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Maine Department of Transportation

Transportation Research Division

Technical Report 05-1

Evaluation of the Schmidt-STRATOS Spreader

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Introduction

In the fall of 2004, the Maine Department of Transportation (MAINEDOT) entered into an arrangement with Schmidt International of St.Blasien, Germany to evaluate Schmidt's STRATOS material spreader. The MAINEDOT agreed to evaluate the equipment for one winter season and in turn provide information and feedback to Schmidt International relative to the Department's experience with the STRATOS spreader.

Scope

The scope of this evaluation included a focus on several features of the STRATOS, as well as determining if the recommended seventy percent granular/thirty percent liquid combination was a viable option for typical storm conditions encountered within the State of Maine. Also of interest to the manufacturer was the ease of installation, ease of operation and general opinions as to the quality of their product.

Methodology

The methodology of this evaluation included a relatively straight forward approach; simply subject the STRATOS spreader to "real world" winter storm conditions experienced by the MAINEDOT and document the results.

Analysis

Utilizing material usage information developed by an inventory tracking system, comparisons were made in an effort to determine if material savings were present while using the STRATOS spreader. Unfortunately, the precision of the data collected for inventory purposes is not accurate enough to make an absolute comparison with the standard spreader typically operated by the MAINEDOT. Comparisons were made nonetheless using the available information.

About the STRATOS Spreader

One of the potential advantages to using the STRATOS spreader is the ability to pre-treat the granular salt with a significantly higher amount of liquid material. MAINEDOT's conventional spreaders are limited to a maximum rate of 10 gallons of liquid material per ton of granular material. The STRATOS machine is capable of applying approximately 55 to 60 gallons per ton of granular material. This additional liquid, coupled with the granular salt, creates an end product that has the consistency of slurry. This slurry appears to stay in the travel lane much better than the granular salt treated with minimal liquid.

It is important to note that the MAINEDOT is currently using a salt with large particle size. To best achieve the desired slurry consistency, the Department should continue to pursue the possibility of procuring a much finer salt for use with the STRATOS equipment.

One issue raised by both the operator and supervisor was with the STRATOS equipment recording material usage and distance in Metric units. This was discussed with the manufacturer and all future units will record using the Imperial system of measurement.

The STRATOS spreader uses a different strategy with respect to application rates than the spreaders and controllers currently being used by the Department. This difference immediately produced a material savings of nearly 25 percent even though the operator and his supervisor were initially unaware this difference existed. When requesting an application rate with existing equipment, operators dial-in the rate of granular material required and the liquid is applied at a rate of up to 10 gallons per ton automatically. For example, a requested rate of 400 pounds per lane mile with conventional units consists of 400 pounds of granular salt and two gallons of brine or 4.6 pounds of salt. A 400 pound application request using the STRATOS spreader consists of 280 pounds of granular salt and 120 pounds of salt brine. At an approximate weight of 10.5 pounds per gallon, this equates to about 11.5 gallons of brine which is approximately 26.2 pounds of salt.

This difference is best explained in Table I below.

TABLE I

400 Pounds per Lane Mile Application

Conventional Spreader

Pounds of Granular Salt Applied	400
Gallons of Salt Brine Applied	
At 10 Gallons/Ton of Granular Salt	2
* Pounds of Salt Applied as Salt Brine	4.6
Total Pounds of Salt Applied Per Lane Mile	404.6

Schmidt-STRATOS Spreader

Pounds of Granular Salt Applied	280
Gallons of Salt Brine Applied	
At 30 Percent of Total Application Rate	11.4
* Pounds of Salt Applied as Salt Brine	26.2
Total Pounds of Salt Applied Per Lane Mile	306.2
Savings per Lane Mile	**98.4 Pounds**

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

Even with this 25 percent savings of material, the operator and his supervisor reported superior melting and better traveling conditions in the STRATOS treated lane compared to lanes treated with conventional spreaders.

Installation

Installation of the STRATOS spreader was completed at the Department's Fleet Services facility in Bangor. This installation took approximately 6 to 8 hours to complete. Fleet Services personnel involved with the installation indicated there is "much less wiring" and "fewer hydraulic connections" than when installing the conventional systems. The hydraulic system is self–contained on the spreader and requires only two hydraulic fittings. Conventional systems require a minimum of three fittings. The only issue to arise during the installation was with the incompatibility of the speed sensor sending unit on the vehicle and the STRATOS receiving unit. This condition is related to the age of the vehicle and should not be an issue with future installations on newer trucks.

It is also interesting to note that at no time was the hydraulic system overtaxed by the amount of material requested or the corresponding travel speed of the truck. With many installations of experimental equipment over the past several years, the Department has experienced instances where the existing hydraulic systems on the vehicles were not capable of providing adequate hydraulic flow or pressure to operate the equipment.

Numerous times throughout the installation, MAINEDOT personnel commented on the overall quality and simplicity of the STRATOS spreader.

Equipment Features of the STRATOS Spreader

Spinner Assembly

Photo 1

Photo 2

A spinner or disc located at the back and center of the hopper (photo 1) spreads the material in a "ribbon–like" pattern. This pattern can be increased to treat two lanes when desired. The disc can also be positioned to treat closer to the centerline when necessary, minimizing the loss of material to the shoulder of the roadway. Each of these features is adjusted using a simple, easy to use controller (photo 2) located in the cab of the vehicle.

Belt Assembly

Photo 3

Photo 4

The belt assembly of the STRATOS is considered superior to the chain material delivery systems currently in use on the Department's conventional hopper spreaders. The belt provides an even, continuous application of salt, whereas the chain system often produces an uneven, skipping application. Photo 3 shows a top-down view of the belt, while photo 4 shows the belt from below the hopper. Note the V-shapes used to carry material. Another advantage to the belt system is that very little salt is deposited in the body of the truck. This is in sharp contrast to what is typically found. The operator indicated that it was not uncommon to have as much as ½ cubic yard of salt in the body of the truck when removing his conventional hopper. With the STRATOS, he typically found less than one small shovel full remaining in the body.

Load Cover and Grate Assembly

Photo 5

Photo 6

Photo 5 shows the load cover in the closed position. It is easily opened and closed by the operator while standing on the ground by simply pulling a tethered strap attached to one of the cover arms. One minor flaw with the latch holding the cover in the down position did cause the cover to open when traveling at

highway speeds. This will be corrected on all future units by increasing the latch size. The grate system used to keep large pieces of salt from entering the hopper is pictured in photo 6 with the cover in the open position.

Mounting, De-mounting and Storage Assembly

Photo 7

Photo 8

Another positive feature of the STRATOS system is the built-in mounting, de-mounting and storage assembly. Legs positioned at each corner of the unit fold into position when unloading (photo 7). The spinner is raised and locked into position when loading, unloading and storing. This unloading and subsequent loading takes approximately 10 minutes to complete. The storage capability of this assembly (photo 8) is considered an excellent alternative to the Department's aging gantry systems. Note the blue colored tanks (500 gallon total capacity) mounted at each side of the hopper.

Electronic Equipment Cover Assembly

Photo 9

Photo 10

The electronic workings of the unit are housed in a small hooded compartment located at the rear of the hopper (photo 9). MAINEDOT personnel were particularly impressed with the simplistic nature of the electronic operating system and the cleanliness maintained under the hood of the compartment even after being exposed to numerous winter storm events (photo 10)

Discussion of Results

As mentioned in the analysis portion of this report, the precision of the data collected for inventory purposes lacks the accuracy necessary to make an absolute comparison with the Department's conventional spreaders. This data was used to make a relative annual comparison of salt usage by route with conventional spreaders and to summarize the salt usage of the STRATOS for the 2004-2005 winter season.

The methodology used for the Annual by Route comparison included totaling salt usage for each of the 2003-2004 and 2004-2005 winter seasons and calculating the average tons per event. Twenty one events occurred during the 2003-2004 season, while 30 events were recorded for the 2004-2005 season. Total use increased for each route during the 2004-2005 season. The STRATOS spreader was put into service after eight events had occurred in the 2004-2005 season. A Case-Tyler Zero Velocity spreader was used on this route for the first eight events of the 2004-2005 season and during the entire 2003-2004 season. Four routes saw an increase in average tons per event; four saw a decrease and one remained relatively flat. Route #6 (STRATOS route) showed the most significant decrease in tons per event.

The Summary of Salt Use for the STRATOS is a summary of salt applied and salt requested for each event the STRATOS was in service (22 events). Salt requested columns represent the amount of salt application that was requested by the supervisor. The actual salt used columns are values generated from the available inventory tracking totals. The differences in the requested and applied columns are believed to be a function of the way in which the STRATOS spreader applies the combined salt and liquid materials, as explained in Table I above.

Each of these results is included in Appendix A.

Perhaps the most significant piece of this evaluation was hands-on, real-world performance. Since the inception of MAINEDOT's Salt Priority system, operators have been instructed to maintain salt placement in a "concentrated windrow-like pattern". Whereas the STRATOS spreads salt or slurry in a broadcast fashion, the first challenge for the Department's operators was to "re-think" salt placement. It is a credit to those involved that they remained open minded to this change.

Primarily, the STRATOS was used in the same manner as a standard hopper, treating the travel lane of the two lane Interstate 95 system in and around the Bangor area. Requested application rates were identical for both the STRATOS and the conventional hopper spreader operating in the passing lane adjacent to the STRATOS. Throughout the winter, both the operator and his supervisor noticed the travel lane melting and remaining bare much faster than the adjacent passing lane. Although some of this can be attributed to the additional traffic utilizing the travel lane during a storm event, the operator and supervisor were confident that the STRATOS was simply providing a superior result. It is theorized that the salt, so highly saturated, results in more material staying in the treated lane, instead of bouncing and scattering into the shoulder area of the roadway. Late in the 2004-2005 season, the STRATOS was used on two occasions to treat multiple lanes with good results. Several times throughout the winter, the supervisor re-directed the STRATOS equipment to other areas of the interstate where ice and snow had become packed and bonded to the road surface. In each instance, it was reported to have quickly cleared this condition.

One mechanical issue occurred during the evaluation period. In early March, a motor used to position the spinner failed. Upon replacement, Fleet Services personnel removed the housing of the old motor and determined that a screw that holds the housing in place had pierced the seal. This allowed salt and water to seep into the moving parts of the motor causing it to fail. The replacement motor was received within two working days and the support provided by the STRATOS manufacturer was very good.

Cost of Equipment Comparison – STRATOS vs. Conventional Spreader

To further compare the STRATOS with the Department's conventional spreaders, an equipment cost comparison was completed. An estimate developed by the office of Fleet Services calculated the total cost of the Departments conventional hopper/spreader to be $26,800.00. The cost quotation received from the STRATOS manufacturer was $32,238.00. This calculates to an additional cost of $5,438.00 for the STRATOS equipment. Using the estimated cost of material saved ($2208.00/year) found in the STRATOS Spreader Summary in Appendix A, the additional cost of the STRATOS would be amortized in 2.46 years of operation.

To further calculate replacement costs, Fleet Services also provided a trade-in estimate for any conventional units already in service within the Department. This estimate was between $3,500.00 and $4,000.00 dollars per unit.

A detailed summary of this estimate can be found in appendix B.

Conclusions/Recommendations

Many MAINEDOT personnel were impressed with the quality and engineering of the STRATOS unit. As discussed above, features of the STRATOS fit well with the Department's continued effort to provide the best available equipment to its operators. It is also the goal of the Department to continue to strive for material savings wherever possible. Based on the results from one winter season, the 25 percent material savings described in Table I are considered to be a modest projection. As operators and supervisors become more comfortable with the equipment, additional savings may be realized.

The 70 percent granular, 30 percent salt brine liquid application worked well in a variety of conditions and temperatures. This high concentration of liquid mixture did not cause "re-freezing" of the roadway. Liquid Calcium Chloride was substituted for the brine during one cold temperature (less than 8 degrees Fahrenheit) event and worked very well in melting packed snow and ice on several interstate ramps.

Overall, the evaluation of the STRATOS spreader was considered positive. It is important to note that these results are based on a one year evaluation period. This limited time may or may not be representative of long term performance characteristics of the STRATOS equipment.

It is recommended that additional evaluations be undertaken to determine the accuracy of the metering equipment, if multiple-lane treatment is a viable option and if anti-icing techniques can be conducted using the STRATOS. It is also recommended that the Department continue its efforts to provide a finer particle size salt for use with the STRATOS unit.

For any future purchases, the Department should require the STRATOS equipment record material usage and distance, using the Imperial system of measurement.

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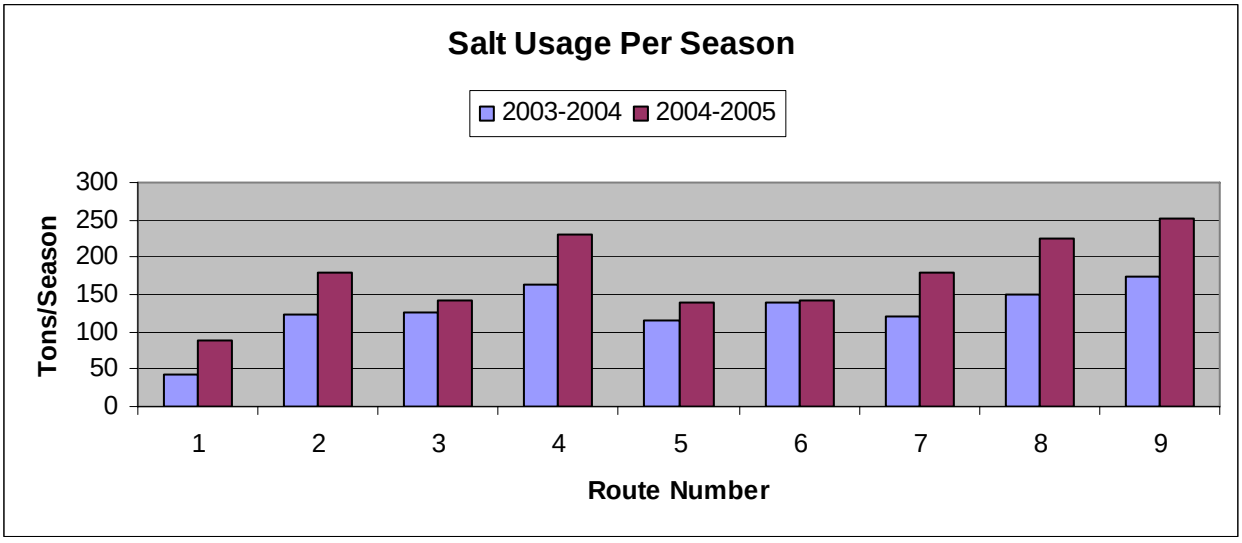
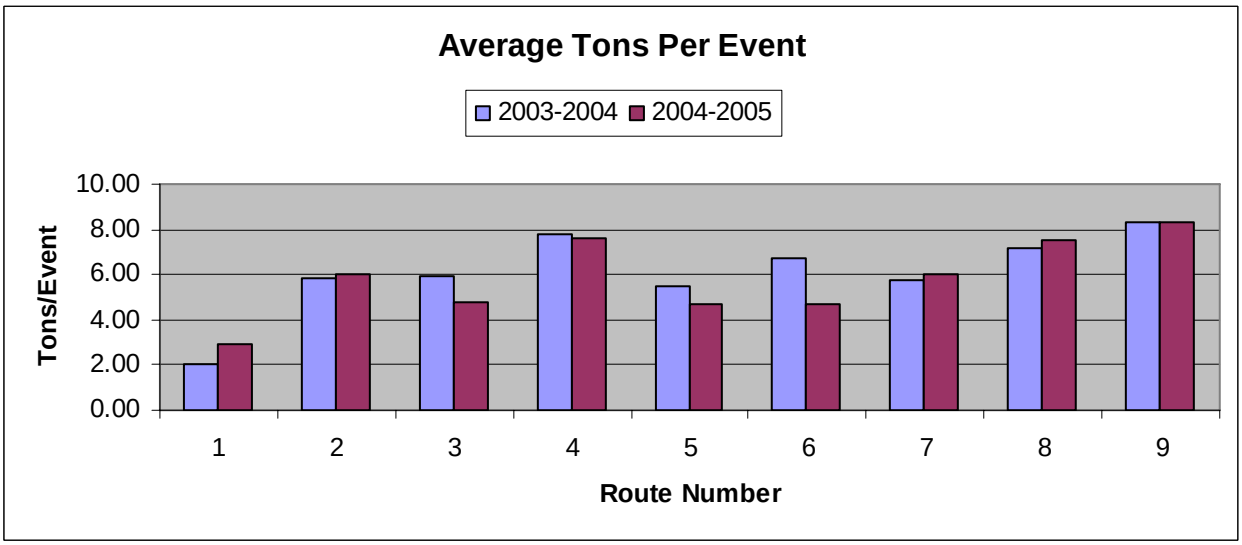
Appendix A

Annual Salt Usage by Route

Route Number	Route Description	Total Tons 2003-2004	Total Tons 2004-2005	Average Tons Per Event 2003-2004	Average Tons Per Event 2004-2005
1	Rte. 2 Veazie	42.7	87.3	2.03	2.91
2	Rte. 16 Alton	122.4	180.6	5.83	6.02
3	Rte. 1A Holden	124.6	142.5	5.93	4.75
4	Rte. 15 Kenduskeag	163	229.1	7.76	7.64
5	Rte. 15 Orrington	115.7	139.8	5.51	4.66
6	**I-95 SB/I-395 Right (STRATOS)**	**140.4**	**141.2**	**6.69**	**4.71**
7	I-95 SB/I-395 Left	121.7	180.7	5.80	6.02
8	I-95 NB Right	151.1	225	7.20	7.50
9	I-95 NB Left	174.6	250.7	8.31	8.36

	2003-2004	2004-2005
Number of Events:	21	30





Date	Event	Pounds of Granular Salt	Gallons of Salt Brine	Pounds of Salt From Brine	Total Pounds of Salt (actual)	Total Pounds of Salt (Requested)	Total Miles Treated	Average Pounds Per Mile (actual)	Average Pounds Per Mile (Requested)
1/3/2005	9	8472.0	345.8	795.3	9267.3	12180.0	40.6	228.0	299.7
1/6/2005	10	8656.2	353.3	812.6	9468.8	12180.0	40.6	233.0	299.7
1/8/2005	11	13696.0	559.0	1285.7	14981.7	18450.0	51.2	292.3	360.0
1/10/2005	12	9945.5	405.9	933.7	10879.1	14210.0	40.6	267.7	349.6
1/12/2005	13	10188.2	415.8	956.4	11144.6	14120.0	45.5	245.0	310.4
1/14/2005	14	4236.1	172.9	397.7	4633.8	6090.0	20.3	228.3	300.0
1/17/2005	15	4236.1	172.9	397.7	4633.8	6090.0	20.3	228.3	300.0
1/19/2005	16	9945.5	405.9	933.7	10879.1	14210.0	40.6	267.7	349.6
1/23/2005	17	10522.8	429.5	987.9	11510.7	15730.0	47.7	241.5	330.0
1/25/2005	18	8072.7	329.5	757.8	8830.5	11352.0	35.4	249.3	320.4
1/26/2005	19	18152.0	740.9	1704.1	19856.0	23230.0	71.1	279.3	326.7
2/4/2005	20	6075.3	248.0	570.3	6645.6	8660.0	24.4	272.8	355.5
2/10/2005	21	35082.7	1431.9	3293.5	38376.2	60900.0	142.0	270.2	428.8
2/15/2005	22	4107.2	167.6	385.6	4492.8	6090.0	22.1	203.6	276.0
2/17/2005	23	8711.8	355.6	817.8	9529.6	12540.0	48.5	196.6	258.7
2/18/2005	24	5658.0	230.9	531.2	6189.1	7465.0	26.5	233.8	282.0
2/21/2005	25	22641.1	924.1	2125.5	24766.6	30450.0	96.8	255.9	314.7
3/1/2005	26	13365.7	545.5	1254.7	14620.4	21040.0	54.3	269.2	387.3
3/7/2005	27	17914.8	731.2	1681.8	19596.6	25520.0	56.2	348.4	453.7
3/11/2005	28	7054.7	287.9	662.3	7717.0	18190.0	45.6	169.4	399.3
3/14/2005	29	13641.3	556.8	1280.6	14921.9	21621.0	57.7	258.4	374.5
3/16/2005	30	7225.7	294.9	678.3	7904.0	8700.0	25.0	315.6	347.4
		247601.2	**10106.2**	**23244.2**	**270845.4**	**369018.0**	**1053.2**	**252.5**	**337.4**
		Tons Saved	**49**						
		Dollars Saved ($45 per ton)	**-- $2,208.00**						

Appendix B

Maine DOT
Conventional Spreader System

Item	Cost
Stainless Steel Hopper (10 Cubic Yard)	$13,000.00
Ground Speed Control System (Including Liquid Dispensing System)	$ 9,000.00
Stand Alone Storage Legs	$ 3,500.00
Load Cover	$ 600.00
Liquid Tanks	$ 700.00
	$26,800.00

Quotation for STRATOS B 60-36 VCXN

Item	Cost
Spreader 7.8 Cubic Yard, made of steel, with belt feed system Paint: orange (RAL 2011)	
Pre-wet system with 2.220 litres (approx 500 gallons) CX Control (with 2 control circuits)	
Standard spreading disc 490 (7-30 feet) Ladder	
Subtotal basic spreader	**$22,117**
Option	
Roro demount 10 tons	$2,253
Safety chain	$132
Tighten chains - 2 items	$94
Electric spreading pattern adjustment (CX), operated from the controller	$680
3rd circuit for spreading disc (CX)	$264
Control box support	$106
Cable extension	$132
Bracket including wiring for beacon	$128
max level switch	$238
min level switch	$238
Subtotal - Options	**$4,263**
Total price for basic spreader with the above mentioned options	**$26,380**
Alternatives (Additional prices)	
Rear cover.	$978
Deviding folding cover (tarp)	$731
Minimess with manometer	$119
Stainless steel (not painted) vs Steel	$2,423
CL vs CX (including 3rd closed loop and spread pattern adjustment).	$1,607
Total	**$32,238**