



research for winter highway maintenance

Product Experience Feedback 2006-2018 Winter Seasons

Clear Roads conducts an informal Product Experience Survey at the end of each winter season. Member states are invited to share the results of pilot-testing of winter maintenance products and materials that their agencies have conducted that year. This document compiles all survey results received from 2006 through the current winter season.

Clear Roads does not endorse any of the products evaluated. This informal survey is meant to be a tool for states to share experiences with winter maintenance products, not a scientific evaluation of product performance.

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2017-2018 RESULTS

Note: In the 2018 survey, some DOTs submitted test results for previous years. This section includes those responses as well as all results from states' 2017-2018 testing.

BLADES AND PLOWS

BlockBuster blades (Winter Equipment)

<http://winterequipment.com/shop/systems/blockbuster>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	6	2016-18	3	3	4	4	3	3
Utah	13	2017-18	2	2	4	3	3	3

Comments

Iowa DOT (2016-2018) • Overall rating: 3

We have an ongoing research project with Iowa State through the 2018-2019 winter season to track blade performance. No results available yet.

Utah DOT (2017-2018) • Overall rating: 3

Drivers report that this blade runs down about as quick as a regular single carbide, but costs 2.5 - 3 times as much.

Evolution Edges - TXS blade (Chemung Supply Co.)

<https://www.evolutionedges.com/snow-plow-blades-and-cutting-edges-innovative/carbide-inserts-txs-snow-plow-blade>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	1	2016-17	3	2	4	5	4	4

Comments

Utah DOT (2016-2017) • Overall rating: 3

The single driver that tested this replacement Joma blade said that the Performance was an "A", but that the Ease Of Blade Change was a "C" on a scale of A-D.

Evolution Edges - VST cutting edge (Chemung Supply Co.)

<https://www.evolutionedges.com/snow-plow-blades-and-cutting-edges-innovative/poly-carbide-vst-cutting-edge>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	3	2017-2018	4	5	4	4	3	3

Comments

Utah DOT (2017-2018) • Overall rating: 3

Some drivers reported that there are still a ton of vibrations even though this product is billed as a Vibration Suppression Technology. Shoes are used.

Ice-O-Force blades (Ironhawk)

<http://www.ironhawkindustrial.com/products-quotes.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	1	2016-17	4	3	3	4	4	4

Comments

Utah DOT (2017-2018) • Overall rating: 4

Not much interest in this brand of blade among the Maintenance Station Supervisors since we only had 1 blade tested.

Joma plow blades

<http://www.blackcatwearparts.com/products/snow-plow/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	12 front plow blades	2016-2018	4	4	4	4	4	4
Utah	6	2016-18	4	4	5	5	5	5

Comments

Iowa DOT (2016-2018) • Overall rating: 4

We have been using JOMA blades for many years with very good results. We have an ongoing research project with Iowa State to track blade performance and cost on various road surface types. No results available yet.

Utah DOT (2017-2018) • Overall rating: 5

This is the most used blade in our inventory.

Kuper by Betek premium carbide insert blades

<http://www.kueperblades.com/>

info@kueperblades.com

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
North Dakota	N/A	2016-2017	3	4	4	5	5	5

Comments

North Dakota DOT (2016-2017) • Overall rating: 5

The Kuper Betek Premium cutting edges lasted much longer than ordinary carbide insert edges. The Betek used high quality materials and brazing process to ensure long lasting tungsten carbide insert wear.

Kuper Kombi

<http://www.kueperblades.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	12 sets of front blades	2016-2018	4	4	4	3	3	3

Comments

Iowa DOT (2016-2018) • Overall rating: 3

We have an ongoing blade research project with Iowa State to determine performance and cost on various road surface types. No results available yet.

Kuper Tuca SX carbide plow blades

<http://www.kueperblades.com/blades/products/tuca-sx-wave>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	2	2017-18	3	4	3	5	4	4

Comments

Utah DOT (2017-18) • Overall rating: 4

Even though there were only 2 of these tested, the drivers that did test them thought that they worked great.

Lake Effect blade assembly (Ironhawk)

<http://www.ironhawkindustrial.com/files/105086284.pdf>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	2	2016-17	4	1	2	4	3	2

Comments

Utah DOT (2016-2017) • Overall rating: 2

While the blade cleans fairly well and lasts about 3 months, it is very hard to install and remove.

Nordik Move cutting edges

<http://nordikblades.com/products/nordik-move/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Connecticut	Several dozen	2016-2018	4	4	4	4	4	4
North Dakota	N/A	2016-2017	3	2	3	3	3	3

Comments

North Dakota DOT (2016-2017) • Overall rating: 3

While there were positive comments about the edges, there were also other concerns. In the three districts that tested the new blades, there was a varying level of knowledge of the different types of cutting edges and how to compare them all. Some of the operators were evaluating against standard carbide edges. We all agreed that the MOVE edges performed better than the standard carbide edges, but this was not really an apples to apples comparison. Those with experience with different hybrid edges did not like the MOVE edges as much as the other hybrid edges that NDDOT currently uses. The MOVE edges were more complex to our operators than the other hybrid edges.

PolarFlex blades (Valley Blades Ltd.)

<http://www.valleyblades.com/polarflex/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	6	2016-18	4	4	3	4	4	4

Comments

Utah DOT (2016-2018) • Overall rating: 4

Most of the drivers love the Polar Flex, but there have been a few that complain that the individual teeth snag on the edge of pavement. Another challenge is that sometimes teeth get shoved upward and won't come back down. Another complaint is when you change out an individual tooth and then you have to wait for it to wear down to be flush with the older teeth.

Razor XL (Winter Equipment)

<http://winterequipment.com/shop/systems/razor-xl>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	30	2017-18	4	3	4	5	4	5

Comments

Utah DOT (2017-2018) • Overall rating: 5

This was one of the most popular blades that we tested and there was much interest in trying them out as indicated by the 30 blades tested.

CAMERAS

Axis Communications M1065-L plow camera

<https://www.axis.com/en-us/products/axis-m1065-l>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	600	2017-2018	5	5	5	5	5	5

Comments

Iowa DOT (2017-2018) • Overall rating: 5

Very pleased with the performance of the Axis product and the support we have received from the Axis staff members and distributor. Project background: We used iPhones in our Plow Cam project. The iPhones were becoming less reliable and the constant changes/updates to the iPhones were causing us problems. Moving to an IP camera eliminated the OS issue and the reliability of the IP camera was significantly better. We started with 3, increased to 600 for the 2017-2018 winter season. We will outfit all 900 trucks for the 2018-2019 season.

Live View plow cameras

<https://www.liveviewtech.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Montana	10	2015-2017	2	4	4	5	5	5

Comments

Montana DOT (2015-2017) • Overall rating: 5

MDT was able to make the plows forward facing which was extremely important to the traveling public.

DEICERS/CHEMICALS

Dowflake Xtra calcium chloride flakes

<https://www.oxycalciumchloride.com/products/dowflake-xtra-83-87-calcium-chloride-flakes>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	N/A	2017-2018	5	5	N/A	N/A	5	5

Comments

Arizona DOT (2017-2018) • Overall rating: 5

Comments from Flagstaff Supervisor: They typically use this when temperatures are extremely low and material is not working as fast as needed. They will pre-make loads prior to the storm. This helps with ensuring it is mixed and ready to go in case they need it. It is typically mixed one 50-pound bag to a front end loader bucket full of Ice Slicer. They will usually use it for 3-4 loads per storm (when needed). They stated this stuff works extremely fast with breaking up the ice and is very corrosive.

GPS/AVL SYSTEMS

LaserLine Guidance Laser for Wing Plows (Model GL3000C)

<http://www.laserlinemfg.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	N/A	2017-18	3	N/A	3	3	3	3
Idaho	2-3	2017-18	5	4	4	5	5	5
Utah	10	2015-18	3	4	3	3	4	3

Comments

Arizona DOT (2017-2018) • Overall rating: 3

Comments from our Payson Supervisor: Lasers have been a huge help for the area we work in. I have used Wings without and with. With having this piece of equipment, the drivers seem more confident when working narrow roads, or dealing with a lot of guardrail, even in whiteout conditions. The lasers can pick up delineation, and even the guardrail tabs. The only thing you need to make sure you do is set it up right for the truck that is using it, and what area. Not all areas are the same, and not all trucks are the same. The other issue when installing these is that you need to make sure they are hooked up correctly to have the lens cleaned off when operating the laser during a storm. They have come a long way in the past couple of years in keeping these lenses clean. If these fail or break down, it does take some time to have these repaired from a vendor standpoint.

Idaho Transportation Department (2017-2018) • Overall rating: 5

Based on the experience, we are now making this unit a standard on all trucks with wing plows.

Utah DOT (2015-2018) • Overall rating: 3

We use wing plow lasers mostly in straight line operations around the city. We have found that using them in canyons and on very curvy roads just causes the laser to bounce around where the wing plow isn't going to really be anyway and they end up being a distraction rather than helping.

INFORMATION MANAGEMENT SYSTEMS/SENSORS

High Sierra temperature sensor

<http://highsierraelectronics.com/mobilesurface sentinel/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	300 units	2016-2018	4	3	4	3	3	3

Comments

During our first season of testing, the High Sierra sensors worked very well and we did not experience any unit failures. Based on this performance, we increased the number of units to 300 for the next winter season plus we outfitted all 50 of our Supervisor pickups. Once the 2017-2018 season started we experienced numerous unit failures. When we addressed this issue with High Sierra, they were willing to replace the defective units, however we continued to have unit failures. We held a meeting with High Sierra senior management about the issue we were experiencing with the high failure rates and they shared with us that they had changed a material used in the sensors plus they had changed part of their manufacturing process. High Sierra also told us they had made the decision to go back to the original materials and manufacturing process and they would continue to replace all of the units that failed. Throughout this process High Sierra has been willing to work the issues we have had with these sensors. They have been willing to replace all units that have failed at no cost to the Iowa DOT. We will be going into the 2018-2019 with 300 trucks and 50 Supervisor pickups outfitted with these units and we will be tracking their performance.

Vaisala RWIS station

<https://www.vaisala.com/en/products/systems/road-weather-information-system-rwis>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Vermont	10	2016-2018	5	5	5	5	5	4

Comments

We have had very good experience with the entire station. We have just started our own maintenance of the RWIS stations in the last 1 ½ years, so we will have more insight into the reliability, but again are very happy with the way the stations have performed.

2006-2018 COMBINED RESULTS

BLADES AND PLOWS

Air foil (Henderson)

<http://www.henderson-mfg.com/index.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Minnesota	4	2009-10	4	4	3	4	5	4
Average rating			4 - helpful	4 - easy	3 - average	4 - maintained good condition	5 - extremely well	4 - satisfied

Comments

Minnesota DOT (2009-2010) • Overall rating: 4

Worked well. Since [then,] we have developed our own design and [built a] product that utilizes scrap traffic sign material, and that has performed as well.

Betek Premium cutting edges

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
North Dakota	N/A	2016-2017	3	4	4	5	5	5
Average rating			3 - average	4 - easy	4 - helpful	5 - maintained excellent condition	5 - extremely well	5 - extremely satisfied

Comments

North Dakota DOT (2016-2017) • Overall rating: 5

The Kuper Betek Premium cutting edges lasted much longer than ordinary carbide insert edges. The Betek used high quality materials and brazing process to ensure long lasting tungsten carbide insert wear.

BlockBuster blades - hammerhead carbide (Winter Equipment)

<http://winterequipment.com/blockbuster-classic>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	6 sets of 11' front blades	2015-2017	4	2	4	4	4	3
Average rating			4 - helpful	2 - not very easy	4 - helpful	4 - maintained good condition	4 - well	3 - average

Comments on BlockBuster blades (hammerhead carbide)

Iowa DOT (2015-2017) • Overall rating: 3

Comments from the Operators:

- * Very heavy and tough to install.
- * Worked well on micro surface roads.
- * 2 trucks went the entire winter season without changing blades, when they would normally go through 2-3 sets of blades in a winter season.

BlockBuster blades (Winter Equipment)

<http://winterequipment.com/snow/systems>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	6	2016-18	3	3	4	4	3	3
Iowa	8	2014-15	3	2	4	3	3	3
Michigan	4	2014-15	n/a	4	n/a	3	n/a	3
Utah	13	2017-18	2	2	4	3	3	3
Utah	52	2012-14	5	4	5	5	5	5
Vermont	1	2013-15	4	3	5	4	4	4
Average rating			3.4 - average	3.0 - average	4.4 - helpful	3.7 - maintained good condition	3.6 - well	3.5 - satisfied

Comments

Iowa DOT (2016-2018) • Overall rating: 3

We have an ongoing research project with Iowa State through the 2018-2019 winter season to track blade performance. No results available yet.

Iowa DOT (2014-2015) • Overall rating: 3

Blades were very expensive, twice the cost of JOMA blades. Blades were very heavy and difficult to install. Operators commented that these blades were very noisy during operations. We did not see any benefit to using these blades over JOMA or Kueper

Utah DOT (2017-2018) • Overall rating: 3

Drivers report that this blade runs down about as quick as a regular single carbide, but costs 2.5 - 3 times as much.

Utah DOT (2012-2014) • Overall rating: 5

Test was conducted on 10 year old concrete pavement (8,000 PSI) using same driver in the same truck. The system far outlasted all other ten systems tested, including UDOT standard high performance segmented flexible carbide blades. Cost was high compared to other systems. We are going to test system more widely to determine comparative per-plow-hour and life cycle costs. The system shows little wear after two full plow seasons.

Vermont Agency of Transportation (2013-2015) • Overall rating: 4

Blades will wear for long time. Problem we had was it didn't clean down to pavement because of the wide base. Carbide fell on first set of blades and they replaced it. Takes a long time to get the blade to cut an edge in

Evolution Edges - TXS blade (Chemung Supply Co.)

<https://www.evolutionedges.com/snow-plow-blades-and-cutting-edges-innovative/carbide-inserts-txs-snow-plow-blade>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	1	2016-17	3	2	4	5	4	4
Average rating			3 - average	2 - not very easy	4 - helpful	5 - maintained excellent condition	4 - well	4 - satisfied

Comments

Utah DOT (2016-2017) • Overall rating: 3

The single driver that tested this replacement Joma blade said that the Performance was an "A", but that the Ease Of Blade Change was a "C" on a scale of A-D.

Evolution Edges - VST cutting edge (Chemung Supply Co.)

<https://www.evolutionedges.com/snow-plow-blades-and-cutting-edges-innovative/poly-carbide-vst-cutting-edge>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	3	2017-2018	4	5	4	4	3	3
Average rating			4 - helpful	5 - extremely easy	4 - helpful	4 - durable	3 - average	3 - average

Comments

Utah DOT (2017-2018) • Overall rating: 3

Some drivers reported that there are still a ton of vibrations even though this product is billed as a Vibration Suppression Technology. Shoes are used.

HDPE snowplow blade (custom)

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	1 set	2012-13	n/a	4	n/a	1	2	1
Average rating			n/a	4 - easy	n/a	1 - noticeable deterioration	2 - not very well	1 - not at all satisfied

Comments

Utah DOT (2012-2013) • Overall rating: 1

Blade tested was 2-3/4" x 7" x 12' HDPE fabricated by Holland Equipment, Salt Lake City. This is not a commercially available product in our market. HDPE blades had been used by contractor on the I-15 CORE project (Total reconstruction of 27 miles of I-15 in urban area). Contractor was satisfied with performance. UDOT test showed that they performed poorly with our moldboard downward pressure loading. They did preserve pavement markings very well but lasted only 6 hours plow down. There may be better performance if plow shoes are used.

Henderson Snow Foe RSP Flex: Reversible Snow Plow

<http://www.henderson-mfg.com/plowsf.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
North Dakota	90	2015-16	4	2	3	3	3	3
Average rating			4 - easy	2 - not very easy	3 - average	3 - average	3 - average	3 - average

Comments

North Dakota DOT (2015-2016) • Overall rating: 3

It worked fairly well. Required specialized hydraulics on the truck. Standard practice is to reduce the use of front plows and use more underbody plows in order to reduce snow fog so flexible plow is becoming more limited. Experienced micro cracking of the poly moldboard and needed replacement. After manufacturer replacement, unit works fine.

Ice-O-Force blades (Ironhawk)

<http://www.ironhawkindustrial.com/products-quotes.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	1	2016-17	4	3	3	4	4	4
Average rating			4 - helpful	3 - average	3 - average	4 - maintained good condition	4 - well	4 - satisfied

Comments

Utah DOT (2017-2018) • Overall rating: 4

Not much interest in this brand of blade among the Maintenance Station Supervisors since we only had 1 blade tested.

Ice-O-Force underbody blades (Ironhawk)

<http://www.ironhawkindustrial.com/files/104803749.pdf>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	2 sets of 11' underbody	2016-17	4	4	4	4	4	4
Average rating			4 - helpful	4 - easy	4 - helpful	4 - maintained good condition	4 - well	4 - satisfied

Comments

Iowa DOT (2016-2017) • Overall rating: 4

Operator comments:

- * Install was very easy.
- * Seemed to wear very good on all surfaces and was very quiet.
- * Worked well on packed snow.

Joma plow blades

<http://www.blackcatwearparts.com/products/snow-plow/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Delaware	n/a	2014-2017	n/a	5	5	4	4	5
Illinois	3+ sets	2009-2016	4	4	4	4	4	4
Illinois	3 sets	2008-12	5	5	5	5	5	5
Illinois	3 sets	2008-11	4	5	5	5	5	5
Illinois	1 set	2008-09	3	4	3	5	4	4
Iowa	12 front plow blades	2016-2018	4	4	4	4	4	4
Kansas	6	2015-2016	n/a	3	3	4	3	3
Maine	2 sets	2009-11	n/a	4	5	5	5	5
Minnesota	2 sets	2008-09	4	4	4	5	5	5
Minnesota	6 districts	2008-09	n/a	5	n/a	5	5	5
Minnesota	3 sets	2007-08	n/a	4	4	5	4	4
Missouri	n/a	2015-2017	4	5	5	5	4	4
Missouri	6 sets	2008-10	4	5	5	5	5	5
Missouri	n/a	2008-09	n/a	3	n/a	4	4	4
Missouri	n/a	2007-08	5	4	4	4	4	4
Montana	10 sets	2014-15	4	3	4	4	4	4
North Dakota	4 sets	2010-11	5	3	4	4	4	4
North Dakota	4 sets	2010-11	n/a	5	n/a	5	5	5
Ohio	40+ sets	2007-08	4	5	4	5	5	5
Ohio	16 trucks	2007-08	5	5	5	5	5	5
Pennsylvania	n/a	2014-2017	3	4	3	5	4	4
Utah	2 sets	2006-07	4	5	4	5	5	5
Utah	6	2016-18	4	4	5	5	5	5
Wisconsin - Columbia County	50 plus	2006-11	4	5	4	5	4	4
Wisconsin - Dane County	8 plows	2008-11	4	4	5	5	4	5
Wisconsin - Monroe Cty.	60-plus pieces	2006-11	4	5	4	4	5	5
Average rating			4.1 - helpful	4.3 - easy	4.3 - helpful	4.7 - maintained excellent condition	4.4 - well	4.5 - extremely satisfied

Comments

Delaware DOT (2014-2017) • Overall rating: 5

Black Cat Joma blades performed very well during plowing operation. Very minor damage was observed to the cutting edges and plow trucks stayed on their routes much longer than with traditional carbide blades.

Illinois DOT (2009-2016) • Overall rating: 4

Joma blades have proven to be a great product. We have had sets of Joma blades that have lasted 5 years. Joma blades have cut down on blade changes, thus reducing the number of injuries. It cleans the road better and causes less vibration to the truck/plow. Some issues we have had is with maintenance. We had an issue where the bolts made the rubber bushings oval shaped, which has led to damaging the blade sections causing inserts to break or sections to have more play / hang lower than others. Also, replacement parts are expensive. Overall, the product is good and worth the cost.

Comments on Joma plow blades (continued)

Illinois DOT (2008-2012) • Overall rating: 5

Performance as well as increased life have been noted with this system. It works well in areas where raised pavement markers caused damage to standard carbide blades.

Illinois DOT (2008-2011) • Overall rating: 5

The districts that have used the Joma Blades felt they perform well. They have been very durable.

Iowa DOT (2016-2018) • Overall rating: 4

We have been using JOMA blades for many years with very good results. We have an ongoing research project with Iowa State to track blade performance and cost on various road surface types. No results available yet.

Illinois DOT (2008-2009) • Overall rating: 4

Blade outlasted 2 sets of carbide blades on the control plow. Drivers did notice that Joma Blade cleaned the pavement better as well as being quieter than the control blade. Cost is an issue as Joma Blade costs 2.5 to 3 times as much as the standard carbide blades.

Kansas DOT (2015-2016) • Overall rating: 3

We did not do a formal test. Results were mixed. Crews like the reduction of noise and vibration, but the life of the blade was variable.

Maine DOT (2009-2011) • Overall rating: 5

We were hoping that the price may come down to make them a great value.

Minnesota DOT (2008-2009) • Overall rating: 5

Did seem to outlast steel blades and to perform better given the imperfections on the road surface. However, given that it's our (Maintenance Research) goal and duty to provide new technologies to MnDOT's districts to help streamline their daily duties and find replacement equipment with a lower impact on the cost of operation, hours of availability, and down time for maintenance personnel, there has been concern about the cost of the JOMA blades and some areas of the state may have to discontinue use and go back to the regular carbide cutting edges or switch to these alternative blades that we are currently testing, if deemed successful. JOMA blades are on the implementation list.

Minnesota DOT (2007-2008) • Overall rating: 4

The test procedure I used was to place an hour meter in line to record the hours the cutting edges were being used. This eliminated the operator from recording how much time that the cutting edges were lowered and in use. The Milaca truck 93206 right hand on the TP3NR522 (T.H. 169 S.) route had the best results of 108 hr. of usage before replacement. Their route consists of 14 miles of seal coat, 10 miles of micro-surfacing, 5 miles of nova-chip 5 miles of bituminous. The other Milaca truck 200057 on the TP3NR521 (T.H. 169 N.) route had good results with 85.5 hr. before replacement. This route consists of 18 miles of seal coat, 25 miles of bituminous, 7 miles of concrete and 9 miles of micro-surfacing. Both of these routes the drivers recommended using these cutting edges because of longevity, less vibration and quiet operation. One route didn't have to replace the cutting edges all season and was very impressed by the saving of time and safety of not having to change cutting edges 2 or 3 times a season. The Elk River truck 99045 on the TP3NR512 (T.H.10 W.) route had quite different results of 40 hr. before replacement. The biggest difference they had was 45 miles of very poor concrete with many poor cross cracks and potholes. Another possible problem could be plowing habits and excessive speed which are hard to record. The operators said that it seems to be catching on the concrete causing the plow to trip more frequently than the standard cutting edges.

Missouri DOT (2015-2017) • Overall rating: 4

We are very satisfied with the Joma blades.

Missouri DOT (2008-2010) • Overall rating: 5

We have used these blades in all types of weather they have done very well. I would not go back to carbide blades.

Missouri DOT (2007-2008) • Overall rating: 4

A Good Blade that lasts a lot longer and does a better job than the carbide blades

Montana DOT (2014-2015) • Overall rating: 4

Approximately 4 times as long as our standard carbide edges.

Comments on Joma plow blades (continued)

North Dakota DOT (2010-2011) • Overall ratings: 4, 5

- Very quiet, Cleaned better than conventional carbide blades, plows tripped more often (concern).
- The only drawback is Joma blades currently cost us about three times as much as standard blades per plow. This is offset by the fact that we have had reports of Jomas lasting 3 times as long as standard. We have also noticed many benefits from an operational standpoint. Operators report a large decrease in cab noise and vibration. The Jomas were also reported to remove snow better than standard carbide blades. Dickinson plans to start installing Joma blades on all new truck orders. More information: http://www.dot.nd.gov/divisions/materials/research_project/mr201003final.pdf

Ohio DOT (2007-2008) • Overall rating: 5

The Joma blades in Lake County average nearly 6000 plowing miles with some of the trucks running the whole season on only one blade! Joma plow blades have no metal to metal contact with the snowplow which decreases the shock on the plows, the road surface, and most importantly the drivers. A reduction of noise and vibration lead to a reduction of operator and equipment fatigue. Joma plow blades conform to the pavement surface much better than the steel blades which can lead to a reduction in the amount of deicing material needed to treat a roadway. No BWC claims due to lifting plow blades since the switch from steel blades. New technology that has the support of the Lake County staff. Even 25+ yr veterans, who are the hardest to get to buy into a new idea, believe in the Joma plow blades. -There are many hidden cost savings with these rubber blades too. Less vibration leads to less fatigue on front end parts of plow trucks, RPMs are not ripped out of the pavement, and the ability to replace sections of damaged blades with sections from a used blade. Lane striping and crack sealing material isn't "peeled" from the road like with the steel blades. This reduces the need for road repairs. The Joma blades outlast steel blades 4:1. The truck's front end doesn't vibrate as it does when using steel blades. Joma blades are lighter in weight. Less wear on the pavement lane lines.

Pennsylvania DOT (2014-2017) • Overall rating: 4

Blades last longer and reduce noise

Utah DOT (2017-2018) • Overall rating: 5

This is the most used blade in our inventory.

Utah DOT (2006-2007) • Overall rating: 5

Our traditional blades wore out after 21 hours service on the plow (average). The two sets of JOMA blades lasted 124 (Tooele) and 108 hours (Strawberry). Operators reported cleaner roads and much less vibration in the cab. One driver stated that he had to raise and lower the plow to determine if the plow was down because he could not hear the scraping noise. Very positive test results

Wisconsin DOT -- Columbia County (2006-2011) • Overall rating: 4

very costly

Wisconsin DOT -- Monroe County (2006-2011) • Overall rating: 5

We are very happy with the performance of the product, from less driver noise, to ease of installation, along with good wearability.

Kuper Kombi

<http://www.kueperblades.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	12 sets of front blades	2016-2018	4	4	4	3	3	3
Iowa	25 sets of front blades (Kombi H ceramic insert)	2015-2017	4	3	4	3	3	3
Average rating			4 - helpful	3.5 - easy	4 - helpful	3 - average	3 - average	3 - satisfied

Comments on Kuper Kombi

Iowa DOT (2016-2018) • Overall rating: 3

We have an ongoing blade research project with Iowa State to determine performance and cost on various road surface types. No results available yet.

Iowa DOT (2015-2017) • Overall rating: 3

Overall comments from Operators were mixed:

- * We had a combination of the older and newer style of the Kombi H. The newer style performed much better and seemed to be more durable.
- * Most operators liked the ease of installation and they were impressed with how quiet they were
- * Some operators thought the performance of this blade was equal to JOMA blades.

Kuper Tuca SX carbide plow blades

<http://www.kueperblades.com/blades/products/tuca-sx-wave>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Connecticut	6 sets	2014-15	4	4	4	5	5	5
Iowa	6 sets	2014-15	4	4	5	4	4	4
Maine	1 set	2012-13	5	5	5	4	5	5
Maine	6 sets	2012-13	4	4	5	4	4	4
Maine	1 set	2012-13	n/a	4	n/a	5	4	4
Maine	1 set	2012-13	n/a	3	5	5	4	4
Maine	2 sets	2012-13	3	4	4	3	3	3
Massachusetts	2 sets	2013-14	4	4	5	5	4	5
Minnesota	7 sets	2013-14	4	4	5	2	3	2
Utah	2	2017-18	3	4	3	5	4	4
Average rating			3.9 - helpful	4.0 - easy	4.6 - extremely helpful	4.2 - maintained good condition	4.0 - well	4.0 - satisfied

Comments

Iowa DOT (2014-15) • Overall rating: 4

We compared the Kueper Ceramic blades to JOMA and regular carbide blades. In our short testing it appears we were getting longer blade life from the Kueper ceramic blades versus JOMA on micro-surface roads.

Maine DOT (2012-13) • Overall ratings: 5, 4, 3

- I rated a 4 on question 1 only because the drivers side end doesn't handle contact with curbing well. Installing a device on the ends to cushion impact with curbing would be helpful. Other than that it is a great product, and it will most likely last another season!!!!!!
- The Tuca Blades lasted 2 to 3 times longer than conventional blades depending on the road condition it was used on.
- I believe we would need to do a few more trials to make sure the cost is effective.
- One set worked well that was on the Interstate, the other set was on back roads and wore out quickly

Massachusetts DOT (2013-14) • Overall rating: 5

We have enough life left in these blades for another year. Will be doing the cost analysis upon the completion of the trial.

Minnesota DOT (2013-14) • Overall rating: 2

Short life of blades experienced. It was thought that dry snow caused this issue. Only 1 district out of 8 liked the blades due to the possibility of too dry of snow.

Comments on Kuper Tuca SX (continued)

Utah DOT (2017-18) • Overall rating: 4

Even though there were only 2 of these tested, the drivers that did test them thought that they worked great.

Kuper GK5 ceramic-insert blades

<http://www.kueperblades.com/blades/products/gk51>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
North Dakota	N/A	N/A	4	4	4 - helpful	1	1	1
Average rating			4 - helpful	4 - easy	4 - helpful	1 - Noticeable deterioration	1 - Not at all well	1 - Not at all satisfied

Comments

North Dakota DOT • Overall rating: 1

The ceramic was not durable and shattered and failed very quickly. There was a heavy drag due to the rubber encasement. They were all replaced with the Kuper Tuca with improved results.

Kuper ceramic-insert blades

<http://www.kueperblades.com/products.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Illinois	1	2008-09	n/a	5	3	1	4	1
Average rating			n/a	5 - extremely easy	3 - average	1 - noticeable deterioration	4 - well	1 - not at all satisfied

Comments

Illinois DOT (2008-2009) • Overall rating: 1

Product does not hold up to our snow plowing environment. Product needs curb guard capability. Noted less noise, smoother and scrapes better.

Lake Effect blade assembly (Ironhawk)

<http://www.ironhawkindustrial.com/files/105086284.pdf>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	4 sets of front blades	2016-17	4	5	4	4	4	4
Kansas	90	2015-16	n/a	3	2	1	1	1
Utah	2	2016-17	4	1	2	4	3	2
Average rating			4 - helpful	3 - average	2.7 - average	3 - average	2.7 - average	2.3 - not very satisfied

Comments

Iowa DOT (2016-2017) • Overall rating: 4

This is the first year that we have tested these blades. Comments from Operators:

- * Easy to install and seemed to be very durable.
- * Used on Micro surface and concrete with good results. Seemed to work well on packed snow.

Comments on Lake Effect blade assembly (continued)

Kansas DOT (2015-2016) • Overall rating: 1

Blade was marked as a JOMA equivalent. But it failed to live up to it. A manufacturing defect in the first batch had to be replaced and got everybody off on the wrong foot as far as trying something new.

Utah DOT (2016-2017) • Overall rating: 2

While the blade cleans fairly well and lasts about 3 months it is very hard to install and remove.

Monroe flex plow with trip edge

<http://www.monroetruck.com/Products.aspx?category=185&product=131&name=Flex%20Plow>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	25	2015-17	3	4	4	5	5	4
Average rating			3 - average	4 - easy	4 - helpful	5 - maintained excellent condition	5 - extremely well	4 - satisfied

Comments

Goal: Better lane coverage due to wider plow moldboard.

We have problems with uneven bridge expansion joints during the winter months. Whereas a standard expressway plow's bit will either drop in between the expansion joint, or catch on an expansion joint that is higher on one side than the other. Depending on the plow truck's speed, this scenario can cause thousands of \$\$ in damage to equipment.

The Monroe flex plow with trip edge (must differentiate between "trip edge" and trip moldboard. Plows with trip moldboard require the plow driver to exit the vehicle and try to reset the moldboard which is dangerous for more than one reason)

When the Monroe trip edge catches on something, it trips a spring-loaded latch that lets the plow edge go over these hazards. All the operator needs to do to reset the trip edge is bump the plow raise lever to raise the plow about 6" and the edge resets. He doesn't have to get out of the truck or stop the truck.

Multiple-Edge Plows

<http://www.clearroads.org/multiple-blade-plow-prototypes.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Indiana	1	2008-09	4	4	5	5	5	5
Iowa	1	2008-09	4	5	5	5	5	5
Iowa	1	2008-09	1	4	1	2	1	1
Pennsylvania	3	2010-11	3	4	2	3	4	3
Average rating			3 - average	4.25 - easy	3.25 - average	3.75 - maintained good condition	3.75 - well	3.5 - satisfied

Comments

Indiana DOT (2008-2009) • Overall rating: 5

Plow removed majority of moisture from the road service. Enabled road to dry quickly.

Iowa DOT (2008-2009) • Overall ratings: 5, 1

- I would say it the best plow I have had in 36 years with the DOT.
- Kudos for the effort! But nobody in this shop wants this plow. Feel free to move it!

Comments on Multiple-Edge Plows (continued)

Pennsylvania DOT (2010-2011) • Overall rating: 3

Henke's response and customer service lacked. This product had to be modified greatly to be used with a truck equipped with a wing plow. Blade wear was a concern as well as maintenance.

Nordik Move cutting edges

<http://nordikblades.com/products/nordik-move/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Connecticut	Several dozen	2016-2018	4	4	4	4	4	4
North Dakota	N/A	2016-2017	3	2	3	3	3	3
Average rating			3.5 - helpful	3 - average	3.5 - helpful	3.5 - maintained good condition	3.5 - well	3.5 - satisfied

Comments

North Dakota DOT (2016-2017) • Overall rating: 3

While there were positive comments about the edges, there were also other concerns. In the three districts that tested the new blades, there was a varying level of knowledge of the different types of cutting edges and how to compare them all. Some of the operators were evaluating against standard carbide edges. We all agreed that the MOVE edges performed better than the standard carbide edges, but this was not really an apples to apples comparison. Those with experience with different hybrid edges did not like the MOVE edges as much as the other hybrid edges that NDDOT currently uses. The MOVE edges were more complex to our operators than the other hybrid edges.

PolarFlex blades (Valley Blades Ltd.)

<http://www.valleyblades.com/polarflex/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Illinois	2+	2011-16	4	4	4	5	5	4
Illinois	20	2010-15	4	4	4	5	5	5
Illinois	8	2009-13	5	4	4	5	5	5
Illinois	3	2009-12	4	5	5	5	4	5
Iowa	8 sets of front blades	2015-17	4	4	4	4	4	4
Maine	n/a	2010-11	n/a	5	5	3	4	4
Minnesota	3	2013-14	4	2	5	3	3	3
North Dakota	3	2010-11	n/a	4	4	5	4	3
Utah	6	2016-18	4	4	3	4	4	4
Utah	Statewide	2015-16	4	3	4	4	4	4
West Virginia	1	2012-13	4	4	4	5	5	5
Wyoming	n/a	2014-15	3	4	4	2	1	2
Average rating			4.0 - helpful	3.9 - easy	4.2 - helpful	4.2 - maintained good condition	4.0 - well	4.0 - satisfied

Comments on PolarFlex blades

Illinois DOT (2011-2016) • Overall rating: 4

Polar Flex blades were tested to compare the product to Joma blades. Joma blades had an issue w/ the bolt holes at the time becoming worn and oval shaped that would cause damage to the blade segment where it would need to be replaced. Polar Flex blades did everything the Joma blades did - decreased number of blade changes/injuries, cleaned the surface better, and provided a smoother ride with less vibration. Polar Flex blades also solved the bolt issue Joma blades had. Polar Flex blades have lasted 1-5 years, depending on the surface it's clearing: blacktop vs. concrete roadways. Polar Flex blades have had issues with the plow driver damaging some of the 4' sections, but that has been mostly due to hazards in the road while plowing where they catch/hit the blade on something. Parts are expensive. Overall, Polar Flex is a great product.

Illinois DOT (2010-2015) • Overall rating: 5

Feedback from our districts indicates there units is that they clean roads effectively and they last on average at least 3 times the length of conventional plow blades.

Illinois DOT (2009-2013) • Overall rating: 5

The Polar Flex systems have lasted 2 winters in most locations. Typically we would go through multiple sets of blades per winter in those locations. The operators like them as they are very quiet. They also do a great job clearing the pavement because they conform to the pavement.

Illinois DOT (2009-2012) • Overall rating: 5

Provides both an increased length of life and a performance improvement over standard carbide hard blades.

Iowa DOT (2015-2017) • Overall rating: 4

Operator Comments:

- * Install was fairly easy.
- * Seemed to wear good on all surfaces.
- * Flexed very well on uneven surfaces.
- * Very quiet.

Minnesota DOT (2013-2014) • Overall rating: 3

The difficulty in installation was a large setback in the use in this product.

Utah DOT (2016-2018) • Overall rating: 4

Most of the drivers love the Polar Flex, but there have been a few that complain that the individual teeth snag on the edge of pavement. Another challenge is that sometimes teeth get shoved upward and won't come back down. Another complaint is when you change out an individual tooth and then you have to wait for it to wear down to be flush with the older teeth.

Utah DOT (2015-2016) • Overall rating: 4

We had a few minor problems with the blades but the reps came out and worked with us to fix the issues and they did not occur again.

West Virginia DOT (2012-2013) • Overall rating: 5

Very quiet. Worked good at cleaning the road and did a great job cleaning over/around raised pavement markers. Virtually eliminated shock and vibration from the plow transmitted back into the cab. Operators loved it!

Wyoming DOT (2014-2015) • Overall rating: 2

WYDOT will need to purchase another test set. The set provided did not hold up but there may have been operator and mechanical errors that played into the less than stellar performance of the product.

Power float valves (Cirrus)

<http://www.ciruscontrols.com/snow-plow-hydraulics/blade-savers/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	12 units	2016-2017	3	3	4	4	4	4
Average rating			3 - average	3 - average	4 - helpful	4 - maintained good condition	4 - well	4 - satisfied

Comments

We installed these units on trucks that were also being used for blade testing. Goals were to reduce weight on the front plow and to increase blade life.

Operator comments:

* Not sure how much more blade life was achieved but this obviously made a difference. Much better when operating in conditions of light fluffy snow or when clearing areas that have pillow drifts.

* Need a different setup in the truck for the operator to engage the Float valve. (Operator had a to use a toggle switch that was remotely mounted to engage the float. Operators had a difficult time using this toggle switch. This winter season, we are removing the toggle switches and going to a 3 button joystick that will be much easier to operate.)

* This float valve must be used with a load sense pump not a gear pump.

We plan to outfit approximately 30% of our fleet for the 2017-2018 winter season and continue testing this Power Float.

Razor XL (Winter Equipment)

<http://winterequipment.com/shop/systems/razor-xl>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Utah	30	2017-18	4	3	4	5	4	5
Average rating			4 - helpful	3 - average	4 - helpful	5 - maintained excellent condition	4 - well	5 - extremely satisfied

Comments

Utah DOT (2017-2018) • Overall rating: 5

This was one of the most popular blades that we tested and there was much interest in trying them out as indicated by the 30 blades tested.

TowPlow (Viking-Cives)

<http://www.vikingcives.com/pdf/VCU/Tow%20Plow.pdf>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	1	2015-16	3	4	5	5	4	4
Colorado	3	2010-13	5	3	4	5	5	5
Idaho	2	2016-2017	4	3	4	3	3	3
Kansas	2	2015-16	n/a	4	5	5	4	4
Maine	1	2008-09	5	5	5	5	5	5
Michigan	1	2012-13	3	3	n/a	4	5	5
Minnesota	12	2011-14	3	4	3	4	5	4
Minnesota	1	2010-11	4	2	4	4	5	4
Minnesota	1	2009-10	3	4	4	4	4	5
Minnesota	4 districts	2008-09	No Response	No Response	5	No Response	No Response	5
Minnesota	1	2008-09	4	3	4	5	4	5
Missouri	6	2009-11	5	5	5	5	5	5
Missouri	1	2009-11	4	3	5	4	5	4
Missouri	2	2009-11	5	5	5	5	5	5
Missouri	8	2008-09	4	5	5	5	5	5
Missouri	No Response	2008-09	4	4	4	4	5	5
Missouri	No Response	2008-09	5	4	4	4	5	5
Missouri	1	2008-09	5	5	5	5	5	5
Missouri	No Response	2008-09	5	5	4	4	5	5
Missouri	No Response	2008-09	5	4	4	4	5	5
New Hampshire	1	2011-12	4	3	5	5	4	4
North Dakota	2	2011-12	n/a	5	5	4	5	5
Ohio	1	2010-11	5	5	5	5	5	5
Pennsylvania	N/A	2011-2017	3	2	3	2	1	2
Pennsylvania	4	2009-11	2	2	3	5	4	4
South Dakota	1	2015-2017	5	5	5	5	5	5
Utah	10	2011-14	5	4	5	5	5	5
Vermont	2	2013-2017	4	5	4	5	4	5
Washington State	1	2013-16	4	4	4	5	4	4
Wisconsin - Marquette Co.	n/a	2009-11	5	4	5	5	5	5
Wyoming	n/a	2014-15	4	3	5	4	4	4
Average rating			4.2 - helpful	3.9 - easy	4.4 - helpful	4.5 - maintained excellent condition	4.5 - extremely well	4.5 - extremely satisfied

Comments

Arizona DOT (2015-2016) • Overall rating: 4

AZ has ordered one more tow plow for the upcoming winter maint season

Colorado DOT (2010-2013) • Overall rating: 5

We are anxious to get a reversible cast towplow.

Comments on TowPlow (continued)

Kansas DOT (2015-2016) • Overall rating: 4

One plow in rural interstate and one plow in urban interstate. First winter went well and we have ordered 4 more of the units.

Maine DOT (2008-2009) • Overall rating: 5

I'm the first driver in MDOT to try out the Tow plow. I can only hope that from the test, Maine will buy one or more. The Tow plow made my job easier and safer.

Michigan DOT (2012-2013) • Overall rating: 5

The tow plow seems like a viable tool to improve winter maintenance operations. Upon delivery, the TP needed to be enhanced to work with truck, etc. Needed to add lights, etc. We also had to put on a flexible blade, as the pilot route had raised pavement markers, which tore up steel blades. Unloading unused material is a pain because the discharge is on the tongue side (our mechanics plan to alter this in future years). By allowing other regions in our state to use the towplow, we increased interest and plan to buy more, when the funding allows.

Minnesota DOT (2011-2014) • Overall rating: 4

We have added salt brine tanks to some of the tow plows.

Minnesota DOT (2010-2011) • Overall rating: 4

MnDOT has now expanded the use of tow plows throughout the state to about 15-18 units.

Minnesota DOT (2009-2010) • Overall rating: 5

Since initial test period, MnDOT has added six more including some outside the Twin Metro Area. More are planned to be purchased and installed in the future.

Minnesota DOT (2008-2009) • Overall rating: 5

There were some initial problems due to the learning curve, but the more familiar my operators became with the towplow, the more they liked it. I now have 5 operators trained on this piece of equipment.

Missouri DOT (2009-2011) • Overall ratings: 5, 5, 4

- We use the tow plow to clear the driving lane shoulder while the truck clears the driving lane. We then are trying to be equipped to have a left wing on the truck plowing the left lane. This enables us to clear grass to grass with one pass with two trucks versus having to make extra passes to clear the shoulders. When just clearing the left shoulder that truck is in a dangerous position while partially in the lane (sitting duck) with speeds approaching 75-85 MPH. When clearing the shoulders the same time lanes are cleared is much safer. It also enables you to have shoulders cleared if there is an incident. Emergency vehicles have a better chance getting to the incident in a more timely manner. The ability clearing grass to grass also helps when the snow is blowing, it give some storage on the shoulder instead of filling quickly the driving lanes. Plowing grass to grass speeds up the process, saves time and is cheaper. It allows us to get to other routes much sooner. You also have the ability to plow both lanes in a blizzard like condition just to help keep lanes open. Towplow is a very good tool and hope to get more and make more improvements. Need some left towplows or something to be more versatile. VERY GOOD TOOL

- Would like to see a 20' towplow. Would like a spreader rather than a brine tank.

- This has been a very good tool for snow removal and I'm in hopes of getting a third tow plow at Ste Genevieve and using it on I 55 in Ste Genevieve County and Southern Jefferson County

Missouri DOT (2008-2009) • Overall rating: 5 (from all six respondents that year)

- Tremendous product. Worked well. Has improved our snow removal operations considerably. Widens the clearing path of a single truck. TowPlows can also be used to move the snow farther off the shoulder in a way similar to a wing. The positive part of this is that the truck stays on a good driving surface and the TowPlow will cantilever out past the edge of the shoulder.

- The Tow - Plow has been a great asset to our operation we have been able to pull two of our trucks and operators off the interstate and put them on other routes to bring our level of service up for those routes. We had a 8 to 10 inch snow storm and blowing winds in our district which was not in my area but we sent our 2 Tow - Plows to help keep the interstate open from drifting snow and they just kicked butt and simply amassed the crews that was fighting the storm before we showed up. They are a great piece of equipment. The more we do with the tow - plows the more we learn to do.

- We were using 5 trucks to clear the 38' section of roadway in the past. We used the tow-plow and 2 other trucks to achieve the same results. We eliminated 2 trucks. It performed very well and the operator was well pleased with how the truck and tow-plow handled.
- I think it is one of the best pieces of equipment that MoDOT has bought and we are glad we have it to use.
- Nothing but kudos and I wish I had 2 more and we could take care of I-55 with 4 Tow Plows on the main driving service which is from one end to the other would be app. 90 miles of 4 lane. We do have a truck on I-55 taking care of the ramps and overpasses and also 2 rest- areas in the mix. Each truck other than the tow plow takes care of about a 20 to 25 mile stretch. If the Tow Plow gets behind or would need help on something they are out there to help out. Thanks

New Hampshire DOT (2011-2012) • Overall rating: 4

We experienced horsepower issues on state assigned equipment, limiting our patrol speeds on roads with grade. With some minor adjustments in driver thought process, we were able to test the product moderately. The winter season did not produce the extreme conditions one might wish for to thoroughly test the plow unit however, the device does have its merit. One concern is, that if the towing unit has a breakdown, the patrol section is now without two plowing devices, unless a back up unit can be mated to the plow for emergencies. The unit does have its place in the system if it were tailored correctly to our specific needs in NH...

North Dakota DOT (2011-2012) • Overall rating: 5

Operators are somewhat hesitant to use the tow plow for the first time but, after spending some time driving it, realize it is a lot easier to use than they originally thought. Operators took trial runs through their plow routes to get used to obstacles they'd face and areas where they could turn around. Once they get used to it, they love it. Word of mouth has spread news of the tow plow's benefits throughout the state. The Districts who have them want more of them. Most of the Districts who don't have them are requesting them. We really like them, have noticed many benefits, and we plan to keep adding to our fleet. Additional Information: http://www.dot.nd.gov/divisions/materials/research_project/MR201001final.pdf

Ohio DOT (2010-2011) • Overall rating: 5

Extremely valuable piece of equipment. No problems with equipment.

Pennsylvania DOT (2011-2017) • Overall rating: 2

Tow plow could not spread the entire snow route with material and Dump Truck required modifications

Pennsylvania DOT (2009-2011) • Overall rating: 4

Vendor support was quick. Operator manual was complete, but service and parts were lacking material for the add-on options. Truck up-fit cost was high and had to be converted for different means of spreading granular material while plowing.

South Dakota DOT (2015-2017) • Overall rating: 5

We finally had a decent snow year to test out the bi-directional tow plow. We plan to purchase 6 more bi-di's for this next season.

Utah DOT (2011-2014) • Overall rating: 5

Units were consistent in road-readiness. Fit and finish was excellent. Post sale support was outstanding from manufacturer

Vermont AOT (2013-2017) • Overall rating: 5

We were able to deploy the tow plow during overnight storms (and others to a lesser degree) and provide winter maintenance to 2 lanes of traffic with one truck, which allows more coverage when we send workers home due to 1.2 to 1.3 operators per route.

Washington State DOT (2013-2016) • Overall rating: 4

We needed to modify the tow-plow to unload excess salt from the rear. This was a relatively inexpensive exercise but would have been better/less expensive if it had come that way.

Wisconsin DOT -- Marquette County (2009-2011) • Overall rating: 5

As I said Tow plow cleanup time is a slight issue.

Wyoming DOT (2014-2015) • Overall rating: 4

Operators are gaining confidence in how the unit handles.

BRINE MAKERS AND BLENDERS

AccuBrine automated brine maker (Cargill)

<https://www.cargill.com/industrial/winter-road-maintenance/brine-makers>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	1	2015-16	4	3	4	5	3	3
Minnesota	1	2007-08	4	3	3	4	5	4
New York	1	2008-09	3	3	4	3	3	3
Pennsylvania	59	2010-2017	3	3	3	4	4	3
Virginia	5,000 gallons	2008-09	5	4	5	4	5	5
Virginia	n/a	2008-09	3	2	3	n/a	No Response	3
Average rating			3.7 - helpful	3 - average	3.7 - helpful	4 - maintained good condition	4 - well	3.5 - satisfied

Comments

Arizona DOT (2015-2016) • Overall rating: 3

Regarding question #'s 12,13 [how well the product addressed the problem; overall satisfaction] - we didn't really get a chance to evaluate the unit for a long enough period to adequately assess these.

Pennsylvania DOT (2010-2017) • Overall rating: 3

During trial period used rock salt to make brine, had to clean machine more often. Recommend using evaporated salt less cleaning

Virginia DOT (2008-2009) • Overall ratings: 5, 3

- The automatic brine maker makes the brine with such ease and to the correct specs that the only concern we now have to deal with is the application to the roadways.
- Some leaking experienced with product; some parts of contract language not followed by vendor.

Brine Boss (VariTech Industries)

<http://www.varitech-industries.com/BrineBoss>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
New York	36	2013-2017	4	4	4	2	3	3
Texas	1	2011-2017	5	5	5	5	5	5
Utah	n/a	2014-2016	5	4	5	5	5	5
Average rating			4.7 - extremely helpful	4.3 - easy	4.7 - extremely helpful	4 - maintained good condition	4.3 - well	4.3 - satisfied

Comments

New York State DOT (2013-2017) • Overall rating: 3

Automated monitoring system works well. Units produce quantities of brine as advertised. We are working with the vendor to resolve what appear to be minor cracks in the top reservoir and base reservoir in some units, as well as a corrosion issue with a receptacle. It is very difficult to clean out sediments from the unit.

Texas DOT (2011-2017) • Overall rating: 5

Great product

Comments on Brine Boss (continued)

Utah DOT (2014-2016) • Overall rating: 5

Brine Boss enabled us to produce more brine in less time and because of the automation we didn't have an employee babysitting the system the entire time.

Salt Blending Station: JWB Manufacturing

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Minnesota	1	2009-10	3	2	2	4	5	5
Average rating			3 - average	2 - not very easy	2 - not very helpful	4 - maintained good condition	5 - extremely well	5 - extremely satisfied

Comments

Minnesota DOT (2009-2010) • Overall rating: 5

Many modifications were necessary to arrive at a field-readiness condition. It's saved an average of \$15/ton based on our experience.

Salt Brine Maker: Henderson Brine Xtreme

<http://www.hendersonproducts.com/brinextreme.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Virginia	1	2013-14	4	5	5	4	4	5
Average rating			4 - helpful	5 - extremely easy	5 - extremely helpful	4 - maintained good condition	4 - well	5 - extremely satisfied

Comments

Virginia DOT (2013-2014) • Overall rating: 5

The unit has a small footprint, continuously produces brine within an acceptable percentage of salt, has high rate of production, includes remote alarms for operators and blends two additional products in an acceptable concentration range.

Salt Brine Maker: Reed Systems

<http://reedssystemsltd.com/brine-makers/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
New York	1	2008-09	5	n/a	5	4	4	5
Virginia	1	2008-09	3	3	4	3	3	3
Virginia	1	2008-09	4	5	4	5	4	4
Virginia	1	2008-09	2	3	4	4	4	4
Average rating			3.5 - helpful	4.3 - easy	4.3 - helpful	4 - maintained good condition	3.8 - well	4 - satisfied

Comments on Salt Brine Maker (Reed Systems)

New York State DOT (2008-2009) • Overall rating: 5

low tech unit that has a good production rate

Virginia DOT (2008-2009) • Overall ratings: 4, 4, 3

I feel Reed Systems could design a better double wall storage tank. It present a style which reflects poor manufacture quality and design.

Salt Brine Maker: VariTech

http://www.varitech-industries.com/html/salt_brine.html

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Missouri	1	2008-09	5	5	4	4	5	5
Average rating			5 - extremely helpful	5 - extremely easy	4 - helpful	4 - maintained good condition	5 - extremely well	5 - extremely satisfied

Comments

Missouri DOT (2008-2009) • Overall rating: 5

We used the Varitech brine maker to make salt brine for all 5 of my buildings and hauled it out of one location to outlying buildings. Worked very for what we wanted. Could easliy make 10,000 gal a day.

CAMERAS

AgCam on-board camera system (Dakota Micro)

<http://dakotamicro.com/agcam/products.php?category=Cameras-Monitors>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
North Dakota	N/A	2015-2016	4	4	5	5	5	5
Average rating			4- helpful	4 - easy	5 - extremely helpful	5 - maintained excellent condition	5 - extremely well	5 - extremely satisfied

Comments

North Dakota DOT (2015-2016) • Overall rating: 5

Positioned to view box, spreader, wing, towplow, and to the rear to see approaching traffic. Also installed on pickups as a backup camera and payloaders to help see blind spots. Used in summer to view pavement preservation operations (worker safety). Mounting so that lens stays clean. Side windows and mirrors often become frosted or covered and the camera is the only way to see outside truck. Systems are working very well and well liked by staff. We have approximately 90 systems in service.

Axis Communications M1065-L plow camera

<https://www.axis.com/en-us/products/axis-m1065->

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	600	2017-2018	5	5	5	5	5	5
Average rating			5 - extremely helpful	5 - extremely easy	5 - extremely helpful	5 - maintained excellent condition	5 - extremely well	5 - extremely satisfied

Comments

Iowa DOT (2017-2018) • Overall rating: 5

Very pleased with the performance of the Axis product and the support we have received from the Axis staff members and distributor. Project background: We used iPhones in our Plow Cam project. The iPhones were becoming less reliable and the constant changes/updates to the iPhones were causing us problems. Moving to an IP camera eliminated the OS issue and the reliability of the IP camera was significantly better. We started with 3, increased to 600 for the 2017-2018 winter season. We will outfit all 900 trucks for the 2018-2019 season.

FLIR Infrared Cameras (vehicle-mounted)

<http://www.flir.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	N/A	2008-2009	2	2	1	1	1	1
Average rating			2 - not very helpful	2 - not very easy	1 - extremely unhelpful	1 - poor	1 - not at all well	1 - not at all satisfied

Live View plow cameras

<https://www.liveviewtech.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Montana	10	2015-2017	2	4	4	5	5	5
Average rating			2 - not very helpful	4 - easy	4 - helpful	5 - maintained excellent condition	5 - extremely well	5 - extremely satisfied

Comments

Montana DOT (2015-2017) • Overall rating: 5

MDT was able to make the plows forward facing which was extremely important to the traveling public.

Pro-Vision camera system

<http://www.provisionusa.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Rhode Island	1	2013-14	5	n/a	n/a	5	5	5
Vermont	N/A	2015-2016	3	4	4	5	4	4
Average rating			4 - helpful	4 - easy	4 - helpful	5 - maintained excellent condition	4.5 - extremely well	4.5 - extremely satisfied

Comments

Rhode Island DOT (2013-2014) • Overall rating: 5

This system uses a single camera mounted at the rear of the vehicle. The camera is powered by an in-cab monitor that energizes automatically when the vehicle is put in reverse but can also be manually activated any time.

DEICERS/CHEMICALS

Boost salt brine enhancer inhibitor (EnviroTech)

<http://envirotechservices.com/deicing-anti-icing/salt-brine-additives/boostsb/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Idaho	4000 gallons	2016-2017	5	5	5	N/A	5	5
Average rating			5 - extremely helpful	5 - extremely easy	5 - extremely helpful	N/A	5 - extremely well	5 - extremely satisfied

Comments

Idaho DOT (2016-2017) • Overall rating: 5

Boost was effective at various concentrations and reduced the number of applications on the roadway. The use of Boost helped maintain the salt brine mixed with Boost at colder temperatures and worked better at staying on the road longer.

Dowflake Xtra calcium chloride flakes

<https://www.oxycalciumchloride.com/products/dowflake-xtra-83-87-calcium-chloride-flakes>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	N/A	2017-2018	5	5	N/A	N/A	5	5
Average rating			5 - extremely helpful	5 - extremely easy	5 - extremely helpful	N/A	5 - extremely well	5 - extremely satisfied

Comments

Arizona DOT (2017-2018) • Overall rating: 5

Comments from Flagstaff Supervisor: They typically use this when temperatures are extremely low and material is not working as fast as needed. They will pre-make loads prior to the storm. This helps with ensuring it is mixed and ready to go in case they need it. It is typically mixed one 50-pound bag to a front end loader bucket full of Ice Slicer. They will usually use it for 3-4 loads per storm (when needed). They stated this stuff works extremely fast with breaking up the ice and is very corrosive.

Fusion Deicer

<http://eco-solutions.net/municipal-fusion>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	3,600	2008-09	4	4	4	3	3	3
Illinois	8,000	2008-09	n/a	n/a	3	4	4	4
Average rating			4 - helpful	4 - easy	3.5 - helpful	3.5 - maintained good condition	3.5 - well	3.5 - satisfied

Comments

Illinois DOT (2008-2009) • Overall rating: 4

It's still too early to tell if this is an alternative to salt brine.

Geomelt

<http://www.snisolutions.com/antiicing.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Illinois	14,568 gallons	2008-09	n/a	n/a	n/a	n/a	3	3
Illinois	8,000 gallons	2007-08	n/a	n/a	5	n/a	3	3
Missouri	8,000 gallons	2008-09	5	4	5	5	5	5
Missouri	12,000 gallons	2007-08	5	3	4	5	5	5
Missouri	10,000 gallons	2007-08	4	3	5	4	4	4
Missouri	20,000 gallons	2007-08	3	4	4	4	4	4
Ohio		2007-08	2	4	5	3	2	3
Ohio	12,000 gallons	2007-08	4	3	5	3	3	3
Ohio	1,000 gallons	2007-08	4	5	4	4	3	4
Ohio	1,971 gallons	2007-08	4	4	3	3	2	2
Average rating			3.9 - helpful	3.8 - easy	4.4 - helpful	3.9 - maintained good condition	3.4 - average	3.6 - satisfied

Comments on Geomelt

Illinois DOT (2007-2008) • Overall rating: 3

IDOT will continue to evaluate the product. The chemical was mixed with salt brine and used to prewet granular salt. The operators reported that roads cleaned up faster when using this product. No formal evaluation has been performed by IDOT.

Missouri DOT (2008-2009) • Overall rating: 5

Employees thought product performed good as Calcium if not better. End of shift leather gloves still fit. Thought they might had one to two more cycle times than crew on either side. Load salt and GO.

Missouri DOT (2007-2008) • Overall ratings: 5, 4, 4

• The lumping or hardening of our salt was practically eliminated. The lumps easily broke up in the loading process. Very good results.

- I am sold on Beet Juice. It performs very well under the stated conditions of lower temps. It took a little reworking of our delivery systems. We will incorporate more stations that use beet juice in Eastern Jackson Co.
- Geomelt performs exceptionally well as an anti-caking agent. Stockpiles treated with Geomelt have remained free flowing. Initial reports on its effectiveness as an anti-icing agent are inconclusive. We plan on conducting a more indepth evaluation during the 2008-09 winter.

Ohio DOT (2007-2008) • Overall ratings: 3, 3, 4, 2

- Best thing about Geomelt was not having to use grits when applying this product
- We did not have consistency with the product. The drivers had a hard time with the theory of plowing the road and not re applying materials. We could not show the additional cost as a benefit. Keep in mind this was using the product on the salt as a treated pile.
- Longer to react but results last longer for pavement. Takes less material to treat highway. Not as effective below 20. Suggest treating initially with salt and then geomelt mixture.
- Did not use enough to really know.

IceBan (Scotwood Industries)

<http://www.scotwoodindustries.com/brands/13/products/27>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Missouri	750 gallons	2014-2016	4	4	4	5	4	4
Average rating			4 - helpful	4 - easy	4 - helpful	5 - maintained excellent condition	4 - well	4 - satisfied

Comments

Missouri DOT (2014-2016) • Overall rating: 4

The testing we performed in 2015-2016 looks promising and in the testing we put Ice-Ban up against our normal winter de-icing products. We did see a reduction in salt usage and we decided to expand the testing this year with 12,000 gallons of the Ice-Ban product.

IceKicker (Saltworx)

<http://saltworx.net/ice-kicker/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Idaho	N/A	2016-2017	4	4	4	N/A	4	4
Average rating			4 - helpful	4 - easy	4 - helpful	N/A	4 - well	4 - satisfied

Comments

Idaho DOT (2016-2017) • Overall rating: 4

Ice Kicker was a good product and we used less per lane mile than regular salt.

Ice Slicer deicer

<http://www.iceslicer.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
South Dakota	12 semi loads at 30 tons per load	2015-2017	5	5	5	5	5	5
Average rating			5 - extremely helpful	5 - extremely easy	5 - extremely helpful	5 - maintained excellent condition	5 - extremely well	5 - extremely satisfied

GPS/AVL SYSTEMS

Cirus GPS/AVL

<http://www.ciruscontrols.com/snow-plow-data-management/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Idaho	409 units	2014-2017	4	4	5	5	5	5
Idaho	N/A	2013-14	4	4	5	5	4	4
Idaho	N/A	2013-14	5	5	5	N/A	4	4
Average rating			4.3 - helpful	4.3 - easy	5 - extremely helpful	5 - maintained excellent condition	4.3 - well	4.3 - satisfied

Comments

Idaho Transportation Department (2013-2014) • Overall rating: 4

Excellent customer service, working with Cirus data tool to customize to Idaho's needs were outstanding. Provide all the information we needed except for plow position. Hardware issue with ITD trucks.

Geotabs

<https://www.geotab.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Missouri	N/A	2015-2017	4	5	5	5	4	4
Average rating			4 - helpful	5 - extremely easy	5 - extremely helpful	5 - maintained excellent condition	4 - well	4 - satisfied

Comments

Missouri DOT (2015-2017) • Overall rating: 4

We are very satisfied. Our entire fleet of 200 heavy duty vehicles in our SW district will be equipped with GEO Tabs this season.

Interfleet GPS/AVL

<http://www.webtechwireless.com/en/solutions/interfleet/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Ohio	N/A	2008-12	3	3	3	3	2	2
Average rating			3 - average	3 - average	3 - average	3 - average	2 - not very well	2 - not very satisfied

Comments on Interfleet GPS/AVL

Ohio DOT (2008-2012) • Overall rating: 2

We did not have good results with the Interfleet system. We are hoping for better results with our newer systems.

LaserLine Guidance Laser for Wing Plows (Model GL3000C)

<http://www.laserlinemfg.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	N/A	2017-18	3	N/A	3	3	3	3
Idaho	2-3	2017-18	5	4	4	5	5	5
Minnesota	N/A	2008-09	4	4	4	5	5	5
Minnesota	1	2007-08	5	5	4	5	4	4
Montana	8	2013-15	4	3	5	5	3	4
Utah	10	2015-18	3	4	3	3	4	3
Utah	16	2007-08	5	4	5	5	4	5
Average rating			4.1 - helpful	4.0 - easy	4.0 - helpful	4.4 - maintained good condition	4.0 - well	4.1 - satisfied

Comments

Arizona DOT (2017-2018) • Overall rating: 3

Comments from our Payson Supervisor: Lasers have been a huge help for the area we work in. I have used Wings without and with. With having this piece of equipment, the drivers seem more confident when working narrow roads, or dealing with a lot of guardrail, even in whiteout conditions. The lasers can pick up delineation, and even the guardrail tabs. The only thing you need to make sure you do is set it up right for the truck that is using it, and what area. Not all areas are the same, and not all trucks are the same. The other issue when installing these is that you need to make sure they are hooked up correctly to have the lens cleaned off when operating the laser during a storm. They have come a long way in the past couple of years in keeping these lenses clean. If these fail or break down, it does take some time to have these repaired from a vendor standpoint.

Idaho Transportation Department (2017-2018) • Overall rating: 5

Based on the experience, we are now making this unit a standard on all trucks with wing plows.

Minnesota DOT (2007-2008) • Overall rating: 4

This was a great cost savings project, we had no accidents with fixed objects along the road when in use. The vendor was great to deal with and just a great all around project. There are plans to use this on the paving machine.

Montana DOT (2013-15) • Overall rating: 4

To early to tell.

Comments on LaserLine Guidance Laser for Wing Plows (continued)

Utah DOT (2015-2018) • Overall rating: 3

We use wing plow lasers mostly in straight line operations around the city. We have found that using them in canyons and on very curvy roads just causes the laser to bounce around where the wing plow isn't going to really be anyway and they end up being a distraction rather than helping.

Utah DOT (2007-2008) • Overall rating: 5

Our field crews installed the units without having to use the central shops. We cut back avoidable hits by 85% overall. The worse the conditions the more help the laser unit is. Overall, we are very pleased with the GL3000C.

INFORMATION MANAGEMENT

AccuWeather SkyGuard Online

<http://www.accuweather.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Pennsylvania	N/A	2012-2013	2	2	4	4	4	3
Average rating			2 - not very helpful	2 - not very easy	4 - helpful	4 - maintained good condition	4 - well	3 - average

Comments

Pennsylvania DOT (2012-2013) • Overall rating: 3

- During the trial period, the web site provided the following: - All basic weather information for locations set by users. This function appeared to work well. - PA Traffic cameras. This function appeared to work well. - Current website is best run using T1 lines, and could not be used effectively with Internet Explorer 8 browsers. - Included very detailed weather warnings for individual stockpiles, but they were created at a County level, not for specific stockpiles. This feature appeared to work well. - Users can have their own User ID and therefore can customize the website for their desired location. This function appeared to work well. - PennDOT-specific maps were updated 4 times per day; National maps were updated two times per day.
- During the trial period, the Email Alert service provided the following: - An unlimited number of users; but, forecasts were sent to everyone in the County, regardless of their reporting location. - A single email Alert containing multiple stockpile locations. The vendor did not provide forecasts for individual stockpiles. - An identification of a staff meteorologist available by telephone for specific weather-related issues. The meteorologist was contacted several times with excellent customer service provided. - Timely and accurate email Alerts for the following events: Snow, Heavy Snow, Snow Squall Warning, Heavy Rain, Heavy Snow Canceled, Heavy Rain Canceled
- Service used radar to included Squall Alerts as the alerts are occurring, but forecasting squalls in advance is not possible at this time.

High Sierra temperature sensor

<http://highsierraelectronics.com/mobilesurface sentinel/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	300 units	2016-2018	4	3	4	3	3	3
Iowa	10 units	2016-2017	4	5	4	5	4	4
Average rating			4 - helpful	4 - easy	4 - helpful	4 - maintained good condition	3.5 - well	3.5 - satisfied

Comments on High Sierra temperature sensor

Iowa DOT (2016-2018) • Overall rating: 3

During our first season of testing, the High Sierra sensors worked very well and we did not experience any unit failures. Based on this performance, we increased the number of units to 300 for the next winter season plus we outfitted all 50 of our Supervisor pickups. Once the 2017-2018 season started we experienced numerous unit failures. When we addressed this issue with High Sierra, they were willing to replace the defective units, however we continued to have unit failures. We held a meeting with High Sierra senior management about the issue we were experiencing with the high failure rates and they shared with us that they had changed a material used in the sensors plus they had changed part of their manufacturing process. High Sierra also told us they had made the decision to go back to the original materials and manufacturing process and they would continue to replace all of the units that failed. Throughout this process High Sierra has been willing to work the issues we have had with these sensors. They have been willing to replace all units that have failed at no cost to the Iowa DOT. We will be going into the 2018-2019 with 300 trucks and 50 Supervisor pickups outfitted with these units and we will be tracking their performance.

Iowa DOT (2016-2017) • Overall rating: 4

We outfitted 10 trucks each with Vaisala, Weather Cloud, and the High Sierra. The High Sierra sensors performed the best and were the most consistent. We had no sensor failures with the High Sierra sensors.

This sensor connects with our Cirrus Speedsmart controller to display the temp reading on the controller display in their truck for the operator and the temp info is fed through our GPS/AVL system that is then displayed on our internal website.

We plan to expand out testing during the 2017-2018 winter season by outfitting 350 snow plow trucks and 50 supervisor pickups.

Loadrite Loader Scale

<http://loadritescales.com/product/product-type/loader-scales>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Maryland	5	2016-2017	3	4	3	4	4	3
Minnesota	1	2011-12	4	4	4	4	3	4
Average rating			3.5 - helpful	4 - easy	3.5 - helpful	4 - maintained good condition	3.5 - well	3.5 - satisfied

Comments

Maryland DOT (2016-2017) • Overall rating: 3

Goal: Rather than using an estimated weight per "scoop" of salt placed in each truck, SHA wanted to know the precise amount of salt placed in each truck. The hope was that this information could be matched up with the location data on the trucks whereabouts to determine the amount of salt spread in specific at risk watersheds.

Comments: Presently there is no way for a central office to control the entries in the field (i.e., storm numbers, naming convention for trucks, material types) which will cause issues with rolling up statewide data. Also, all reports had to be recreated in each Shop rather than a central office developing a common report to be used by all. The controller also seemed to use antiquated technology which didn't allow for easy selection of trucks and material type. The weights were helpful, but the individual Shops who tested had to rely exclusively on the quality of their administrative people entering data before each storm and the quality of the loader operator making good selections when loading salt. Because of this, some Shops found greater success than others.

Minnesota DOT (2011-2012) • Overall rating: 4

The product worked well to track amount of product(s) that was used out of a stockpile, could be used to help track inventory where agencies don't have funding to purchase a precision controller to measure amount of product(s) applied during a Snow and Ice event. Safety consideration: the operator can see how much weight they load, avoiding overweight and safety concerns.

Lufft USA Multi-Parameter Weather Sensors (WS601)

<http://lufft.com/en/products/all-in-one-sensors/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Pennsylvania	2	2012-13	5	4	5	5	2	3
Average rating			5 - extremely helpful	4 - easy	5 - extremely helpful	5 - maintained excellent condition	2 - not very well	3 - average

Comments

Pennsylvania DOT (2012-2013) • Overall rating: 3

Following their installation in December (Perry) and January (Fulton), data was recorded. The snowfall data recorded was compared to Millersville University's snow totals tracking to determine the effectiveness of the weather stations. The Lufft weather station is set up to record data in meteorological formats and units, such as liquid precipitation, and does not record snowfall by accumulation. For the purposes of recording snowfall totals and comparing them to salt usage, this station does not fulfill the goal.

MacQueen Equipment Liquid Chemical Tracking Software

<http://www.macqueeneq.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Minnesota	1	2011-12	3	3	2	4	4	4
Average rating			3 - average	3 - average	2 - not very helpful	4 - maintained good condition	4 - well	4 - satisfied

Comments

Minnesota DOT (2011-2012) • Overall rating: 4

Due to lighter winter, more real-life testing and assessment is required.

Maintenance Decision Support Systems (MDSS)

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Michigan	N/A	2012-13	4	N/A	4	N/A	3	4
Pennsylvania	15 Routes	2011-13	4	5	5	4	3	3
Average rating			4 - helpful	5 - extremely easy	4.5 - extremely helpful	4 - maintained good condition	3 - average	3.5 - satisfied

Comments

Michigan DOT (2012-2013) • Overall rating: 4

MDSS seems like it can be a very useful tool if coupled with AVL technology. Our pilot did not have this, so parameters had to be entered into the system by supervisors after the storm. Viewing the weather maps, and treatment recommendations on the website seemed very beneficial. Michigan is going to forge ahead with instrumenting our trucks with AVL, and plan to utilize MDSS services statewide (Meridian or another provider).

Pennsylvania DOT (2011-2013) • Overall rating: 3

Has difficulty dealing with "Lake Effect" snow.

Vaisala RWIS station

<https://www.vaisala.com/en/products/systems/road-weather-information-system-rwis>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Vermont	10	2016-2018	5	5	5	5	5	4
Average rating			5 - extremely helpful	5 - extremely easy	5 - extremely helpful	4 - maintained excellent condition	5 - extremely well	4 - satisfied

Comments

Vermont AOT (2016-2018) • Overall rating: 4

We have had very good experience with the entire station. We have just started our own maintenance of the RWIS stations in the last 1½ years, so we will have more insight into the reliability, but again are very happy with the way the stations have performed.

Vaisala temperature sensor

<http://www.vaisala.com/en/products/surfacesensors/Pages/default.aspx>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	10 units	2016-2017	4	4	4	2	2	2
Pennsylvania	N/A	2015-2017	4	2	2	3	4	4
Average rating			4 - helpful	3 - average	3 - average	2.5 - average	3 - average	3 - average

Comments

Iowa DOT (2016-2017) • Overall rating: 2

We had 2 of 10 sensor units fail during the winter season. This sensor did not seem to provide consistent readings. We do not plan to continue any testing with this temp sensor.

WeatherCloud temperature sensor

<http://weathercloud.co/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	10 units	2016-2017	2	2	2	2	1	1
Average rating			2 - not very helpful	2 - not very easy	2 - not very helpful	2 - not very durable	1 - Not at all well	1 - Not at all satisfied

Comments

Iowa DOT (2016-2017) • Overall rating: 1

These sensors failed miserably. Installs were difficult, tech support spotty, and the sensors did not work as advertised. Also, Weather Cloud stored the temperature data and wanted to charge an ongoing service fee for data storage. We removed all of these temp sensors and sent them back. We will not continue to test these sensors.

WeatherSentry Online (Schneider Electric)

<http://www.schneider-electric.com/en/product-range-presentation/61678-weathersentry-online-transportation-edition>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Illinois	n/a	2009-12	5	5	5	n/a	5	5
Massachusetts	n/a	2008-13	5	4	5	n/a	5	5
Pennsylvania	n/a	2012-13	4	5	4	4	5	5
Average rating			4.7 - extremely helpful	4.7 - extremely easy	4.7 - extremely helpful	4 - maintained good condition	5 - extremely well	5 - extremely satisfied

Comments

Illinois DOT (2009-2012) • Overall rating: 5

The ability to get personal response to specific questions was helpful to our staff. The accuracy of forecasts was also very good. The product has evolved and seems to continually improve.

Massachusetts DOT (2008-2013) • Overall rating: 5

The support this company provides has proven to be the most important aspect of having a contracted weather service. They go above and beyond most service companies.

Pennsylvania DOT (2012-2013) • Overall rating: 5

- The web site provided the following: - An unlimited number of users. - Ability to place color-coded Dashboards that identify important elements for up to 15 locations that will provide real-time monitoring using custom parameters. This function was used on a limited basis and appeared to function well. - A custom layer for stockpiles. - Historical weather data for anywhere pulled from nearest weather station. This feature appeared to work well. - An on-line chat with a meteorologist having a goal to address concerns within 15 minutes, but the service was not used. However, the sales staff was contacted regarding general questions with very fast response times. - "Virtual points" (even outside of state borders) could be added to represent the weather experience for another location. This feature was not used. - Available traffic camera images from multiple states including most of the snowbelt, South East Canada, and east coast states that are refreshed every 5 minutes. This function worked well. - "Custom Treatment Recommendations" for highways can display customizable treatment recommendations based on PennDOT policies and operations. This function was not used. - Create multiple treatment plans due to differing levels of service, varying route cycle times, and different chemicals. Treatment Plans can be printed. Anytime the weather scenario changes an icon will turn red to inform of the changing treatment recommendations. This function was not used. - National Weather Service Warnings, Watches and Advisories viewable as layers. This function appeared to work well. - National Weather Service Areas of Maximum Impact can show regions most likely to be impacted by a tornado, thunderstorm, or flood. This function was not used. - Help and Search features. This function was not used. - Traffic speed data on radar map for PA and contingent states and severe weather corridor locations providing direction and speed of storm cells. This function appeared to work well. - Provides adjacent states' RWIS data. This function appeared to work well. - "Precip Monitor" shows numerous locations at a glance. This function appeared to work well. - Worked well on Internet Explorer 8

- During the trial period the email Alerts provided the following: - Precipitation Timing - Forecast of Precipitation - Forecast of Frozen Precipitation - Observed Snow - Forecast of Low Temperature - Observed Low Temperature - Timing Alerts sent out as often as the changing forecast dictated; however, the service did not issue cancellations. - Capability to accommodate individuals wanting to receive email alerts only for problem areas (not all stockpiles). This function appeared to work well. - Capability to change distribution very easily to accommodate stockpile changing from Summer to Winter and other changes to formen's reporting locations. This function worked well. - Ability to customize for each user. This function worked well. - A timer that can be set by users that will stop email alerts during certain times of the day and/or days of the week. This function appeared to work well. - An absence of forecasting precipitation intensity.

- Service used weather forecasting stations located across PA and adjacent states, and issued email "Alerts" based on customized triggers automatically generated by forecasting radar.

- Service had the ability to create virtual pin points for forecasting which will better accommodate areas with no available weather stations by setting pin points at key locations.

LIGHTING

KC HiLites 8-inch Pro-Sport HID Fog Lamp (#1851)

<http://www.kchilites.com/8-pro-sport-hid.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	50	2015-2016	3	4	3	5	4	4
Average rating			3 - average	4 - easy	3 - average	5 - maintained excellent condition	4 - well	4 - satisfied

KC HiLites 6-inch Daylighter HID Fog Lamp (#1668)

<http://www.kchilites.com/6-daylighter-hid.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	50	2015-2016	3	4	3	5	4	4
Average rating			3 - average	4 - easy	3 - average	5 - maintained excellent condition	4 - well	4 - satisfied

Truck-Lite LED Snowplow Headlights

<http://www.truck-lite.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	50	2015-2016	3	4	3	5	4	3
Maine	8 sets	2011-12	4	5	4	4	4	5
Average rating			3.5 - helpful	4.5 - extremely easy	3.5 - helpful	4.5 - maintained excellent condition	4 - well	4 - satisfied

Comments

Arizona DOT (2015-2016) • Overall rating: 3

The lights perform very well. These are focused beam LED's, and mounted below the drivers line of sight improved visibility significantly. We also aimed these lights so the beam is going straight out in the operators line of sight by angling them slightly left/right, and downward. In certain weather conditions and temps the lenses will freeze over with ice. We tested a heated housing version of the same light and had zero lens ice issues. As a result, the new plow trucks we have on order for the upcoming winter season will be equipped with the heated lens version.

Maine DOT (2011-2012) • Overall rating: 5

Awaiting Final Report. Initial feedback has been positive.

Whelen heated lens covers

http://www.whelen.com/auto/product?head_id=5&cat_id=113&prod_id=738

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
South Dakota	10	2015-2016	4	5	4	4	3	3
Average rating			4 - helpful	5 - extremely easy	4 - helpful	4 - maintained good condition	3 - average	3 - average

SPREADERS/LIQUID APPLICATION SYSTEMS

Henderson First Response System (Slurry Spreader)

<http://www.henderson-mfg.com/liquid.html>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
North Dakota	1	2015-16	4	4	5	5	5	5
Minnesota	1	2011-12	4	3	4	n/a	4	4
Average rating			4 - helpful	3.5 - easy	4.5 - extremely helpful	5 - excellent	4.5 - extremely well	4.5 - extremely satisfied

Comments

North Dakota DOT (2015-2016) • Overall rating: 5

One unit in state. The slurry box performs very well. Operator has very high opinion of the unit. Relatively high cost for the unit makes expansion to fleet difficult.

Minnesota DOT (2011-2012) • Overall rating: 4

Limited usage because of lighter winter, so product durability was not assessed.

Henderson Zero-Velocity Spreader

<http://www.hendersonproducts.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Minnesota	2	2008-09	4	4	5	5	5	5
Average rating			4 - helpful	4 - easy	5 - extremely helpful	5 - maintained excellent condition	5 - extremely well	5 - extremely satisfied

Comments

Minnesota DOT (2008-2009) • Overall rating: 5

It is on the implementation list

Monroe Salt Slurry Generator

<http://www.monroetruck.com/Products.aspx?category=199&product=119&name=Salt%20Slurry%20Generator>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Illinois	1	2014-16	4	4	4	5	4	4
Illinois	7	2010-12	5	n/a	5	5	5	5
Illinois	3	2009-12	5	n/a	5	5	5	5
Minnesota	1	2010-11	3	2	3	4	4	4
Average rating			4.3 - helpful	3 - average	4.3 - helpful	4.8 - maintained excellent condition	4.5 - extremely well	4.5 - extremely satisfied

Comments

Illinois DOT (2014-2016) • Overall rating: 4

The slurry generator has proven to save on salt and the truck route it covers is usually finished ahead of the other truck routes. The slurry generator does call for the use of more liquid salt, which can be an issue if you do not have enough on hand. There are a lot more components with the slurry generator versus the tailgate spreader as well as a huge price difference. Hopefully, overtime repairs stay at a minimum, though we have not had any issues yet. The slurry generator has worked great for us so far, and would obtain more if the budget would allow for it.

Illinois DOT (2010-2012) • Overall rating: 5

Monroe's support has been very good. We estimate approximately a 30% savings in salt. Initially our test started with 2 units and we have increased to 7 units.

Illinois DOT (2009-2012) • Overall rating: 5

There were some initial minor issues, but now that we have the systems working well they are excellent. They improve performance while reducing the amount of salt required. They are especially effective in situations where deicing is necessary.

Minnesota DOT (2010-2011) • Overall rating: 4

Awaiting final report.

Salt Skirts

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Minnesota	4	2009-10	N/A	4	N/A	4	4	4
Average rating			N/A	4 - easy	N/A	4 - maintained good condition	4 - well	4 - satisfied

Comments

Minnesota DOT (2009-2010) • Overall rating: 4

MnDOT purchased two different vendors' products and modified them into one in order to better meet its needs.

Scale-Tec Calibrator IV Portable Spreader Calibration Scale

<http://www.scale-tec.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Illinois	1	2008-09	3	5	3	5	5	4
Minnesota	25	2008-09	n/a	4	4	5	5	5
Average rating			3 - average	4.5 - extremely easy	3.5 - helpful	5 - maintained excellent condition	5 - extremely well	4.5 - extremely satisfied

Comments

Illinois DOT (2008-2009) • Overall rating: 4

Excellent tool to calibrate spreader control systems

Minnesota DOT (2008-2009) • Overall rating: 5

It's on the implementation list.

VariTech Industries Liquid Application System - 1850 gal.

<http://www.varitech-industries.com/Products/Application-Systems/Slide-In-Anti-Icing-System>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Arizona	3	2015-16	3	4	5	5	5	4
Average rating			3 - average	4 - easy	5 - extremely helpful	5 - maintained excellent condition	5 - extremely well	4 - satisfied

Comments

Arizona DOT (2015-2016) • Overall rating: 4

VariTech is a subsidiary of Force America so we deal with the same rep for both in AZ. Their support after the sale is always outstanding

WINDSHIELD/WIPERS

Clear Fast

<http://www.nartron.com/>

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Iowa	1	2006-07	4	4	4	5	3	4
Iowa	1	2006-07	3	4	N/A	4	5	5
Iowa	1	2006-07	5	4	N/A	5	4	4
Iowa	1	2006-07	5	3	N/A	5	4	4
Iowa	1	2006-07	4	4	3	4	4	4
Average rating			4.2 - helpful	3.8 - easy	3.5 - helpful	4.6 - maintained excellent condition	4 - well	4.2 - satisfied

Comments

Iowa DOT (2006-2007) • Overall ratings: 4, 4, 4, 4, 5

- Product is a good tool for dealing with certain conditions such as freezing rain and fogging windshield. The snow that accumulates on the windshield due to blowing or end of plow driftings however, was more than the product could handle.
- Liked the idea of a simple on/off switch for the product versus having a manufacturer specific switch for the product, works well with the shaker system, operators found this product very user friendly
- Cleans window fine, doesn't deice very much Shaker - during snow storm keep wipers clean
- Cleans window, didn't do a whole lot for ice. Clear Fast draws volt meter down.
- Used lots of fluid through the washer.

Heated Windshield Washer Fluid System

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Wisconsin	1	2007-08	3	3	3	3	1	1
Wisconsin	1	2007-08	3	4	2	4	2	2
Average rating			3 - average	3.5 - easy	2.5 - average	3.5 - maintained good condition	1.5 - not very well	1.5 - not very satisfied

Comments on Heated Windshield Washer Fluid System

Wisconsin DOT (2007-2008) • Overall ratings: 1, 2

- No difference - our Patrolman who operated the plow truck with the heated Windshield Washer Fluid said not to waste your money on this product.
- I do not feel the product worked well enough to budget for the rest of our trucks

Hot Shot heated wiper fluid system

No longer available from the manufacturer. For past survey results, please email greg.waidley@ctcandassociates.com.

Wiper Shaker

www.wipershaker.com

State	Quantity tested	Season tested	Instructions	Ease of installation	Vendor support	Durability	Addressed problem	Overall satisfaction
Indiana	1 set	2006-07	4	3	N/A	5	4	5
Indiana	4 sets	2006-07	4	4	4	4	4	4
Indiana	N/A	2006-07	4	4	N/A	4	4	4
Indiana	5 sets	2006-07	5	4	5	3	4	5
Iowa	1 set	2006-07	5	4	N/A	5	4	4
Iowa	1 set	2006-07	5	3	N/A	5	4	4
Iowa	1 set	2006-07	4	3	3	4	4	4
Iowa	1 set	2006-07	5	4	N/A	5	4	4
Minnesota	4 sets	2006-07	4	5	N/A	5	5	5
Average rating			4.4 - helpful	3.8 - easy	4 - helpful	4.4 - maintained good condition	4.1 - well	4.3 - satisfied

Comments

Indiana DOT (2006-2007) • Overall ratings: 4, 5

- Worked well in light snow and in freezing rain.
- On one unit the wires pulled out of the unit. It was sent back to the factory and a replacement box was sent back. Good service.

Iowa DOT (2006-2007) • Overall ratings: 4, 4, 4, 4

- During freezing rain, motors iced up and didn't vibrate well.
- Iced up with freezing rain. Did work well in heavy snow.
- This was combined with the HotShot washer system. When cold, ice would build up beyond shaker capability. Worked well in combination with HotShot washer system.
- Easy to use and works well. Ice may accumulate on the ends of wipers in bad storms.