 Technician from Assaloni successfully completed the installations at about 7:30 Tuesday evening. The plow installation utilized a DIN plate fabricated by Assaloni. DIN plates are used almost exclusively by European manufacturers. This was the first exposure to the plate for MaineDOT personnel.

The hopper was also calibrated and a minimal amount of training was provided to the driver.

Overall, the installation went smoothly and even with the existence of a language barrier, an interpreter provided by Assaloni easily conveyed instructions from the Assaloni technician to MaineDOT technicians.

Several communications to discuss specifics of both the equipment and the truck, to which it was mounted, were completed in advance of the installation and were considered to be very beneficial.

Photos 1 through 4 show some of the plow and spreader installation procedures.

Photo 1: Hopper Being Readied for Installation

Photo 2: Control Box at Rear of Hopper

Photo 3: "DIN Plate" Bracket

Photo 4: Plow with extension deployed.

Methodology

The methodology developed for this research was not unlike most efforts at evaluating products in a real-world environment. MaineDOT would subject the equipment to winter conditions and provide a potential proving ground in which the plow and spreader would have to perform as well, or better than the existing equipment already in use by MaineDOT. Personnel operating and overseeing the equipment would be interviewed to gather feedback and data would be collected to identify any potential material savings that might exist from using the equipment.

Primary Plow Route Description

The Assaloni Plow and Spreader were primarily used on sections of Route 202 and Coldbrook Road in the town of Hampden during both the 2007-2008 and 2008-2009 winter seasons. This plow route was considered an excellent selection because it provided three varying characteristics representative of typical plowing conditions encountered by MaineDOT. The Coldbrook Road consists of a two lane – paved shoulder section (1.92 centerline miles) and a two lane non-paved shoulder section (0.52 centerline

miles). The Route 202 portion of this plow route consists of a two lane section with paved shoulders (2.37 centerline miles) and a 4 lane, interstate like section (1.09 centerline miles). In addition, the intersection of Coldbrook Road and Route 202 includes no fewer than 12 converging lanes and a slip ramp for westerly turning traffic onto Route 202, from the northerly section of Coldbrook Road (see Figure 1, below).

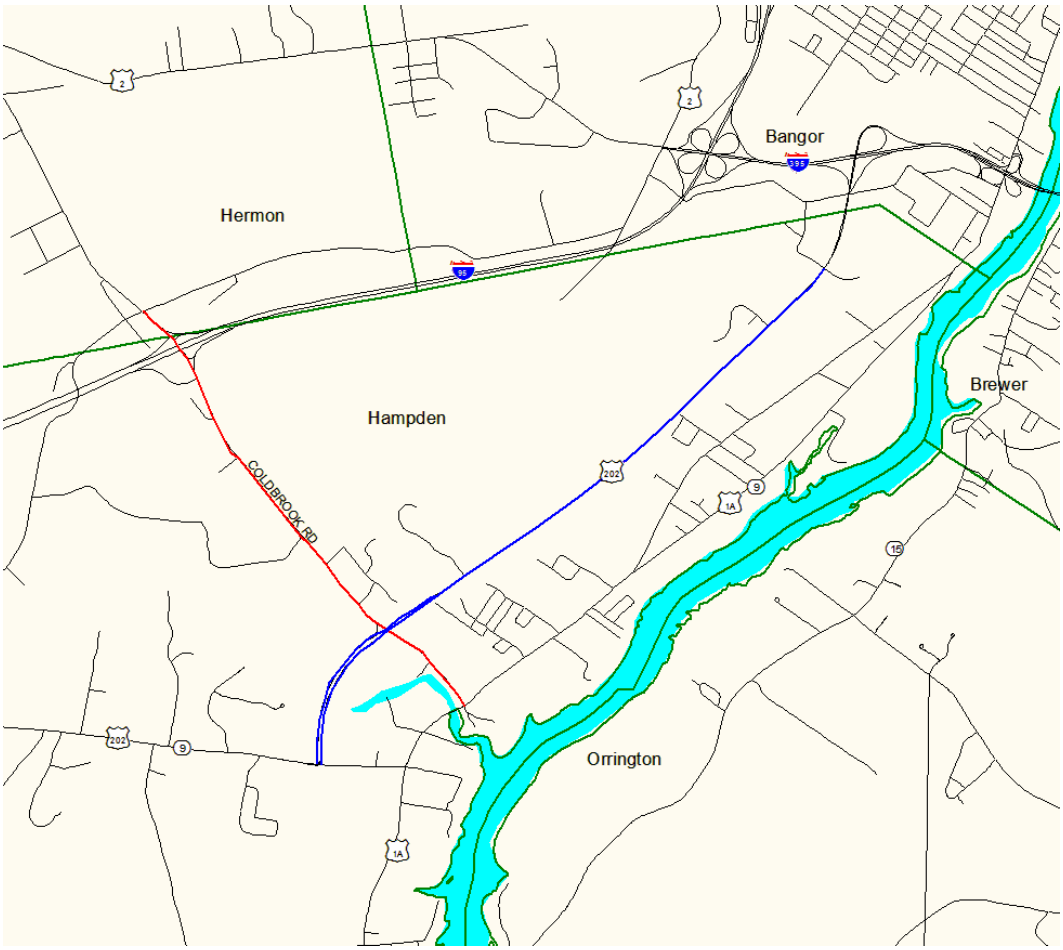

Figure 1: Plow Route Diagram

Discussion of Results

As stated above, this evaluation was originally scheduled to conclude after the 2007-2008 winter season. Mechanical issues with both the telescoping plow and material spreader necessitated the continuation of this evaluation into the winter of 2008-2009. Unfortunately, these issues persisted throughout the 2008-2009 winter season.

Below is a summary of the experiences, concerns and DOT personnel's comments for each of the two pieces of equipment.

Telescoping Plow (2007 – 2008)

After the initial installation on December 11th, 2007, the telescoping plow was immediately put into service. A light snow (2 – 4 inches) fell the evening of December 11th and the morning of December 12th.

Overall, the plow worked well during this first event except for very slow reaction time of the plow functions (raising and lowering, switching left to right and deployment of the extension).

Another light storm dropped 1 to 3 inches of snow beginning December 13th. For this event, the marker light attached to the driver's side of the plow broke away (see Photo 5). The telescoping portion of the plow also "froze" in the extended position. This was corrected by simply washing the packed snow from around the extension piece.

Discussions with Assaloni personnel determined this problem, along with the problem of slow plow functions, was likely caused by the incompatibility of the self contained electric hydraulic system on the plow and the electric system of the truck. European electrical systems typically operate using a 24 volt system. Vehicles in North America use a 12 volt system to operate their electrical components. While the 24 volt motor on the plow will operate using 12 volts, the motor produces less power, resulting in the slow functions and the inability to retract the extension.

A more significant storm began Sunday morning, December 16th and dropped 6 to 8 inches of heavy, wet snow. The snow changed to rain late Sunday evening and after several hours of rain, the temperatures dropped to well below freezing. This sudden change in temperatures, coupled with the wet, heavy snow, caused most the roads to be coated in approximately 1 inch of packed ice and snow. The plow route serviced by the Assaloni was no exception. The operator reported that the Telescoping plow did not cut, or scrape the packed snow as well as his conventional plow. In addition, a crank handle, used to adjust the lift wheel on the drivers side became dislodged and was lost (see Photo 6). A direct impact with a bridge joint also bent the plow at the mold board, near its center (see Photos 7 and 8). Significant vibrating was reported when the extension portion is positioned on the gravel shoulder at the south-easterly end of Coldbrook road.

At this point of the evaluation, it was determined the plow would be removed from the truck until representatives from Assaloni could return and address the problems being encountered.

Photo 5: Missing Plow Marker Light

Photo 6: Missing Wheel Lift Crank Handle

Photo 7: Plow Damage – Rear View

Photo 8: Plow Damage – Front View

The representatives from Assaloni returned to Maine on January 14th, 2008 in an effort to resolve the issues being encountered by MaineDOT.

Using a valve block provided by Assaloni, the hydraulic system was changed from the electro-hydraulic system to the existing system of the truck. This installation took less than 4 hours to complete and greatly increased the speed of the plow functions. An additional feature, enabling the driver to apply down pressure if needed, was also part of this repair. These changes took advantage of the existing truck hydraulic system and no additional changes to the system were required.

The marker light and crank handle were also replaced. The bend at the bottom of the plow was straightened by Fleet Services Technicians.

From this date until February 29th, the plow was used for 14 winter storm events. On February 29, the plow was removed from service because the plow blades had worn to termination. The polyurethane block on the extension to which the plow blades attach was also severely damaged from impact to a large pot hole associated with a catch basin (see Photos 9 and 10). This damage occurred while the plow was being operated using the down pressure option.

Photo 9: Damage to Poly Block - Rear View

Photo 10: Damage to Poly Block – End View

Overall, the operator was satisfied with the performance of the plow during this period. The operator indicated the intersection of Coldbrook Road and Route 202 was cleaned much faster with the telescoping plow. The quick switch option and the ability to position the plow perpendicular to the truck, creating a wider clearing path, allowed the operator to complete his plow route approximately 1 hour quicker than with the conventional plow.

It was noted that on two occasions snow banks had to be removed in and around the intersection because the telescoping plow did not allow the operator to push the snow back as far as he could with his conventional plow and wing.

The down pressure option enabled the plow to cut packed snow better. This did cause the blades to wear much faster.

The Din plate also enabled the operator to remove and mount his plow quicker than his conventional plow.

Telescoping Plow (2008 – 2009)

Before the plow was re-installed for the 2008-2009 winter, repairs to some of the damage incurred during the previous winter were completed. This work was performed by Viking-Cives USA at its Harrisville, New York facility. These repairs included the replacement of the poly block attached to the extension and straightening and "full length" reinforcement of the moldboard (see Photos 11 and 12).

Photo 11: Repaired Poly Block

Photo 12: Straightened/Reinforced Moldboard

The plow was returned to MaineDOT on January 16th and returned to service. New plow blades were also installed at MaineDOT's Bangor facility.

For this winter season, a new driver operated the equipment. The plow was used for approximately 8 storm events. The plow was removed from service in late February because of damage to the moldboard caused by an impact to a bridge joint while the plow was operating using the down pressure feature. This damage occurred at the same position on the plow as during the 2007-2008 evaluation (see Photos 7 and 8 above). This damage caused a windrow of snow to be left on the roadway.

The operator indicated that the intersection could be cleaned faster and that the down pressure feature allowed the plow to cut and scrape hard packed snow and ice better than the conventional plow. He liked the ability to see the entire plow in front of the truck and not having to guess where his wing was located. He also found it easier to maneuver the truck in heavy traffic situations.

Material Spreader (2007 – 2008)

As with the plow, the Assaloni material spreader was put in service on December 11th, 2007. For this initial event, both the operator and his supervisor were impressed with the way in which the hopper performed. They did voice concerns that the unit did not appear to be using the correct amount of liquid.

A second storm event occurred December 13 and again the hopper performed well, except for the liquid issue mentioned above. Approximately 30 gallons of liquid was used for 4 cubic yards of salt. Several checks were performed on the hopper and no immediate reason for this disparity was identified.

On December 16th, a more significant storm dropped 6 to 8 inches of heavy, wet snow. During this storm, the liquid issue persisted and the hopper stopped functioning. It was later determined that a feature on the trucks hydraulic system, designed to shut off the hydraulics when the fluid level is low, had malfunctioned and stopped sending fluid to the hopper.

The hopper was removed from the truck after this storm because the liquid issue was considered significant enough that it impacted the overall ability to maintain the road in a desirable condition.

Assaloni representatives returned on January 14th, 2008 and replaced the Control Box located in the cab of the truck. This change appeared to correct the liquid issue. The hopper was utilized during a storm on the 14th and both the Assaloni Technician and MaineDOT personnel agreed it was working well.

From this point until February 22nd, 2008 the hopper was used for approximately 12 storm events. Although the issue with the liquid volume had been corrected, additional problems surfaced. On numerous occasions, the spinner would stop working. This occurred when the operator put the system in the “pause mode” and the spinner would not re-start. This problem, along with other similar problems continued and on February 8th, a dialogue was started with Assaloni representatives in an effort to trouble-shoot these issues. Most of the systems power related wiring was checked and it was determined that the issue was most likely with the power supply. As mentioned with the issues relating to the Telescoping Plow, European manufacturers utilize a 24 volt system, while North American systems use a 12 volt electrical system. Additional electrical system checks were completed and a third Control box was installed. These efforts did not resolve the problems.

MaineDOT continued to use the hopper until the end of February even though the problems persisted and at that time it was removed from the truck.

The operator and his supervisor continued to stress that when the system worked properly, they were very impressed with the results. They particularly liked the ability to treat multiple lanes with a single pass. For several smaller storm events (less than 1 inch of snow), the unit was used on several additional plow routes successfully.

Material Spreader (2008 – 2009)

In November, 2008, before the hopper was put into service, a technician from Mog Implements reviewed the workings of the hopper to determine what might be done to remedy the issues encountered in 2007-2008. With the help of an Assaloni representative, the technician determined that a relay intended to send power to a solenoid that operates the hopper was not installed during the original installation. The proper relay could not be purchased locally, so the technician was directed to install a switch in the cab of the vehicle that would send the power directly to the solenoid when turned on. Additional checks were completed to the electrical system and it appeared the hopper was working properly.

The hopper was used for several storms in December with only minimal problems. On several occasions the spinner stopped working. This was resolved by simply powering down and restarting the control box. With the exception of this issue, the operator and his supervisor were very satisfied.

In early January, this problem became more prevalent. To maintain the hopper in working order, the operator would put the system in "manual mode" by adjusting the solenoids at the back of the hopper.

The Mog Implements technician returned and once again completed a series of checks on the electrical system. At this point, the technician concluded that the problem was most likely in the computer control at the rear of the hopper (see Photo 2 above). The intermittency of the problem made trouble shooting very difficult. It is theorized that any damage that may have occurred to the computer control may have been caused by the initial failure to include the relay or switch discussed above.

MaineDOT continued to try and work with these issues until they became so persistent that the un-reliability of the hopper was impacting the overall condition of the plow section. The hopper was removed from service at the end of February.

Conclusions/Recommendations

As stated in the Introduction portion of this report, the installations of the Assaloni Telescoping Plow and Material Spreader were the first in North America on a non-Unimog vehicle. Many of the issues encountered during this evaluation are believed to be a function of this initial effort. The incompatibility of the 24 volt European system and the 12 volt North American system is considered to be the most significant issue to overcome. Additionally, North American hydraulic systems are designed to operate most efficiently with higher volumes, while European systems operate best with higher pressures. This issue has been present with all of MaineDOT's previous efforts to evaluate European manufactured equipment.

The two operators and supervisor associated with this evaluation were interviewed in early May, 2009.

Each of these individuals indicated that the hopper performed very well when working properly. The multi-lane application and 70/30 mixing were both seen as advantages over conventional spreaders. The auger system was considered comparable to the belt delivery systems used on several of the Departments existing hoppers.

The Telescoping Plow performed well in some applications and less so, in others. While it made clean-up at the intersection of Coldbrook Road and Route 202 faster, additional equipment had to be deployed to

the plow route on two occasions to push back snow banks. The operators and supervisor believe the plow may have been subjected to plowing conditions that were too rigorous for its design. The Telescoping plow was designed primarily for high speed, highway conditions.

Much of the damage to the plow occurred while the down pressure feature was being utilized. Each operator indicated they used the down pressure feature about 60 percent of the time they were plowing. Both indicated they used maximum down pressure when it was engaged. One suggestion was to possibly provide some means to monitor the actual down pressure being applied. This might minimize damage and also extend the wear life of the plow blades.

The supervisor indicated that he believed the plow would work well on the interstate system and ramp system throughout the city of Bangor. The ability to adjust the plow perpendicular to the truck and increase the clearing width makes it particularly appealing for plowing ramps during significant storm events.

Problems encountered throughout this evaluation must be resolved before consideration is given to adding this equipment to MaineDOT's fleet. If these issues are corrected, MaineDOT staff believes the Assaloni Telescoping Plow and Material Spreader would be valuable additions to its snow fighting efforts.

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