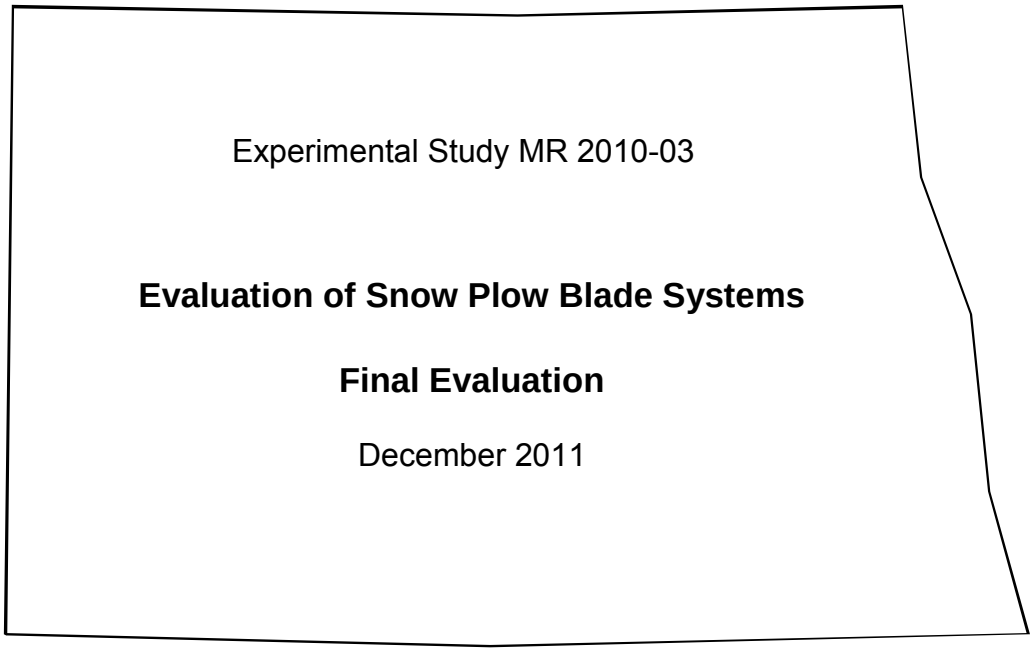
NORTH DAKOTA

DEPARTMENT OF TRANSPORTATION

MATERIALS AND RESEARCH DIVISION



Experimental Study MR 2010-03

Evaluation of Snow Plow Blade Systems

Final Evaluation

December 2011

Prepared by

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

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Andy Mastel

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Disclaimer

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Evaluation of Snow Plow Blade Systems MR 2010-03

Purpose and Need

The safe and efficient removal of snow and ice from highways and structures is a critical task for the NDDOT. The public relies on the Department to provide safe traveling surfaces in a timely manner. The efficiency of snow and ice removal depends on the experience and expertise of the NDDOT's District Employees, and on the use of the latest technology for snow and ice removal.

The workhorse of the NDDOT's snow and ice removal fleet is the truck mounted snow plow, outfitted with various snow plows. These plows are equipped with replaceable blade systems whose service life is determined by a number of variables, e.g. pavement type, number and type of snow or ice events, snow plow speed, snow plow operator technique, blade durability and quality, etc. The replacement frequency of the blade systems has an impact on the cost of operation, hours of availability, and down time for maintenance.

The current NDDOT standard blade replacement is carbide steel. Several new blade systems have become available. The NDDOT desires to evaluate three of these new blade systems in an effort to reduce costs and improve efficiency.

Objective

The objective of this project is to evaluate the field performance of three snow plow blade systems during the 2010-2011, fall through spring snow and ice season. The current NDDOT standard carbide blade system will serve as the control product for the project.

Experience of District Maintenance Employees operating and maintaining the equipment will be used to compare the service life, general effectiveness and efficiency, and cost of operation for the blade systems.

Scope

- The Dickinson District will install four different blade systems on 15 snow plow trucks. Blade systems to be evaluated include:

System 1 – Control, Carbide steel

- These blades come in various length sections and no adapters are required.
- Contains 3/4 inch carbide inserts in each section.
- To outfit a NDDOT straight reversible plow requires 3 four foot sections.

Photo 1: Traditional Carbide Blade System

Photo 2: side profile

System 2 – Joma

- Blades come in four foot sections encased in rubber.
- Steel Sections are spaced at one foot centers in the rubber.
- Contains 1.0 inch carbide inserts in each section
- To outfit a NDDOT straight reversible plow requires 3 four foot sections and adapters.

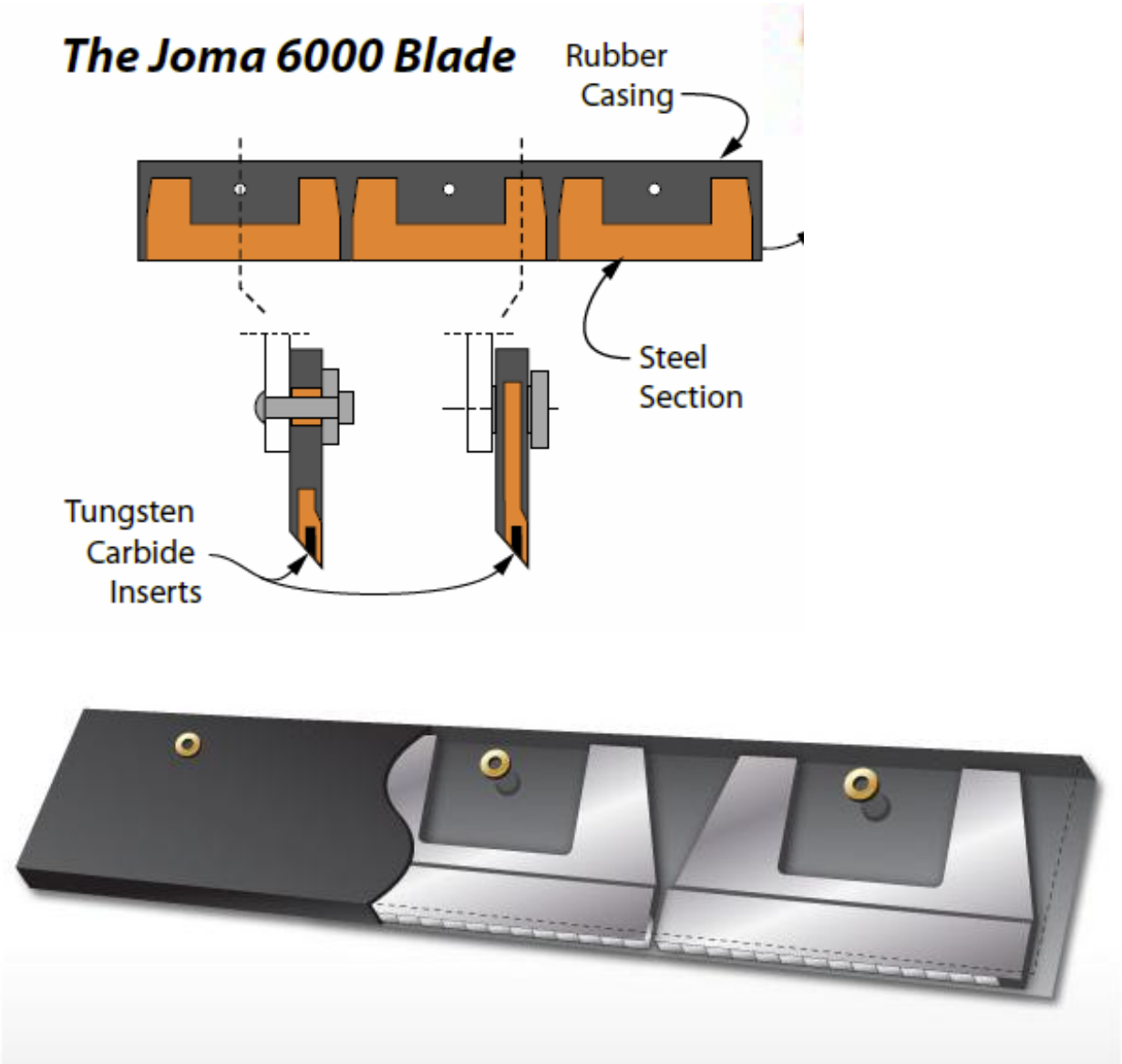


Figure 1: Joma Blade System

System 3 – Polar Flex

- Adapter plates come in four foot sections as shown in the picture below.
- Polar Flex blades come in one foot replaceable segments with two bolts holding each segment.
- The one foot segments can be changed individually.
- Contains 1.0 inch carbide inserts in each segment.
- To outfit a NDDOT straight reversible plow requires 3 adapter plates, 3 rubber inserts and 12 one foot segments.

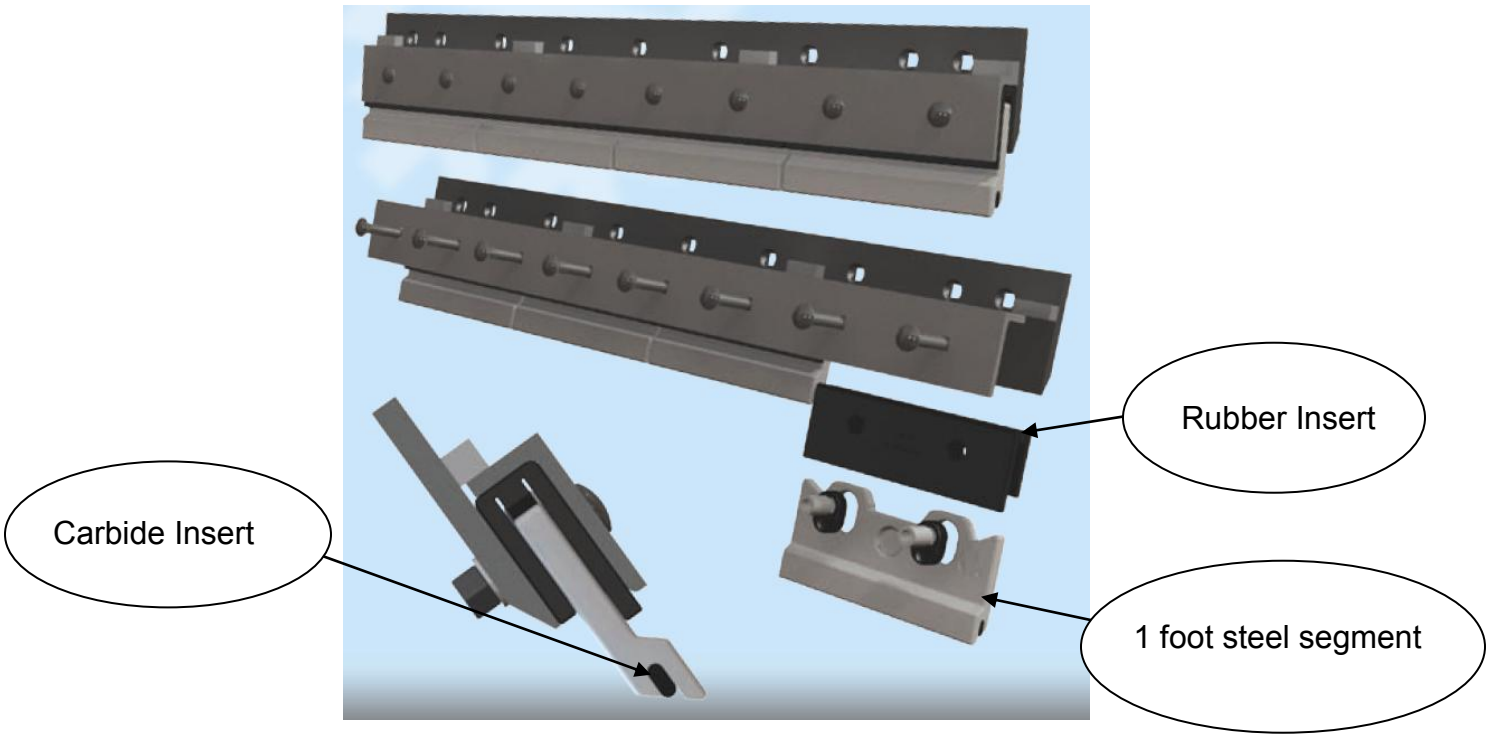


Figure 2: Polar Flex Blade System

System 4 – Stacked Blade Traditional Carbide Steel

- These blades come in various length sections and no adapters are required.
- Contains 3/4 inch carbide inserts in each section.
- To outfit a NDDOT straight reversible plow requires 6 four foot sections.

Photo 3: Stacked Blade System

Each blade system will be maintained on the same truck throughout the 2010-2011 snow and ice season; unless the performance observed is judged to be inadequate for continued evaluation.

The Dickinson District, with assistance from the Maintenance Division, will collect data and documentation from the District Maintenance Employees.

The Materials and Research Division and Maintenance Division will compose a survey for the District Maintenance Employees operating and maintaining the equipment to complete after a snow or ice event, or blade replacement activity.

Evaluation Criteria

Field performance of the blade systems will be evaluated using the following performance measures:

Service Life – District Maintenance Employees who operate the snow plow trucks will record the hours of roadway contact and keep replacement records for the blade systems.

Effectiveness and Efficiency – The District Maintenance Employees operating and maintaining the equipment will keep records on the road and weather conditions during snow plow operation. They will provide information on their observations regarding the performance of the blade system relative to snow and ice removal.

Equipment Maintenance – District Maintenance Employees who maintain the equipment will keep records on the frequency or replacement, time/labor required to replace, and relative difficulty of replacement.

The field performance evaluation will be conducted during the fall 2010 and spring 2011 snow and ice season. A final report documenting the outcome of the evaluation will be written by Materials and Research after the data has been assembled and analyzed.

Blade System Evaluation

Fifteen NDDOT trucks and District Maintenance Employees participated in testing the different snow plow blade systems. The District developed a spreadsheet for use after every snow and ice event. Materials and Research created a survey for the District Maintenance Employees operating and maintaining the equipment and their supervisors to fill out.

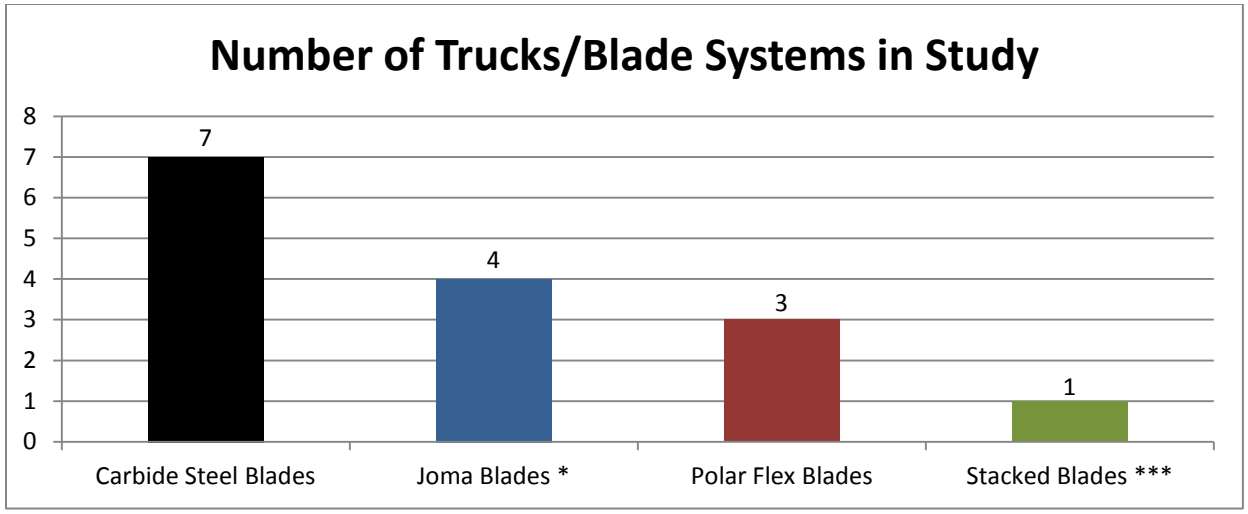
All fifteen trucks were equipped with 12.0' wide straight reversible snow plows. Below is a table showing the testing matrix for the research performed.

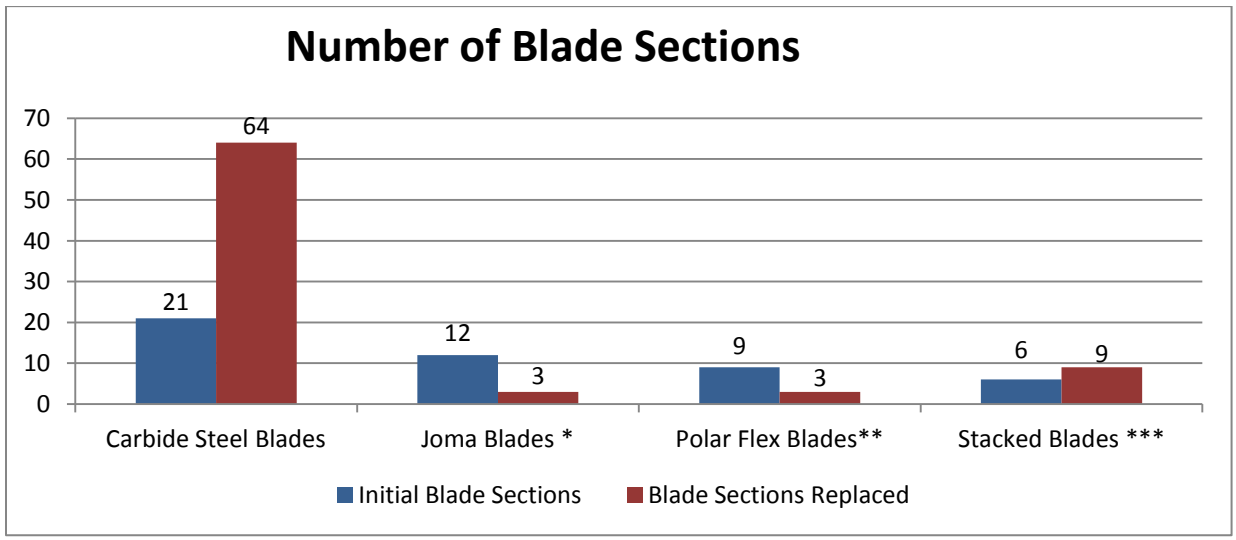
Blade Type	Truck #	Maintenance Section	Highway	HBP, PCC, or Both?
Carbide Blade	9315	Belfield	US 85	HBP
Carbide Blade	9743	Beulah	ND 200	HBP
Carbide Blade	9593	Killdeer	ND 22	HBP
Carbide Blade	9951	Beach	ND 16	HBP
Carbide Blade	9625	Dickinson	ND 22	HBP
Carbide Blade	9441	Hettinger	US 12	HBP
Carbide Blade	9724	Richardton	I-94	Both
Joma	9768	Dickinson	I-94	PCC
Joma	9788	Beulah	ND 49	HBP
Joma	9756	Belfield	I-94	HBP
Joma	9442	Dickinson	ND 22	HBP
Polar Flex	9914	Beach	I-94	HBP
Polar Flex	9440	Killdeer	ND 200	HBP
Polar Flex	9923	Richardton	I-94	Both
Stacked Blade	9623	Hettinger	US 12	HBP

Table 1: Unit #s and route plowed during test period.

District Spreadsheet Data

All the District Maintenance Employees listed in Table 1 on the previous page filled out a spreadsheet during the testing period. A summary of the data collected is shown below.





***** Employee 9768 reported that the angle was not set correctly on his plow for the Joma blades resulting in reduced service life. This accounted for replacement of three Joma blade sections.

**One Polar Flex blade section contains 4 one-foot segments.

*** Stacked traditional carbide blades showed no improvement in snow/ice removal or wear performance. They were replaced with single traditional carbide blades after the initial set wore out.

Survey

Materials and Research created a survey for the District Maintenance Employees to collect field data. The survey consisted of three parts; description of snow removed or deicing activity, experiences of District Maintenance Employees operating the equipment and experiences of District Maintenance Employees maintaining the equipment. As originally designed, it was intended that the survey be completed after each snow removal or deicing activity. However with the extraordinary number of events this past season it was not possible to meet that intent. The survey was instead used to report on the performance, maintenance, and perception of the blade systems.

The District Maintenance Employees were asked to rate the performance of the Joma, Polar Flex and stacked traditional carbide blade systems compared to traditional carbide blade system. A rating of 5 is equal to the performance of a traditional carbide blade system. Ratings higher than 5 are better and lower than 5 suggest worse performance. Below is a summary of the survey questions and the results from the District data.

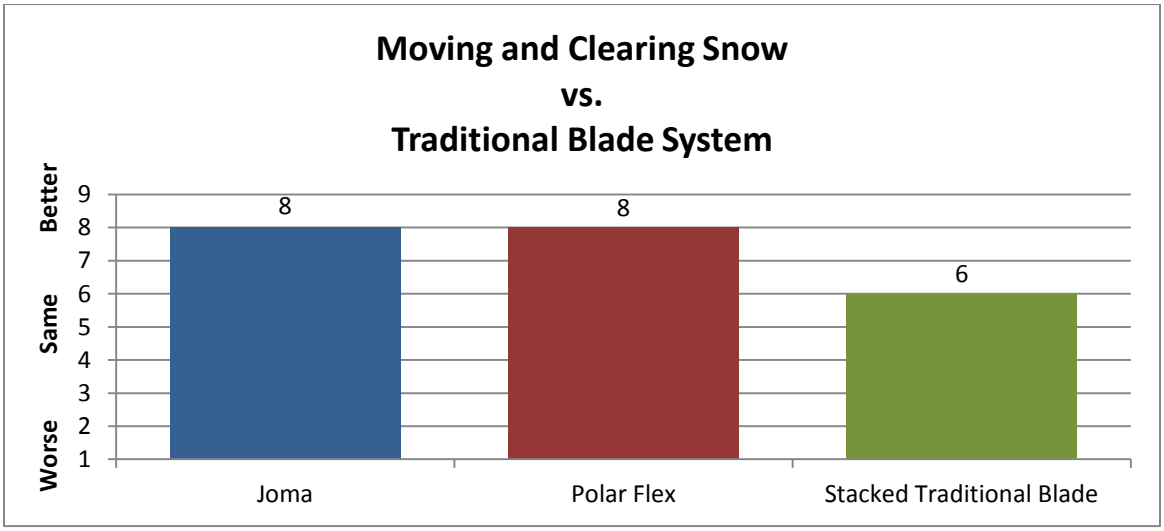
PART I: DESCRIPTION OF SNOW REMOVAL OR DEICING ACTIVITY

Individual event data is not available.

PART II: TRANSPORTATION TECHNICIAN PROVIDED INFORMATION

1. Performance of Equipment:

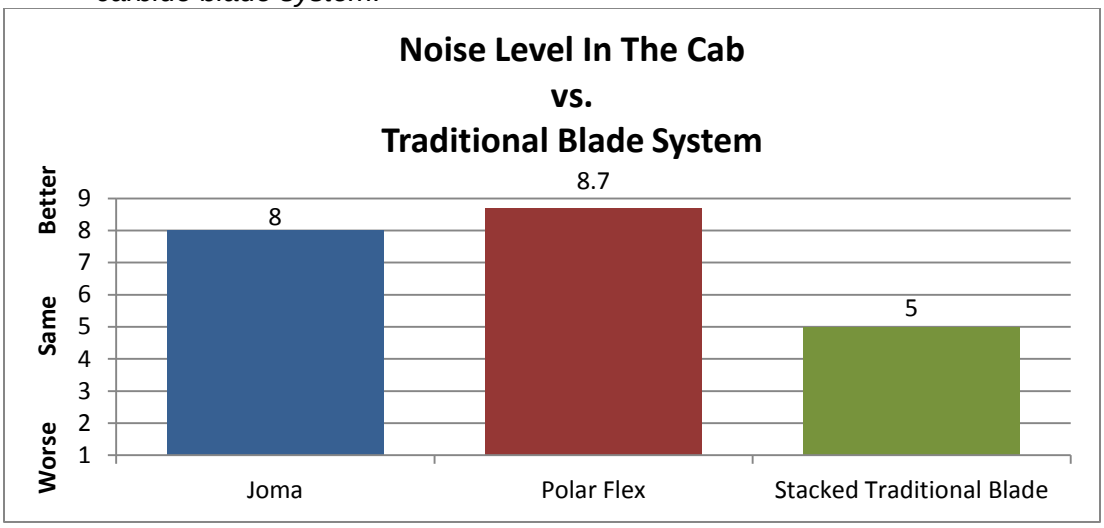
a) ***Snow Removal:*** *How effective was the test blade system in moving and clearing the snow as compared to a traditional carbide blade system? (how clean was the roadway, etc.)*



Employee comments: All blade systems were reported to have cleaned better than the traditional carbide blades.

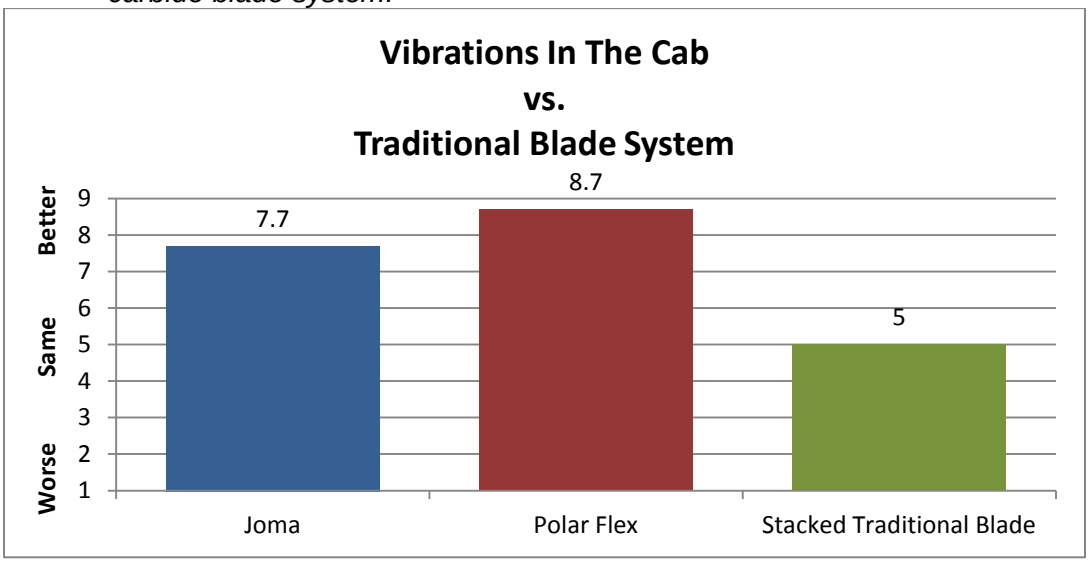
2. Transportation Technician Experience:

a) ***Noise Level in the Cab:*** *Rate the noise level in the cab as compared to the traditional carbide blade system.*



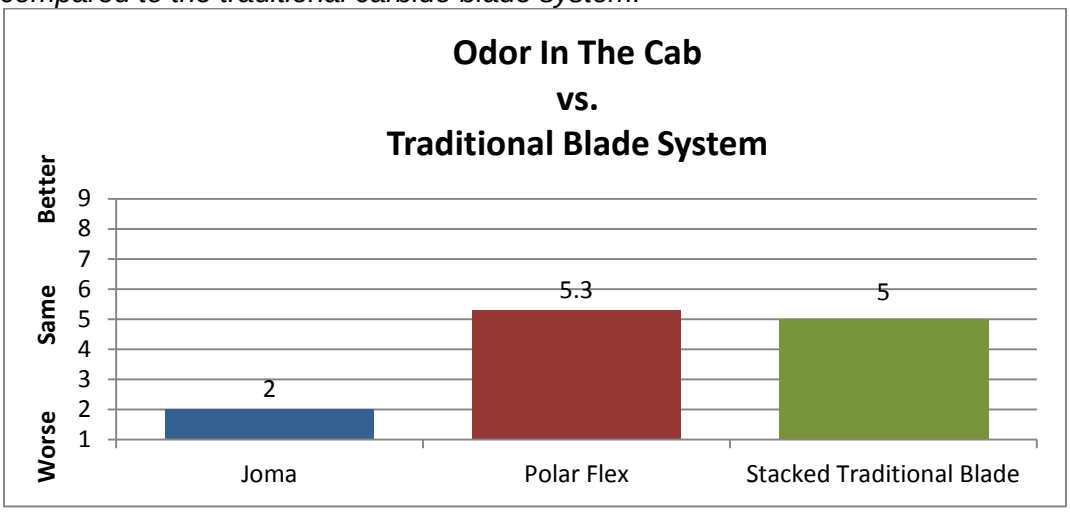
Employee comments: Joma and Polar Flex blades were reported to have significant noise reduction in the cab of the truck.

b) ***Vibrations in the Cab:*** *Rate the vibration in the cab as compared to the traditional carbide blade system.*



Employee comments: District Maintenance Employees testing the Joma and Polar Flex systems commented on reduced vibration in the cab. Employee 9923 (using Polar Flex) also commented on having reduced bounce.

***Odors in the Cab**: If there is an odor in the cab from the test blade system, rate the smell as compared to the traditional carbide blade system.*



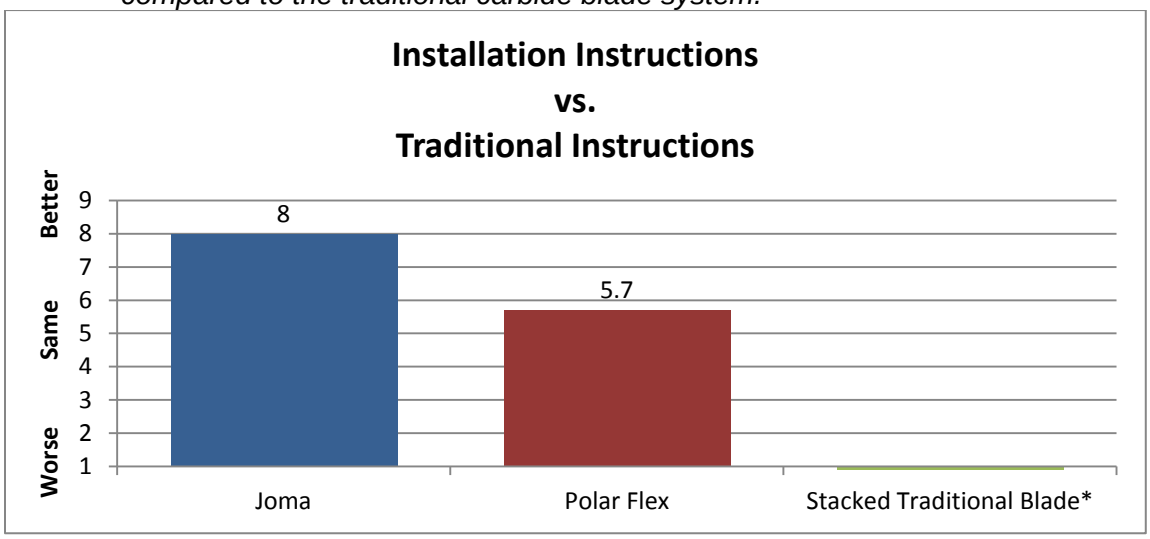
Employee comments: Joma blades were reported to have an initial burnt rubber odor. No odor was reported with Polar Flex blades.

PART III: MAINTENANCE SUPERVISOR PROVIDED INFORMATION

Maintenance by District Transportation Technician and/or Shop

a) ***Installation:***

i. *Rate the effectiveness of the installation instructions for the test blade systems as compared to the traditional carbide blade system.*

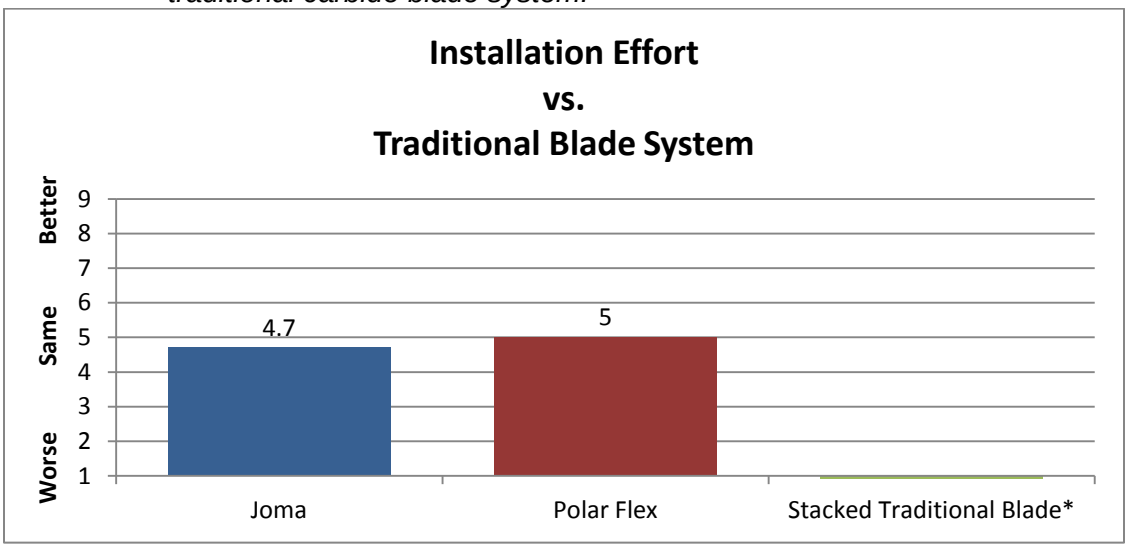


* No data was available for the Stacked Traditional Blade System.

Employee comments: Employees commented that the Joma and Polar Flex instruction pamphlets were helpful. Employee 9768 also said that the Joma blades are not as hard on hands and fingers when installing. Several comments have been made that the polar Flex Blades have a specification that the blade is supposed to be set to 75-85 degrees. It was also

reported that at that angle the plow may want to “trip” easily.

ii. Rate the effort required to install the test blade system as compared to the traditional carbide blade system.



* No data was available for the Stacked Traditional Blade System.

Staff Hours Required? on average, 30-60 Minutes for any blade system

Employee comments: It was reported that the Joma takes two people because of the weight and they come in three pieces. The Polar Flex were reported to be harder to install initially but employee 9923 thinks after that they will be easier to put the replacements on because they come in one foot sgments. Employee 9914 commented that the Polar Flex blades are a lot heavier to install than traditional but is not an issue with the lifting system that we have developed.

b) ***Replacement:***

i. What was the reason for the blade system replacement? What was its condition?

Employee Comments: Some Joma and Polar Flex users commented that they have not changed their blades.

ii. What parts were replaced? What was the cost?

Part: No Comments *Cost*: No Comments.

iii. Rate the effort required for the replacement of the test blade systems as compared to the traditional carbide blade systems?

Staff Hours Required? No Comments

Equipment Downtime Hours? No Comments

c) ***Technical Support:***

i. *Rate the quality of the manufacturer's response to questions as compared to those from the manufacturer of the traditional carbide blade system.*

Comments: One Employee reported same as traditional.

ii. *Rate the effort required when ordering replacement parts as compared to ordering replacement parts from the manufacturer of the traditional carbide blade system?*

Comments: One Employee reported same as traditional.

iii. *Rate the availability of replacement parts for the test blades systems as compared to the availability of parts from the manufacturer of the traditional carbide blade system?*

Comments: One Employee reported same as traditional for the Joma blade system.

Economics

The Maintenance Division provided the following information relating to the blade systems. Below is a chart showing the costs associated with the different blade systems.

Blade Type	Refills Per Foot cost	Complete Plow Setup
Carbide Steel	$44.60	$525.20
Joma*	$143.75	$1875.84
Polar Flex *	$99.36	$2310.00
Stacked Carbide Steel	$44.60	$1050.40

Table 2: Blade System Prices

* Plow setup includes adapters that are only required for initial setup but occasionally need replacement if damaged.

Summary

Fifteen snow plow trucks in the Dickinson District were equipped with four different snow plow blade systems. The District Maintenance Employees reported performance data on the blade systems during the fall 2010 to spring 2011 snow and ice removal season. District Maintenance employee comments and data from this study indicate the following:

- The stacked carbide steel blade test showed no advantage over traditional carbide blades and was discontinued early in the study.
- The Joma and Polar Flex blade systems conform to the road better especially on rutted asphalt roads. When plowing roads the goal is to get all the snow and ice off the roadway. Better blade systems on our snowplows provide cleaner roads which can potentially decrease the use of deicing products.
- The noise is reduced with both the Joma and Polar Flex blades. This may lead to better driver comfort, to quieter radio communication, and also better public perception (especially at night through urban areas).
- There was an odor from the Joma Blades during some initial "set" period. No odor was reported with the Polar Flex Blades.
- There was less vibration in the cab of their trucks with the Joma and Polar Flex blades. With increased demand for keeping our highway system clear at all times this could help with worker fatigue and overall job satisfaction.
- Plow "tripping" occurred when adjusted per Polar Flex specifications. The Polar Flex manufacturer specification states that the angle on a two-way plow should be 75 to 85 degrees. The normal operating NDDOT blade system angle is 50 to 70 degrees. This issue may be resolved. The manufacturer sent an email to the Maintenance Division on 8/26/2011 saying "As all plows have different geometry and different designs the angle that will work best for Polar Flex may fall outside the range indicated in the instructions. In reality the range that will insure optimal performance of Polar Flex is 52 - 85 degrees."
- The Joma and Polar Flex blades are lasting on average 3 to 4 times longer than traditional carbide steel blades. Advantages of increased blade service life may include less risk of injury due to hazards incurred during installation and less field down time for the snow plow and the employee. Installation of traditional blade systems takes two employees approximately 30 minutes.

The Dickinson District reported that based on the results of this study and their experiences this last snow and ice removal season, they intend to expand the use of the Joma blade system. However with the issue of the blade angles being resolved they may consider also using the Polar Flex blade system. Generally speaking the District feels that these blade systems provide better cleaning performance and longer service life than the traditional carbide blade systems.

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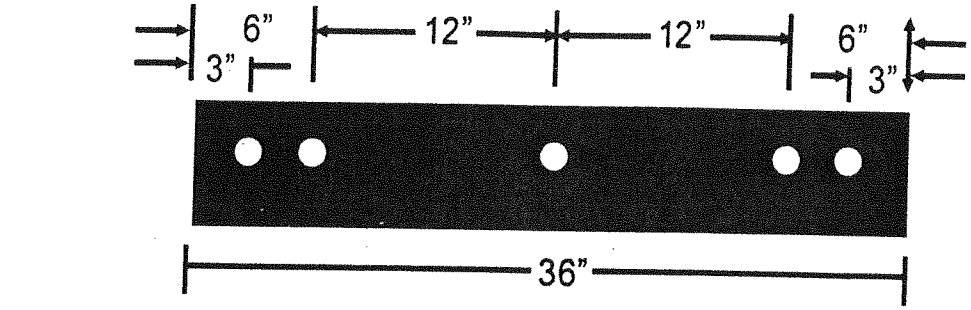
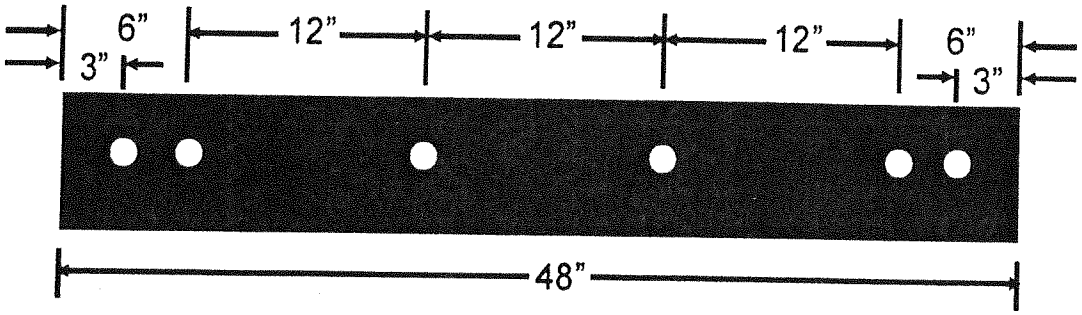
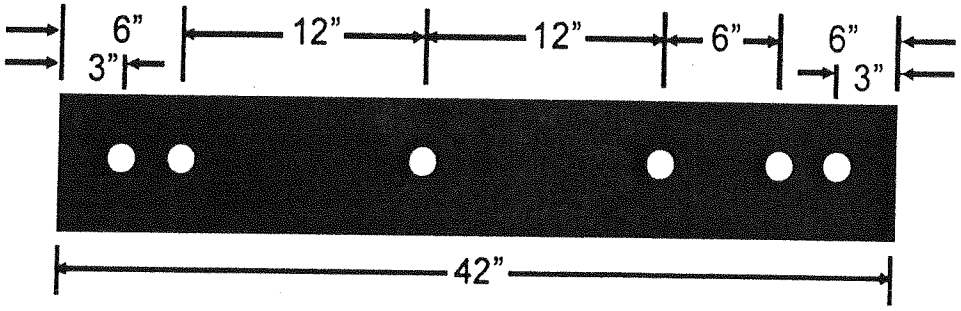
Appendix A: Carbide Steel Drawings

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

PUNCHING SPACE
SNOWPLOW CUTTING EDGES

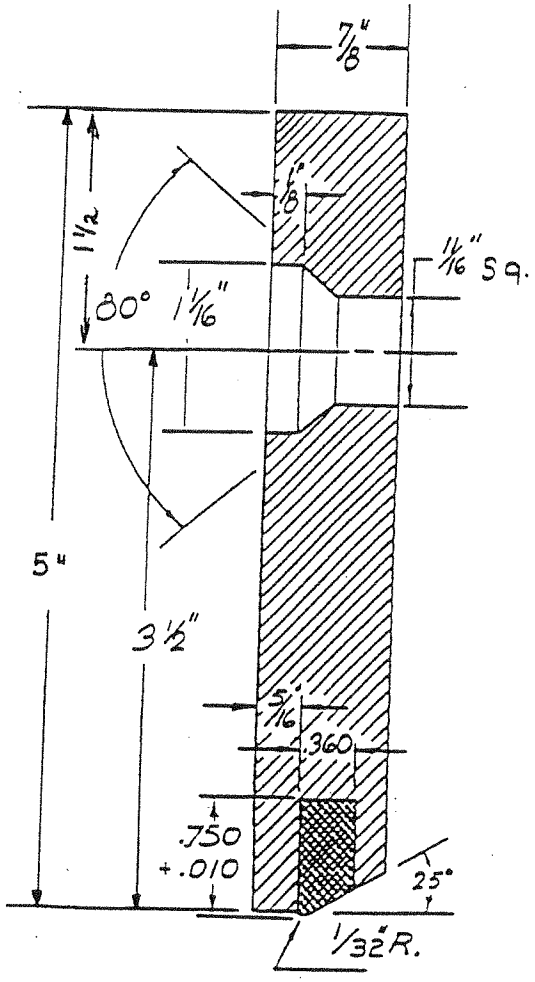


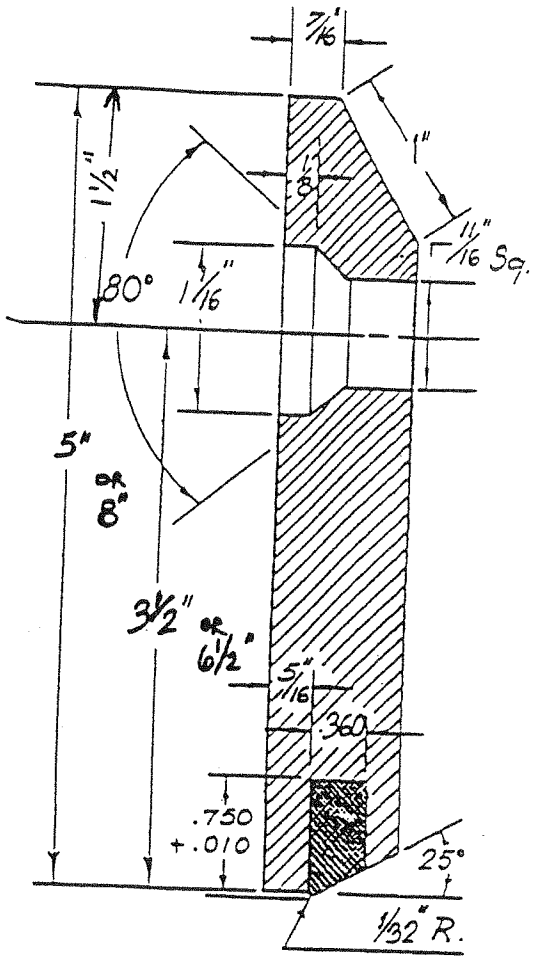




ATTACHMENT A

TUNGSTEN EDGES





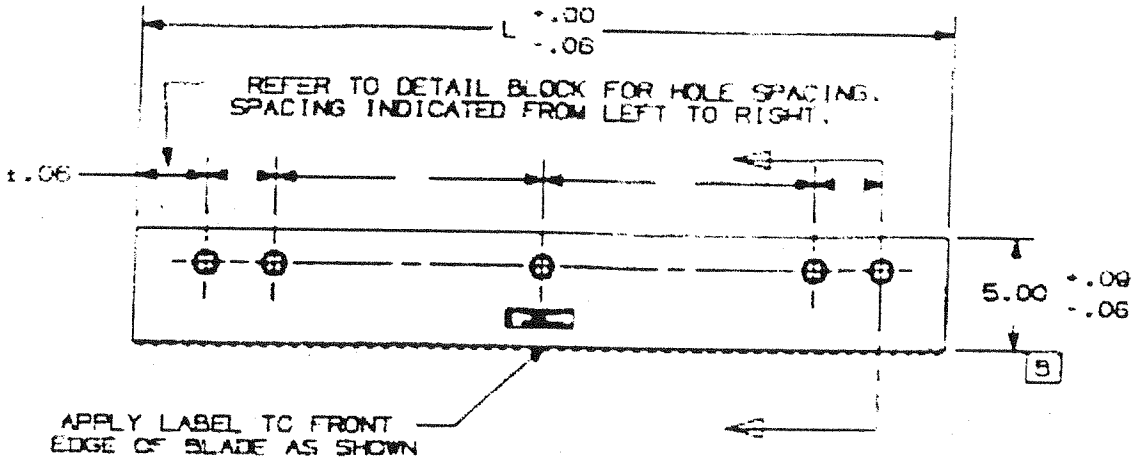
SNOWPLOW

8"- MOTOR GRADER
5"- UNDERBODY

ATTACHMENT B

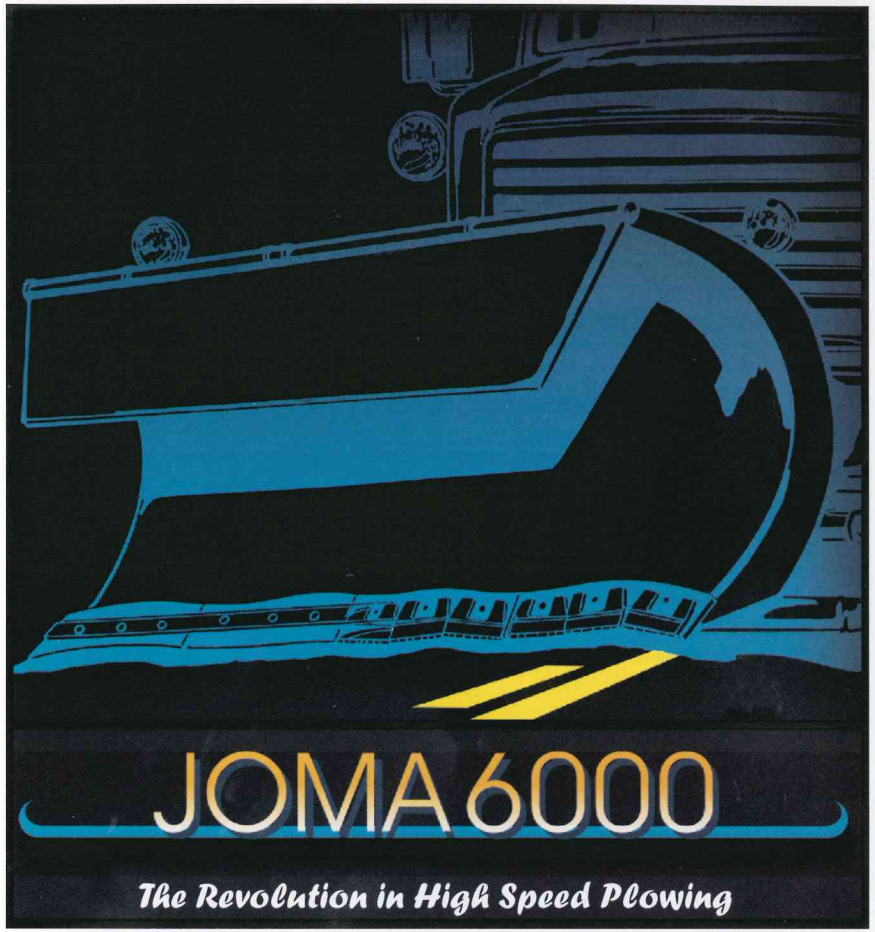
ISOLATED CARBON EDGE CUTTING BLADES

DET. NO.	DESCRIPTION	"L"	HOLE SPACING
1	7/8 X 5 X 36 CP	36	3-3-12-12-3-3
2	7/8 x 5 x 48 CP	48	3-3-12-12-12-3-3



ATTACHMENT C

Appendix B: Joma Blade System Information



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Revised 04/09/08

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St. Cloud, MN 56301
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Toll Free (888) 340-4558

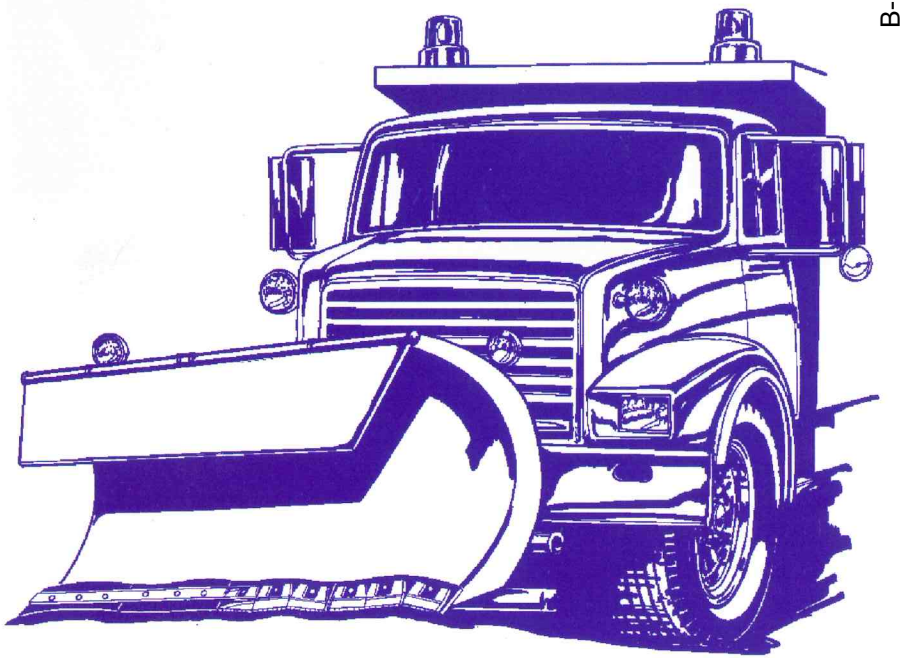
Black Cat Blades Ltd.

JOMA 6000

ISO 9001 Certified

Installation & Use Guide

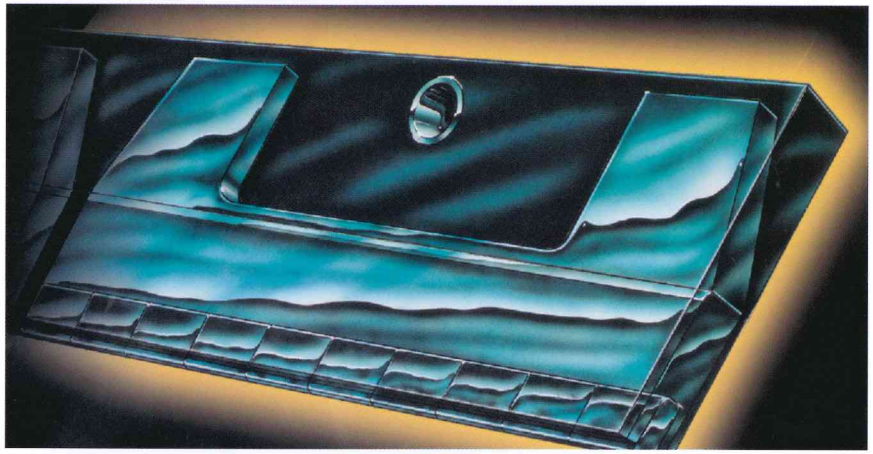
The JOMA 6000 is a unique snow plow blade that offers exceptional characteristics for many high speed plowing operations. Proper installation and operation is critical to achieving the desired results. To maximize the benefits of using the system all first time installers and users should read this guide completely.



JOMA 6000 by Black Cat Blades

Product Description:

The JOMA 6000 blade system is made up of independent tungsten carbide inserted segments suspended in a rubber blade. One segment is positioned per foot of finished blade. These specially shaped segments are completely surrounded by rubber and are not directly attached to the plow. The segment is allowed to float in the rubber under the weight of the plow, which allows the blade to conform to the shape of the road surface. This flexibility allows the blade to produce a cleaner surface than traditional solid plow blades while proving to be less damaging to road surfaces and markings. If installed properly the blade will reduce vibration and road chatter as well as dramatically reduce the noise level.



This three dimensional view of the one foot segment shows the steel inserted segment inside the rubber. The upper portions of the segment, or "ears", are sandwiched between a clamping bar and the moldboard. This allows each segment to move independently inside the rubber blade.

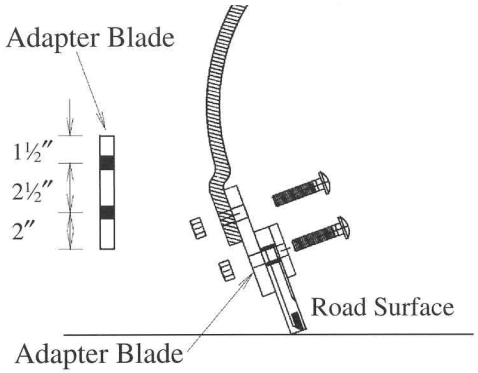
Note: This is only a General Installation Guide; see your local Black Cat Blades JOMA 6000 Servicing Distributor for specific installation recommendations for your particular brand of plows.

JOMA 6000 by Black Cat Blades

Installation Considerations

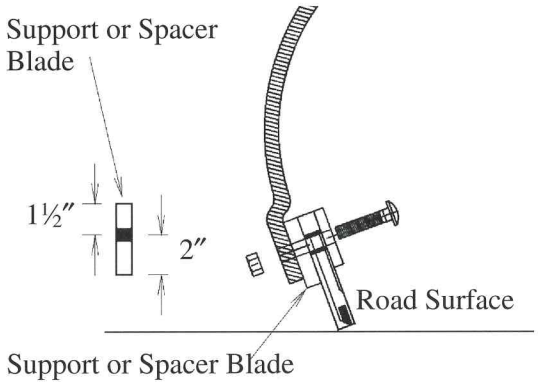
Bolt Hole Spacing:

The JOMA blade is manufactured in 12 inch increments. Each 12 inch section is held in place with one bolt in the center holding the clamping bar over the ears of the segment. For this reason, the JOMA blade must be bolted to the plow at 12 inch centers (6 inches to the first and last bolt). If the moldboard of the plow is other than 12 inch centers, an adapter blade must be used to accommodate the movement of the segments. This simple adapter will have two rows of holes, the top row to mount to the plow and a second row to accommodate the JOMA mounting.



B-2

Stepped or Short Moldboard:



It is recommended the JOMA blade be used with a minimum of 2 inches of back support below the mounting holes to support the segment. If the distance from the center of the mounting holes to the bottom of the moldboard is less than 2 inches, a backing blade should be used. A step in the moldboard above the cutting edge does not allow the JOMA blade segment to move and "seat" as required.

Stepped or Short Moldboard (cont'd):

From the center of the mounting holes, for 2½ inches up the moldboard, a smooth surface is required. If there is a step, as shown in the drawing below, a backing blade will be required that will allow the JOMA to "seat" itself up into the rubber and allow the desired movement of the segments.

Front of Blade:

The JOMA blade is clearly marked with a "FRONT" stamping. On all **front plows** this "FRONT" marking must be facing in the direction of travel. This allows for the proper running angle of the carbide inserts to the pavement.

Underbody Plows:

When mounting the JOMA blades on **underbody plows**, the "FRONT" marking should be facing in to the moldboard.

Hardware:

The JOMA blade is supplied with a specially heat treated clamping bar. This bar is placed over the JOMA blade to "clamp" the JOMA to the plow. Grade 8 or better carriage bolts are recommended for installing the JOMA blade. Recommended torque is 220 foot pounds. Lock Nuts are recommended. The use of Lock Washers is discouraged.

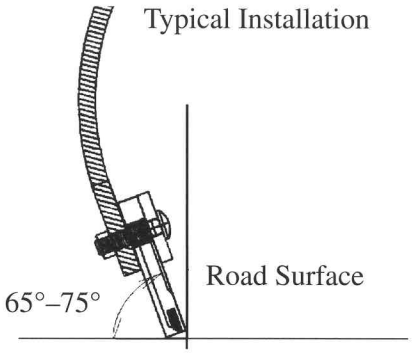
Note: The Moldboard mounting surface must be clean of all foreign material.

JOMA 6000 by Black Cat Blades

Operating Angles

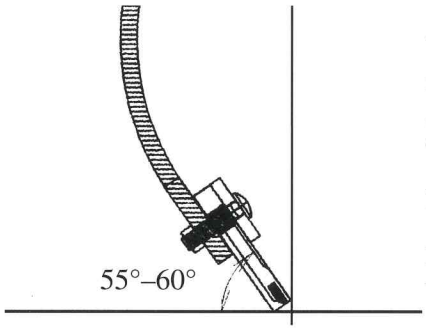
Reversible Front Plows:

The recommended installation requires a moldboard angle of 65 to 75 degrees from the road surface. This approach angle allows the JOMA blade to function at its best. Closer to straight up and down could result in chatter and bounce.



B-3

One Way Plows:



The recommended installation requires a moldboard angle of approximately 55–60 degrees. This approach angle allows the JOMA blade to function at its best. Lesser angles can allow the moldboard to bottom out before the JOMA blade is worn.

JOMA 6000 by Black Cat Blades

Installation / Operation Notes

1. Road Surfaces: The JOMA system performs best on hard surfaces such as asphalt, concrete and tar or chip seal roads.

2. During operation the JOMA blade "seats" itself up into the rubber holder. Do not be alarmed by the rubber being pushed up above the clamping bar; this is normal. As a result of this seating process the JOMA blade actually becomes narrower in its first few hours of operation. This can be mistaken for premature wear. Please note: the seating of the JOMA is normal and the blade may appear to have worn when it has actually only compressed. A careful examination of the end of the blade can expose the carbide insert to determine actual wear or the **front wear indicator** shows the amount of carbide left behind the line.

3. When installing new JOMA blades with runner shoes or castors, they should be adjusted approximately 3/4″ off the surface. This adjustment places enough weight on the JOMA to force the required seating process in the first few hours of operation. Once the JOMA blade has seated, the runners will be contacting the road surface and carrying a portion of the weight of the plow, extending blade life.

4. Operating a plow in a straight-on (dozer) position can result in the blades chattering. Angling the plow should eliminate this. Other causes of excessive chatter or bouncing are weak trip mechanisms or insufficient down pressure (plow weight of 150–350 pounds/foot is recommended).

JOMA 6000 by Black Cat Blades

5. If excessive heat is built up on the bottom edge (usually experienced only during dry plowing operations), the rubber may delaminate from the bottom edge of the segments. The thin layer of rubber on the front edge does not affect the performance of the blade and can be removed with a utility knife if unsightly. This thin flap of rubber has also been blamed for excessive snow deflection over the plowand should be removed if this problem is experienced.

6. Individual sections of the JOMA system can be replaced if necessary without replacing the entire set if the remaining pieces are less than 50% worn. The seating of the new JOMA blade section into the rubber will compensate for the difference allowing for a level cutting edge.

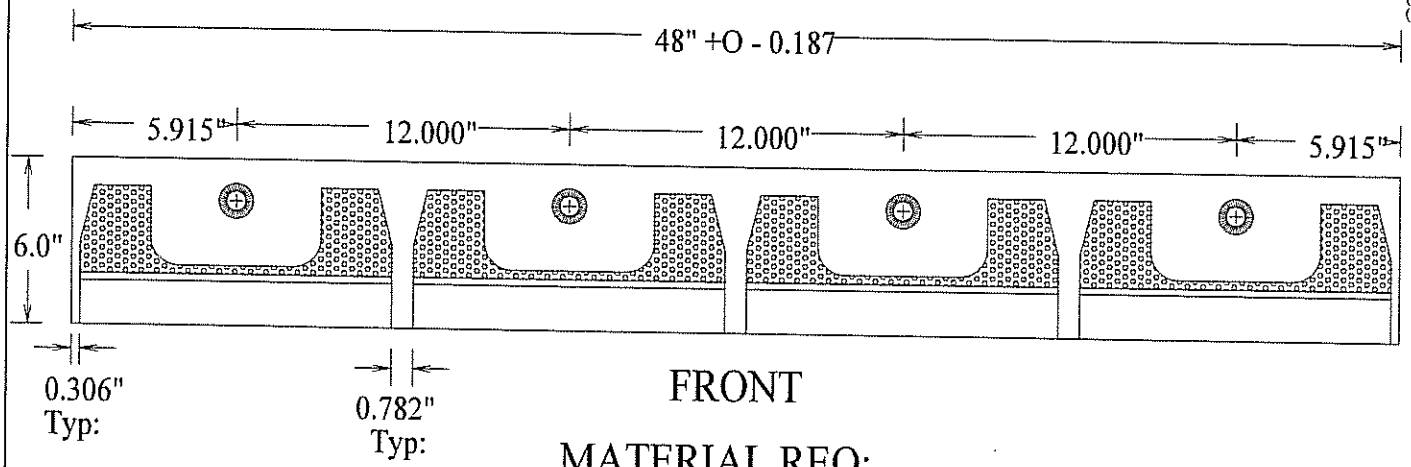
BLACK CAT BLADES LTD.

Customer's Name:	Designation: RUBBER PLOW BLADE	DRAWN BY: PK	APROVED BY:
Part No.: JOMA 6000X4			Date: NOV 29 / 05
Drawing No.: D27912	Make:	Model No.:	Revised Date: (B) SEP. 02/09
Mat, Type: RUBBER	Size and Type of Bolts:		No. of Bolt Holes: 4

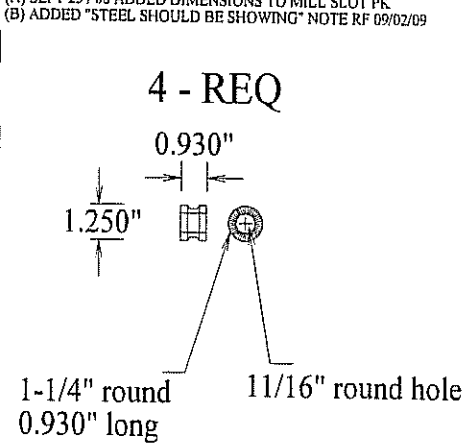
PART DESCRIPTION

App: Ship Wt: 40 lbs

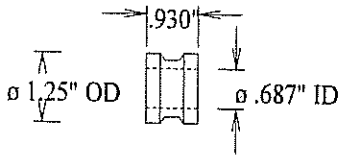
(A) SEPT 25 / 06 ADDED DIMENSIONS TO MILL SLOT PK
(B) ADDED "STEEL SHOULD BE SHOWING" NOTE RF 09/02/09

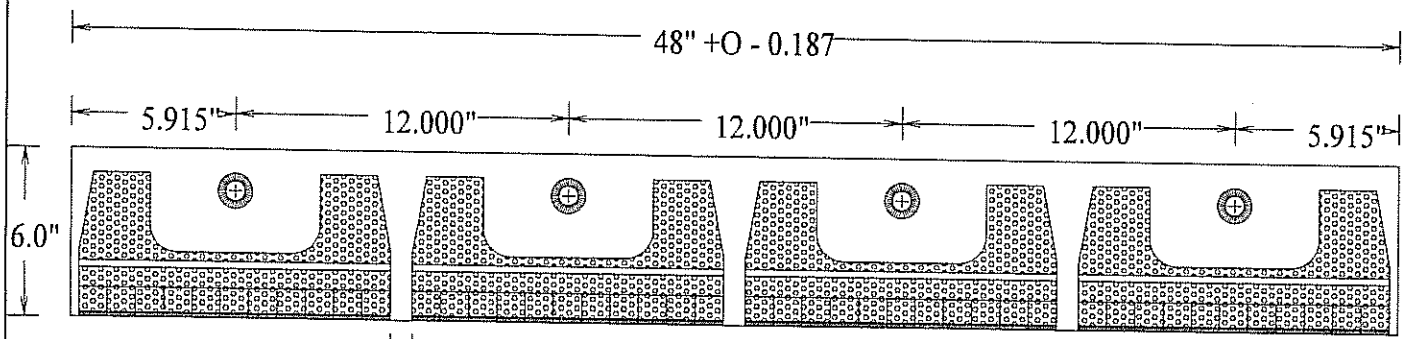


FRONT



MATERIAL REQ:
4 - SEGMENTS INSERTED
4 - MACHINED INSERTS 1-1/4" OD





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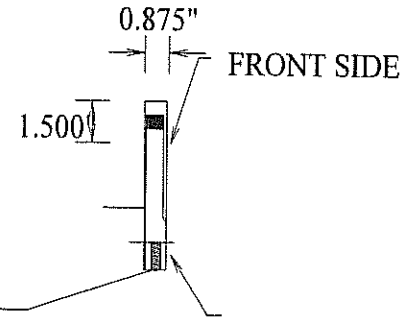


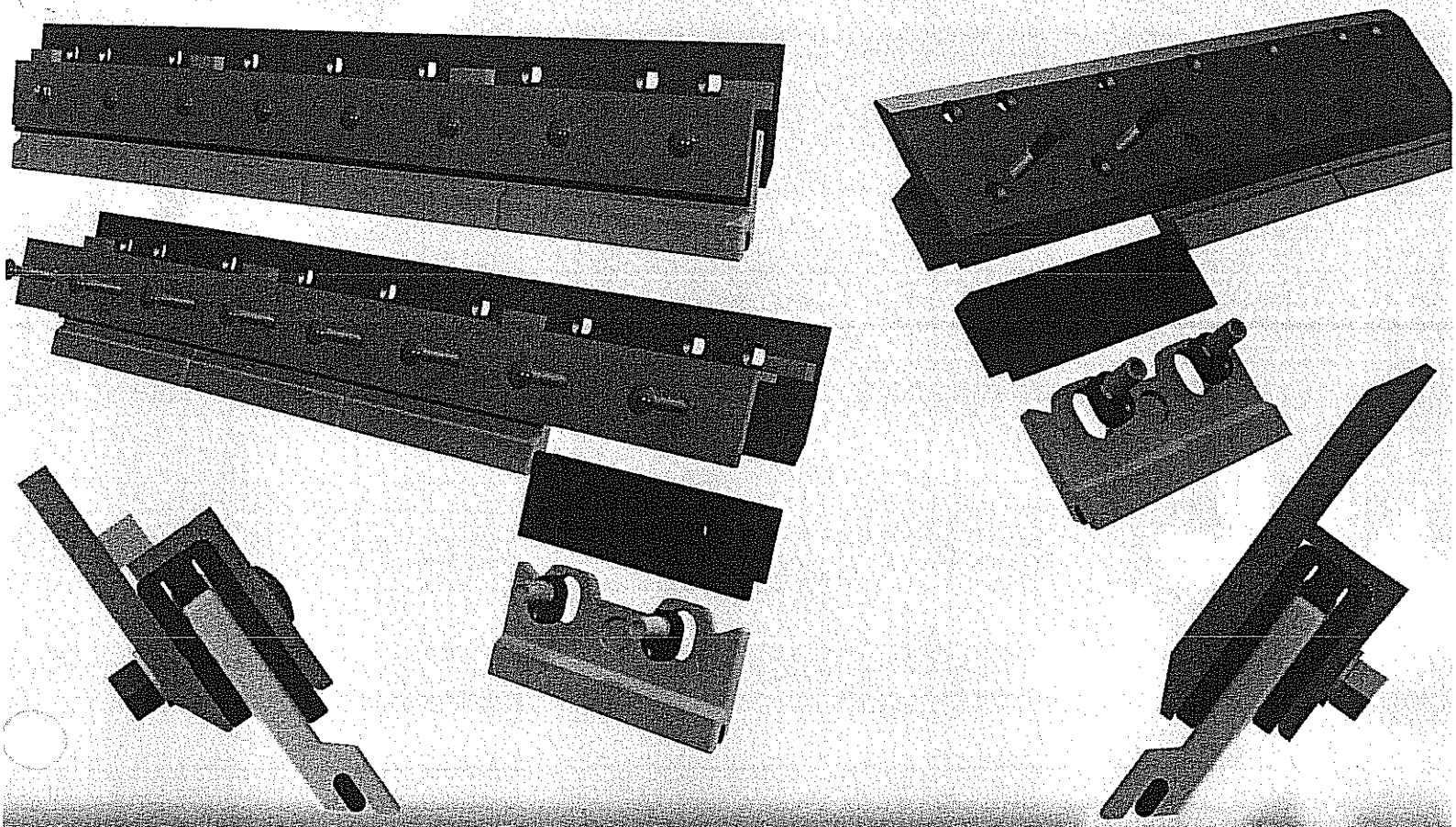
MILL SLOT FOR CARBIDES
8mm WIDE X 24.7mm deep
IN CENTRE OF THICKNESS

SEGMENT FLUSH
WITH FRONT SIDE.
STEEL SHOULD BE SHOWING

Appendix C: Polar Flex Blade System Information

VBL™ ValleyBlades LIMITED

PolarFlex CLEANER. GREENER



PolarFlex

When only the highest level of performance will do, PolarFlex™ by VBL™ is the best choice for segmented, flexible, carbide tipped snow plow blade systems.

Individual 12 inch carbide tipped steel segments are mounted using a patented system of reusable synthetic rubber flexible elements*. This mounting technique significantly reduces vibration while simultameously allowing the cutting edge to conform to the surface of the road. These two capabilities allow the system to clean the road better (less salt, fewer trips, safer roads...) and reduce chatter (longer blade life, less plow maintenance, reduced operator fatigue...). PolarFlex is available in 2 configurations**

Front Mount - Less weight / lower height, easier segment changes, ideal for reversible plows & wings.
Original - Heavy duty one piece welded construction, robust rigid design.

*Flex elements and wear segments can be easily separated for environmentally safe recycling, a unique PolarFlex™ feature.
**Custom size configurations available on request, nose pieces & various styles of curb runners are available for both configurations

VBL heat treated parts are warranted against breakage throughout the useable life of the part.

10209

Valley Blades Limited • 435 Phillip Street, Waterloo, ON, Canada N2J 3Z9 • P. 519.885.5500 TF. 800.461.1824 F. 519.746.2780 • sales@valleyblades.com

9001:2008

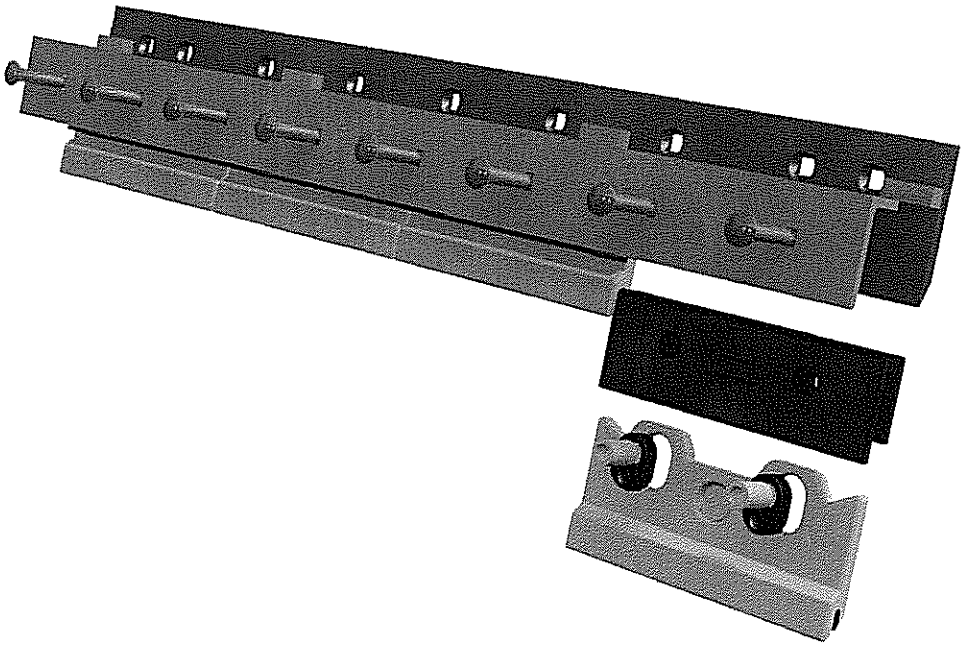
www.valleyblades.com

VBL ValleyBlades LIMITED

June, 2010

PolarFlex CLEANER. GREENER.

Proposal for: NDDOT North Dakota Department of Transportation



This proposal outlines a PolarFlex system that is available on a "by the foot" basis. It can be installed on any plow with a length in whole feet. (eg. 9', 10' 11', 12') Each system consists of the following components: (eg. 11' plow)

Qty.	Part Number.	Description.
11	XWS-12	Carbide tipped wear segment
11	XFE-12-S	EPDM casing
22	XFE-58	EPDM bushing
22	XSB-58	Steel spacer
2*	AUX-48	Securing angle*
1*	AUX-36	Securing angle*
2*	BUX-48-W	Blade mount*
1*	BUX-36-W	Blade mount*
22**	58312CBNC	Carriage bolt**
22**	58HFW	Hardened flat washer**
22**	58LN	Stover lock nut**

*securing angles and blade mounts are available in 3 and 4 foot lengths to suit different plow lengths.
**required hardware included in PolarFlex assembly – 2 bolts/washers/nuts per foot are supplied at no extra cost

PolarFlex system (kit) price: **$192.50 / foot ($2310.00 / 12ft plow)**
PolarFlex replacement wear segment price: **$99.36 / foot ($1192.32 / 12ft plow)**
(all prices are USD, F.O.B Waterloo Ont. Canada)

VBL™ ValleyBlades LIMITED

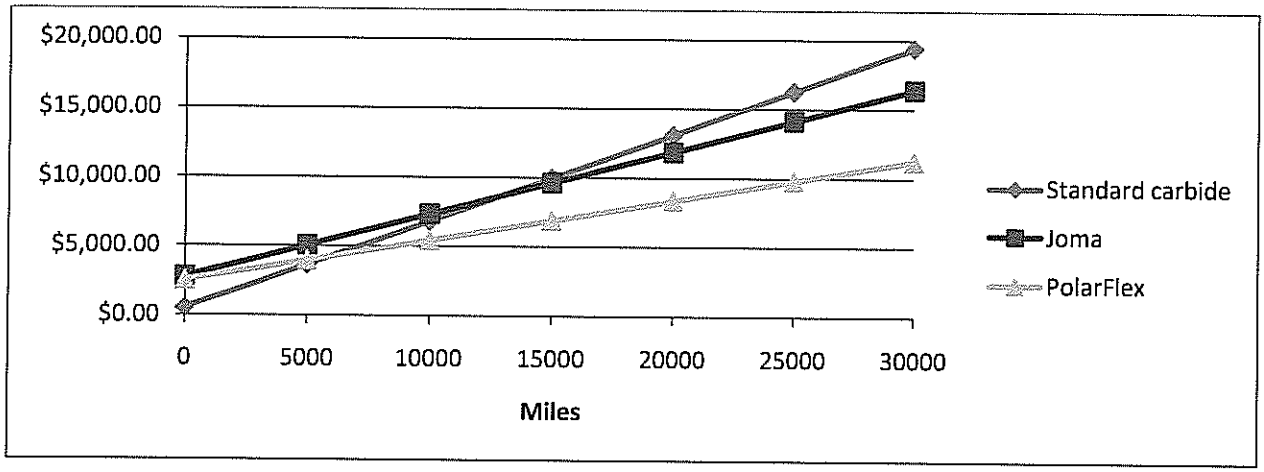
June, 2010

The following chart shows a cost comparison between various blade types. It takes into account:

1. The initial purchase price of the
2. Regular replacement of wear segments
3. Replacing all of the flex elements every 4 edge changes.

*Wear life data and pricing for Polarflex, Joma and Standard carbide based on an average of various state DOT and private contractor tests.

This chart shows a significant decrease in dollars / mile using PolarFlex:



The above illustrates the direct dollars / mile relationship. There are many hidden benefits however that make PloarFlex a significant cost saver. They can be broken down into three basic categories.

Following the contour of the road:

Plowing closer to the real shape of the road clears more snow. By clearing more snow there are two cost savings. Fewer trips over the same patch of road are required saving time, fuel and blade wear. Less salt is required to melt remaining snow and ice. Reducing salt lowers both the financial and environmental costs associated with snow removal.

Reducing vibration:

Reducing vibration is one of the primary mechanisms responsible for the longer blade life. However the often missed cost savings come from a reduction in plow damaged caused by these vibrations. Plows with PolarFlex tend to last significantly longer before repairs / re-welds are required. Vibration reduction cuts down the noise both inside and outside the plow truck. This creates a more pleasant environment for the operators of the trucks, resulting in more alert, safe operators.

Full Disassembly:

Scrap steel gets melted down and turned into new steel. PolarFlex has no rubber bonded to any metal sections. This prevents thousands of pounds of rubber from going into the scrap and being burned. Used flexible elements from PolarFlex can be easily recycled with other plastics, or shipped back to Valley Blades for ecologically responsible disposal. Full disassembly also simplifies system maintenance and repair.

Appendix D: Wear Spreadsheets

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Cutting Edge Testing

Section *Belfield*
Edge Type *Tungsten*
Unit *9315*
Install Date *12/3/2010*
Edge Height
New *5"*

						Cutting Edge Heights (inches)											
						Drivers Edge			Middle Edge			Passenger Edge					
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt	Hours Plowed	Miles Plowed	Observations
12/3/2010	85	New asphalt	Wet	18	Snow covered	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	7	34	Worked good
12/3/2010	85	Micro surfaced	Wet	12	Snow covered	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	7	34	Worked good
12/4/2010	85	New asphalt	Dry	9	Dry	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	5	34	Worked good
12/9/2010	85	Micro surfaced	Dry	5	Dry	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	5	44	Scattered drifts
12/9/2010	85	New asphalt	Wet	35	Wet	4.8	4.8	4.8	4.75	4.75	4.75	4.8	4.8	4.8	3	34	Slush
12/9/2010	85	Micro surfaced	Wet	29	Wet	4.8	4.8	4.8	4.75	4.75	4.75	4.8	4.8	4.8	3	44	Slush
12/10/2010	85	New asphalt	Wet	11	Wet	4.8	4.8	4.8	4.75	4.75	4.75	4.8	4.8	4.8	3	72	Scattered drifts
12/10/2010	85	Micro surfaced	Wet	16	Wet	4.8	4.8	4.8	4.75	4.75	4.75	4.8	4.8	4.8	3	72	Scattered drifts
12/11/2010	85	New asphalt	Dry	8	Dry	4.8	4.8	4.8	4.5	4.5	4.6	4.6	4.8	4.8	3	72	Scattered drifts
12/11/2010	85	Micro surfaced	Dry	8	Dry	4.8	4.8	4.8	4.5	4.5	4.6	4.6	4.8	4.8	3	72	Scattered drifts
12/13/2010	85	New asphalt	Dry	9	Dry	4.8	4.75	4.6	4.6	4.4	4.6	4.6	4.8	4.8	3	72	Scattered drifts
12/13/2010	85	Micro surfaced	Dry	9	Dry	4.8	4.75	4.6	4.6	4.4	4.6	4.6	4.8	4.8	3	72	Scattered drifts
12/20/2010	85	Micro surfaced	Wet	12	Wet	4.25	4.5	4.25	4.1	4.3	4.3	4.5	4.75	4.75	8	188	Snow covered
12/20/2010	85	New asphalt	Wet	14	Wet	4.25	4.5	4.25	4.1	4.3	4.3	4.5	4.75	4.75	8	188	Snowcovered
12/21/2010	85	Micro surfaced	Wet	4	Wet	4.25	4.5	4.25	4.1	4.3	4.3	4.5	4.75	4.75	4	74	Scattered drifts
12/21/2010	85	New asphalt	Wet	8	Wet	4.25	4.5	4.25	4.1	4.3	4.3	4.5	4.75	4.75	4	74	Scattered drifts
						New blade		New blade			Reused/Moved to left side						
12/28/2010	85	New asphalt	Wet	27	Wet	4.5	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.9	5	61	Scattered ice/Compact
12/28/2010	94	Micro surfaced	Wet	24	Wet	4.5	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.9	5	20	Scattered ice/Compact
12/29/2010	85	New asphalt	Wet	20	Wet	4.5	4.75	4.75	4.7	4.7	4.7	4.6	4.75	4.8	2	61	Scattered snow
12/29/2010	85	Micro surfaced	Wet	20	Wet	4.5	4.75	4.75	4.7	4.7	4.7	4.6	4.75	4.8	2	61	Scattered snow
12/30/2010	85	New asphalt	Wet	0	Wet	4.5	4.6	4.6	4.6	4.6	4.6	4.6	4.75	4.8	9	178	Scattered snow
12/30/20108	85	Micro surfaced	Wet	0	Wet	4.5	4.6	4.6	4.6	4.6	4.6	4.6	4.75	4.8	9	178	Scattered snow
12/31/2010	85	Micro surfaced	Wet	0	Wet	4.5	4.6	4.6	4.5	4.5	4.5	4.5	4.75	4.8	6	104	Scattered snow
12/31/2010	85	New asphalt	Wet	0	Wet	4.5	4.6	4.6	4.5	4.5	4.5	4.5	4.75	4.8	6	104	Scattered snow
1/1/2011	85	Micro surfaced	Wet	-2	Dry	4.5	4.6	4.4	4.4	4.5	4.5	4.5	4.75	4.75	5	172	Scattered snow
1/1/2011	85	New asphalt	Wet	-2	Dry	4.5	4.6	4.4	4.4	4.5	4.5	4.5	4.75	4.75	5	172	Scattered snow
1/2/2011	85	Micro surfaced	Dry	17	Dry	4.5	4.6	4.4	4.4	4.5	4.5	4.5	4.75	4.75	2	74	Scattered snow
1/2/2011	85	New asphalt	Dry	17	Dry	4.5	4.6	4.4	4.4	4.5	4.5	4.5	4.75	4.75	2	74	Scattered snow
1/3/2011	85	Micro surfaced	Wet	3	Wet	4.5	4.5	4.4	4.4	4.5	4.5	4.5	4.75	4.75	6	148	Scattered snow
1/3/2011	85	New asphalt	Wet	3	Wet	4.5	4.5	4.4	4.4	4.5	4.5	4.5	4.75	4.75	6	148	Scattered snow
					Put on wades used blades												
1/6/2011	85	New asphalt	Wet	10	Wet	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	74	Scattered snow/ Put used blades on/ half worn out
1/6/2011	85	Micro surfaced	Wet	10	Wet	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	74	Scattered snow/Put used bladeson/half worn out
1/7/2011	85	Micro surfaced	Wet	0	Wet	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	2	74	Scattered snow/Put used bladeson/half worn out
1/7/2011	85	New asphalt	Wet	0	Wet	45	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	2	74	Scattered snow/Put used bladeson/half worn out
1/8/2011	85	Micro surfaced	Wet	0	Wet	4.5	4.5	4.5	4.5	4	4.5	4.5	4.5	4.5	2	74	Scattered snow/Put used bladeson/half worn out
1/8/2011	85	New asphalt	Wet	0	Wet	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	2	74	Scattered snow/Put used bladeson/half worn out
1/9/2011	85	Micro surfaced	Wet	0	Wet	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5	4.5	7	74	Scattered snow/Put used bladeson/half worn out
1/9/2011	85	New asphalt	Wet	0	Wet	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5	4.5	7	74	Scattered snow/Put used bladeson/half worn out
1/10/2011	85	Micro surfaced	Wet	0	Wet	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5	4.5	5	74	Scattered snow/Put used bladeson/half worn out
1/10/2011	85	New asphalt	Wet	0	Wet	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5	4.5	5	74	Scattered snow/Put used bladeson/half worn out
1/11/2011	85	Micro surfaced	Wet	2	Wet	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5	4.5	3	74	Scattered snow/Put used bladeson/half worn out
1/11/2011	85	New asphalt	Wet	2	Wet	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5	4.5	3	74	Scattered snow/Put used bladeson/half worn out
1/12/2011	85	Micro surfaced	Wet	0	Wet	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.4	4.5	4	74	Scattered snow/Put used bladeson/half worn out
1/12/2011	85	New asphalt	Wet	0	Wet	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.4	4.5	4	74	Scattered snow/Put used bladeson/half worn out

Cutting Edge Testing

Section *Belfield*
Edge Type *Tungsten*
Unit *9315*
Install Date *12/3/2010*
Edge Height
New *5"*

						Cutting Edge Heights (inches)											
						Drivers Edge			Middle Edge			Passenger Edge					
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt	Hours Plowed	Miles Plowed	Observations
1/13/2011	85	Micro surfaced	Wet	10	Wet	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.3	4.5	7	75	Scattered snow/Put used bladeson/half worn out
1/13/2011	85	New asphalt	Wet	10	Wet	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.3	4.5	7	74	Scattered snow/Put used bladeson/half worn out
1/15/2011	85	Micro surfaced	Wet	5	Wet	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.3	4.5	4	75	Scattered snow/Put used bladeson/half worn out
1/15/2011	85	new asphalt	Wet	5	Wet	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.3	4.5	4	74	Scattered snow/Put used bladeson/half worn out
1/16/2011	85	New asphalt	Wet	12	Wet	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.2	4.3	3	74	Scattered snow/Put used bladeson/half worn out
1/16/2011	85	Micro surfaced	Wet	12	Wet	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.3	3	74	Scattered snow/Put used bladeson/half worn out
					Put on al's used blades												
1/17/2011	85	New asphalt	Wet	10	Wet	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	7	148	Scattered snow/Put on uses blades/half worn out
1/17/2011	85	Micro surfaced	Wet	10	Wet	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	7	148	Scattered snow/put on used blades/half worn out
1/18/2011	85	New asphalt	Wet	9	Wet	4.5	4.5	4.4	4.4	4.5	4.5	4.5	4.5	4.6	9	148	Scattered snow
1/18/2011	85	Micro surfaced	Wet	9	Wet	4.5	4.5	4.4	4.4	4.5	4.5	4.5	4.5	4.6	9	148	Scattered snow
1/19/2011	85	New asphalt	Wet	12	Wet	4.4	4.4	4.3	4.3	4.5	4.5	4.4	4.4	4.5	8	148	Scattered snow
1/19/2011	85	Micro surfaced	Wet	12	Wet	4.4	4.4	4.3	4.3	4.5	4.5	4.4	4.4	4.5	8	148	Scattered snow
1/20/2011	85	New asphalt	Wet	6	Wet	4.2	4.2	4.1	4.1	4.3	4.3	4.3	4.3	4.5	9	148	Scattered snow
1/20/2011	85	Micro surfaced	Wet	6	Wet	4.2	4.2	4.1	4.1	4.3	4.3	4.3	4.3	4.5	9	148	Scattered snow
					New Blades												
1/21/2011	85	New asphalt	Wet	30	Wet	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	8	188	Scattered snow
1/21/2011	85	Micro surfaced	Wet	30	Wet	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	8	188	Scattered snow
1/22/2011	85	New asphalt	Wet	30	Wet	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.9	7	148	Scattered snow
1/22/2011	85	Micro surfaced	Wet	30	Wet	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.9	7	148	Scattered snow
1/23/2011	85	New asphalt	Wet	28	Wet	4.7	4.7	4.6	4.6	4.7	4.7	4.7	4.8	4.9	5	148	Scattered snow
1/23/2011	85	Micro surfaced	Wet	28	Wet	4.7	4.7	4.6	4.6	4.7	4.7	4.7	4.8	4.9	5	148	Scattered snow
1/24/2011	85	New asphalt	Wet	30	Wet	4.6	4.6	4.5	4.5	4.6	4.6	4.6	4.7	4.8	10	148	Scattered snow
1/24/2011	85	Micro surfaced	Wet	30	Wet	4.6	4.6	4.5	4.5	4.6	4.6	4.6	4.7	4.8	10	148	Scattered snow
1/25/2011	85	Micro surfaced	Wet	28	Wet	4.5	4.5	4.4	4.4	4.5	4.5	4.5	4.6	4.7	2	74	Scattered snow
1/25/2011	85	New asphalt	Wet	28	Wet	4.5	4.5	4.4	4.4	4.5	4.5	4.5	4.6	4.7	2	74	Scattered snwo
1/26/2011	85	Micro surfaced	Wet	35	Wet	4.3	4.3	4.2	4.2	4.3	4.3	4.3	4.4	4.5	4	75	Slush
1/26/2011	85	New asphalt	Wet	35	Wet	4.3	4.3	4.2	4.2	4.3	4.3	4.3	4.4	4.5	4	75	Slush
1/27/2011	85	Micro surfaced	Wet	36	Wet	4.2	4.2	4.1	4.1	4.2	4.2	4.2	4.3	4.4	3	75	Scattered slush
1/27/2011	85	New asphalt	Wet	36	Wet	4.2	4.2	4.1	4.1	4.2	4.2	4.2	4.3	4.4	3	75	Scattered slush
					New Blades												
1/28/2011	85	Microsurfaced	Wet	10	Wet	5	5	5	5	5	5	5	5	5	2	74	Scattered snow
1/28/2011	85	New asphalt	Wet	10	Wet	5	5	5	5	5	5	5	5	5	2	74	Scattered snow
1/29/2011	85	Microsurfaced	Wet	10	Wet	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	5	74	Scattered snow
1/29/2011	85	New asphalt	Wet	10	Wet	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	5	74	Scattered snow
1/30/2011	85	Microsurfaced	Wet	0	Wet	4.8	4.8	4.7	4.7	4.8	4.8	4.8	4.8	4.9	7	148	Scattered snow
1/30/2011	85	New asphalt	Wet	0	Wet	4.8	4.8	4.7	4.7	4.8	4.8	4.8	4.8	4.9	7	148	Scattered snow
1/31/2011	85	Microsurfaced	Wet	0	Wet	4.7	4.7	4.6	4.6	4.8	4.7	4.7	4.8	4.8	8	148	Scattered snow
1/31/2011	85	New asphalt	Wet	0	Wet	4.7	4.7	4.6	4.6	4.8	4.7	4.7	4.8	4.8	8	148	Scattered snow
2/1/2011	85	Microsurfaced	Wet	-30	Wet	4.7	4.7	4.6	4.6	4.8	4.7	4.7	4.8	4.8	5	148	Scattered snow
2/1/2011	85	New asphalt	Wet	-30	Wet	4.7	4.7	4.6	4.6	4.8	4.7	4.7	4.8	4.8	5	148	Scattered snow
2/2/2011	85	Microsurfaced	Wet	-20	Wet	4.7	4.7	4.6	4.6	4.8	4.7	4.7	4.8	4.8	3	74	Scattered snow
2/2/2011	85	New asphalt	Wet	-20	Wet	4.7	4.7	4.6	4.6	4.8	4.7	4.7	4.8	4.8	3	74	Scattered snow
2/3/2011	85	Microsurfaced	Wet	30	Wet	4.7	4.7	4.6	4.6	4.8	4.7	4.7	4.8	4.8	9	148	COMPACT
2/3/2011	85	New asphalt	Wet	30	Wet	4.7	4.7	4.6	4.6	4.8	4.7	4.7	4.8	4.8	9	148	COMPACT
2/4/2011	85	Microsurfaced	Wet	30	Wet	4.7	4.7	4.6	4.6	4.8	4.7	4.7	4.8	4.8	9	158	COMPACT

Cutting Edge Testing

Section *Belfield*
Edge Type *Tungsten*
Unit *9315*
Install Date *12/3/2010*
Edge Height
New *5"*

						Cutting Edge Heights (inches)											
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Drivers Edge			Middle Edge			Passenger Edge			Hours Plowed	Miles Plowed	Observations
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
2/4/2011	85	New asphalt	Wet	30	Wet	4.7	4.7	4.6	4.6	4.8	4.7	4.7	4.8	4.8	9	158	COMPACT
2/5/2011	85	Microsurfaced	Wet	30	Wet	4.7	4.7	4.6	4.6	4.7	4.7	4.7	4.8	4.8	3	74	Scattered snow
2/5/2011	85	New asphalt	Wet	30	Wet	4.7	4.7	4.6	4.6	4.7	4.7	4.7	4.8	4.8	3	74	Scattered snow
2/6/2011	85	Microsurfaced	Wet	27	Wet	4.7	4.7	4.6	4.6	4.6	4.6	4.6	4.8	4.8	7	148	COMPACT
2/6/2011	85	New asphalt	Wet	27	Wet	4.7	4.7	4.6	4.6	4.6	4.6	4.6	4.8	4.8	7	148	COMPACT
2/7/2011	85	Microsurfaced	Wet	20	Wet	4.7	4.7	4.6	4.6	4.6	4.6	4.6	4.7	4.8	7	148	COMPACT
2/9/2011	85	New asphalt	Wet	32	Wet	4.7	4.7	4.6	4.6	4.6	4.6	4.6	4.7	4.8	3	74	Scattered snow
2/9/2011	85	Microsurfaced	Wet	32	Wet	4.7	4.7	4.6	4.6	4.6	4.6	4.6	4.7	4.8	3	74	Scattered snow
2/11/2011	85	Microsurfaced	Wet	35	Wet	4.7	4.7	4.5	4.5	4.5	4.5	4.7	4.7	4.7	8	148	COMPACT
2/11/2011	85	New asphalt	Wet	35	Wet	4.7	4.7	4.5	4.5	4.5	4.5	4.7	4.7	4.7	8	148	COMPACT
2/18/2011	85	New asphalt	wet	-1	Wet	4.7	4.7	4.6	4.5	4.5	4.5	4.6	4.7	4.7	3	74	Scattered snow
2/18/2011	85	Microsurfaced	wet	-1	Wet	4.7	4.7	4.6	4.5	4.5	4.5	4.6	4.7	4.7	3	74	Scattered snow
2/20/2011	85	New asphalt	wet	0	Wet	4.3	4.3	4.3	4.3	4.2	4.2	4.2	4.2	4.2	8	225	Snow drifts
2/20/2011	85	Microsurfaced	wet	0	Wet	4.3	4.3	4.3	4.3	4.2	4.2	4.2	4.2	4.2	8	225	Snow drifts
2/21/2011	85	New asphalt	Wet	-10	Wet	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	5	74	Scattered snow
2/21/2011	85	Microsurfaced	Wet	-10	Wet	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	5	74	Scattered snow
2/23/2011	S85	Microsurfaced	Wet	0	Wet	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	5	68	Shadow dozer
2/24/2011	S85	Microsurfaced	Wet	0	Wet	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	9	98	Make run.Shadow dozer
2/25/2011	S85	Microsurfaced	Wet	0	Wet	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4	36	Shadow dozer.
						New	Blades										
2/27/2011	85	Microsurfaced	Wet	20	Wet	4.8	4.8	4.6	4.6	4.8	4.8	4.8	4.8	4.8	5	175	Snow drifts
2/27/2011	85	New asphalt	Wet	20	Wet	4.8	4.8	4.6	4.6	4.8	4.8	4.8	4.8	4.8	5	175	Snow drifts
3/7/2011	85	Microsurfaced	Wet	10	Wet	4.7	4.7	4.5	4.5	4.7	4.7	4.7	4.8	4.8	5	175	Snow drifts
3/7/2011	85	New asphalt	Wet	10	Wet	4.7	4.7	4.5	4.5	4.7	4.7	4.7	4.8	4.8	5	175	Snow drifts
3/8/2011	85	Microsurfaced	Wet	10	Wet	4.6	4.6	4.4	4.4	4.6	4.6	4.6	4.7	4.7	5	74	Snow drifts
3/8/2011	85	New asphalt	Wet	10	Wet	4.6	4.6	4.4	4.4	4.6	4.6	4.6	4.7	4.7	5	74	Snow drifts
3/11/2011	85	Microsurfaced	Wet	30	Wet	4.5	4.5	4.3	4.3	4.5	4.5	4.5	4.7	4.7	6	75	Slush am Compact pm
3/11/2011	85	New asphalt	Wet	30	Wet	4.5	4.5	4.3	4.3	4.5	4.5	4.5	4.7	4.7	6	75	Slush
3/12/2011	85	Microsurfaced	Wet	20	Wet	4.4	4.4	4.2	4.2	4.4	4.5	4.5	4.7	4.7	6	80	Continious Ice am. Wet pm
						New	Blades										
3/12/2011	85	New asphalt	Wet	30	Wet	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	6	80	Slush
3/12/2011	85	Microsurfaced	Wet	30	Wet	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	6	80	Slush
3/22/2011	85	New asphalt	Wet	30	Wet	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.9	11	225	Compact snow/Snow covered
3/22/2011	85	Microsurfaced	Wet	30	Wet	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.9	11	225	Compact snow/Snow covered
3/23/2011	85	New asphalt	Wet	25	Wet	4.8	4.8	4.7	4.7	4.8	4.8	4.8	4.8	4.9	5	75	Compact snow/Snow covered
3/23/2011	85	Microsurfaced	Wet	25	Wet	4.8	4.8	4.7	4.7	4.8	4.8	4.8	4.8	4.9	5	75	Compact snow/Snow covered
3/24/2011	85	Microsurfaced	Wet	25	Wet	4.8	4.8	4.7	4.7	4.7	4.8	4.8	4.8	4.8	3	75	Compact snow/Snow covered
3/24/2011	85	New asphalt	Wet	25	Wet	4.8	4.8	4.7	4.7	4.7	4.8	4.8	4.8	4.8	3	75	Compact snow/Snow covered
3/25/2011	85	Microsurfaced	Wet	25	Wet	4.8	4.8	4.7	4.7	4.7	4.7	4.7	4.8	4.8	10	225	Compact snow/Snow covered
3/25/2011	85	New asphalt	Wet	25	Wet	4.8	4.8	4.7	4.7	4.7	4.7	4.7	4.8	4.8	10	225	Compact snow/Snow covered
3/26/2011	85	Microsurfaced	Wet	20	Wet	4.8	4.8	4.7	4.7	4.7	4.7	4.7	4.8	4.8	11	300	Continous Ice
3/26/2011	85	New asphalt	Wet	20	Wet	4.8	4.8	4.7	4.7	4.7	4.7	4.7	4.8	4.8	11	300	Continous Ice
3/27/2011	85	Microsurfaced	Wet	20	Wet	4.8	4.8	4.7	4.6	4.7	4.6	4.6	4.7	4.7	10	180	Continous Ice
3/27/2011	85	New asphalt	Wet	20	Wet	4.8	4.8	4.7	4.6	4.7	4.6	4.6	4.7	4.7	10	180	Continous Ice
3/28/2011	85	Microsurfaced	Wet	32	Wet	4.7	4.7	4.6	4.6	4.7	4.6	4.6	4.7	4.7	4	45	Slush

Cutting Edge Testing

Section *Belfield*
Edge Type *Tungsten*
Unit *9315*
Install Date *12/3/2010*
Edge Height
New *5"*

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
3/28/2011	85	New asphalt	Wet	32	Wet	4.7	4.7	4.6	4.6	4.7	4.6	4.6	4.7	4.7	4	45	Slush
4/15/2011	85	Microsurfaced	Wet	29	Wet	4.6	4.6	4.5	4.5	4.6	4.5	4.5	4.6	4.6	4	75	Slush
4/15/2011	85	New asphalt	Wet	29	Wet	4.6	4.6	4.5	4.5	4.6	4.5	4.5	4.6	4.6	4	75	Slush
4/17/2011	85	Microsurfaced	Wet	30	Wet	4.6	4.6	4.5	4.5	4.6	4.5	4.5	4.6	4.6	4	75	Compact snow/Snow covered
4/17/2011	85	New asphalt	Wet	30	Wet	4.6	4.6	4.5	4.5	4.6	4.5	4.5	4.6	4.6	4	75	Compact snow/Snow covered
4/18/2011	85	Microsurfaced	Wet	30	Wet	4.6	4.6	4.4	4.4	4.5	4.4	4.4	4.5	4.6	4	75	Ice/Slush
4/18/2011	85	New asphalt	Wet	30	Wet	4.6	4.6	4.4	4.4	4.5	4.4	4.4	4.5	4.6	4	75	Ice/Slush
4/19/2011	85	Microsurfaced	Wet	28	Wet	4.6	4.5	4.1	4.1	4.5	4.3	4.3	4.5	4.6	9	240	Compact snow /Snow covered/Slush
4/19/2011	85	New asphalt	Wet	28	Wet	4.6	4.5	4.1	4.1	4.5	4.3	4.3	4.5	4.6	9	240	Compact snow/Snow covered/Slush
														Total	775	15459	

Cutting Edge Testing

Section ***Beulah***
Edge Type ***Tungsten***
Unit ***9743***
Install Date ***12/20/10***

Edge Height New ***5"***

						Cutting Edge Heights (inches)											
						Drivers Edge			Middle Edge			Passenger Edge					
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt	Hours Plowed	Miles Plowed	Observations
12/20/2010	200	Asphalt	Dry	-5	Snow covered	5	5	5	5	5	5	5	5	5	6	56	
12/21/2010	200	Asphalt	Dry	-1	Snow covered	5	5	5	5	5	5	5	5	5	4	56	Really fluffy and dry snow
12/24/2010	200	Asphalt	Dry	2	Scattered Snow	5	5	5	5	5	5	5	5	5	6	48	
1/15/2011	200	Asphalt	Dry	8	Scattered Snow										5	132	
1/15/2011	1806	Chip Seal	Dry	6	Scattered Snow										3	28	
1/16-1/20/2011	200-1806	Asphalt	Dry	0-10	Scattered Snow	5	5	5	5	5	5	5	5	5	25	500	Replaced cutting edges on 1/20/2011
1/21/2011	200	Asphalt	Wet	10	Scattered Snow	5	5	5	5	5	5	5	5	5	3	66	
1/21/2011	1806	Chip Seal	Wet	10		5	5	5	5	5	5	5	5	5	3	82	
1/22/2011	200	Asphalt	Wet	9	Scattered Snow										4	56	
1/24/2011	200	Asphalt	Wet	18	Scattered Snow										3	56	
1/24/2011	1806	Chip Seal	Wet	18	Scattered Snow	5								5	4	82	
1/29/2011	200	Asphalt	Wet	16	Scattered Slush	5								5	3	48	
1/29/2011	1806	Chip Seal	Wet	16	Scattered Slush	5									3	82	
1/30/2011	200	Asphalt	Dry	9	Scattered Snow										2	28	
1/31/2011	200	Asphalt	Dry	11	Scattered Snow										4	60	
1/31/2011	1806	Chip Seal	Dry	11	Scattered Snow										4	82	
														Total	82	1462	

Cutting Edge Testing

Section *Killdeer*
Edge Type *Tungsten*
Unit *9593*
Install Date *11/21/2010*
Edge Height
New *5"*

						Cutting Edge Heights (inches)											
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Drivers Edge			Middle Edge			Passenger Edge			Hours Plowed	Miles Plowed	Observations
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
11/21/2010	22	asphalt	dry		snow covered	5"	5"	5"	5"	5"	5"	5"	5"	5"		74	
11/22/2010	22	asphalt															
11/24/2010	22	asphalt															
11/25/2010	22	asphalt															
1-Dec	22	asphalt	dry		compact	5	5	5	5	5	5	5	5	5	1	12	used belly
12/3/2010	22	asphalt	dry		snow cover, compact underneath	5	5	5	5	5	5	5	5	5	12	74	no change in edge
12/4/2010	22	asphalt	dry		scattered compact	5	5	5	5	5	5	5	5	5	8	74	used belly
12/5/2010	22	asphalt	dry		drifted snow	5	5	5	5	5	5	5	5	5	1	32	no change in edge
12/10/2010	22	asphalt	w	19	snow cover	5	5	5	5	5	5	5	5	5	5	74	no change in edge
12/11/2010	22	asphalt	dry	9	snow cover	5	5	5	5	5	5	5	5	5	5.5	74	no change in edge
12/13/2010	22	asphalt	dry	5	compact	5	5	5	5	5	5	5	5	5	2.5	74	used belly
12/20/2010	22	asphalt	dry	8	snow cover	5	5	5	5	5	5	5	5	5	10	222	plowed all day no change in edges
12/21/210	22	asphalt	dry	6	compact	5	5	5	5	5	5	5	5	5	1	20	no change in edge
														Total	46	730	

Cutting Edge Testing

Section *Beach*
Edge Type *8" Tungsten*
Unit *9951*
Install Date *12/2/2010*
Edge Height
New *8"*

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
12/3/2010	16N	Asphalt w/chip seal	Dry	2 degrees	Loose snow/scattered compact										7	180	hours plowed is with plow down
12/3/2010	94 E&W	Asphalt w/chip seal			loose snow/scattered compact										3	56	plowed 1/2 of driving lane and wide shoulder
12/4/2010	16 N	asphalt w/chip seal			loose snow/scattered compact										4	90	hours plowed is with plow down
12/5/2010	16N	asphalt w/chip seal			thin compact										2	90	hours plowed is with plow down
12/6/2010	16N	asphalt w/chip seal			thin compact										2	90	hours plowed is with plow down
12/13/2010	16N	asphalt w/chip seal	Dry	8	scattered snow drifts	7 3/4	7 3/4	7 3/4	7 3/4	7 3/4			7 7/8	7 7/8	one half hour	90	Drivers edge (Lt) is wearing more than pass. Edge
12/17/2010	16N	Asphalt w/chip seal	Dry	5	scattered loose snow										one half hour	90	plowed only scattered areas no visible edge wear
12/20/2010	16N	Asp/w/chp,micor seal	Dry	5	scattered loose snow										8.5	250	plow to Junct.68/double up on heavier areas
12/21/2010	16 N&S	Asphalt w/chip seal	Dry	10	scattered compact/drifts										2	120	plow down approx 2 hrs.
12/22/2010	16N	Asphalt w/chip seal	Dry	5	scattered thin compact										3	90	plow down 3 hours
12/23/2010	16N	Asphalt w/chip seal	Dry	10	scattered snow cover/drifts	7 5/8	7 3/4	7 5/8	7 5/8	7 3/4	7 3/4	7 3/4	7 7/8	7 7/8	5	90	
12/28/2010	16N	asphalt w/chip seal		8	scattered ice										1	100	
12/30/2010	16N	Asphalt w/chip seal	Dry	-3	scattered snow										4	90	plow to Junct. 68
1/3/2011	16N & S	Asphalt w/chip seal	Dry	0	scattered snow/dirfts										6	150	2 rnds south/1 north
1/4/2011	94 E & W	overlay/concrete	Dry	5	scattered snow drifts										1	120	sheltered areas and guardrails
1/5/2011	16N	asp.w/chp seal	Dry		scatt. Sno drifts										2	90	sheltered areas and guardrails
1/6/2011	16N	asp.w/chp seal	Dry		scatt. Sno drifts										4	90	Left edge worn thru tungsten
1/9/2011	16N	asp.w/chp seal	Dry		scatt. Sno drifts										4	90	
1/10/2011	94 W	overlay/concrete	Dry		scatt. Sno drifts										1	60	8" edges gone/have 5" backers/will use them
1/11/2011	16 N	asp.w/chp seal	Dry		Thin compact/scattered										4	90	
1/13/2011	16 N	asp.w/chp seal	Dry	5	scatt sno drifts										2	90	
1/14/2011	16 N	asp.w/chp seal	Dry	18	scatt sno drifts										2	90	Edges worn out/REPLACE WITH COMPLETE SET OF 5"
1/15/2011	16 N	asp.w/chp seal			sno cover	5	5	5	5	5	5	5	5	5	2	90	
1/17/2011	94			5	cont. ice	5	5	5	5	5	5	5	5	5	3	90	All edges @ 5"
1/18/2011	16 N&S	asp.w/chp seal	sno		cont ice w/sno cover	4 3/4	5	5	5	5	5	5	5	5	8	210	
1/19/2011	16 N&S	asp.w/chp seal			sno cover over ice										5.5	120	
1/21/2011	16 N&S	asp.w/chp seal			sno cover										10	240	
1/22/2011	16 N&S	asp.w/chp seal		5	pillow drifts	4 5/8	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8	5	7	150	Left edge wearing/This plow wears same as old plow
1/23/2011	16 N&S	asp.w/chp seal			blow and drift										4	120	
1/24/2011	16 N&S	asp.w/chp seal			sno drifts on ice										9	120	
1/25/2011	16 N	asp.w/chp seal	Dry	15	scatt compact										4	90	
1/26/2011	16 N	asp.w/chp seal			blow on and stick										4	90	
1/27/2011	16 N	asp.w/chp seal			scatt ice										3	90	
1/31/2011	16 N&S	asp.w/chp seal			sno cover	3 3/4	4	4 1/4	4 1/4	4 3/4	4 3/4	4 3/4	5	5		240	left edge and 1/2 of center edge worn
2/1/2011	16 N&S	asp.w/chp seal		-20	scattered snow										5	120	INSTALL NEW LEFT AND CENTER EDGES
2/2/2011	16 N&S	asp.w/chp seal													6	120	
2/3/2011	16 N	asp.w/chp seal			heavy snow drifts										7	90	
2/4/2011	16 N	asp.w/chp seal		10	scattered snow										2.5	90	
2/5/2011	16 N	asp.w/chp seal			scattered snow										3.5	90	
2/6/2011	16 N	asp.w/chp seal			scattered snow										3	90	
2/7/2011	16 N	asp.w/chp seal			scattered snow										5	90	
2/8/2011	16 N	asp.w/chp seal			scattered compact										2.5	90	
2/9/2011	16 N	asp.w/chp seal			compact/scattered drifts										3	90	
2/10/2011	I-94	concrete/overlay			snow covered										6	90	
2/11/2011	16 N&S	asp.w/chp seal													7	120	
2/14/2011	16 N	asp.w/chp seal		25	Scattered snow										0.5	90	

Cutting Edge Testing

Section *Beach*
Edge Type *8" Tungsten*
Unit *9951*
Install Date *12/2/2010*
Edge Height
New *8"*

						Cutting Edge Heights (inches)											
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Drivers Edge			Middle Edge			Passenger Edge			Hours Plowed	Miles Plowed	Observations
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
2/15/2011	16 S	asp.w/chp seal			Scattered snow	4 3/4	4 7/8	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 1/2	0.5		cleaned up after dozers on problem areas
2/20/2011	16 N	asp.w/chp seal													3		Perry drove truck
2/21/2011	I 94	concrete/overlay			Scattered snow										7	120	pass.lane/wide shldr/work with dozers south
2/22/2011	16 N&S	asp.w/chp seal		3											6	120	
2/23/2011	16N&S/94			5											2.5		
2/24/2011	16 N	asp.w/chp seal		-10	Scattered snow										1	90	rite side of left/left of ctr worn/stack used edges over top
2/27/2011	16N/I94			5	Scattered drifts										1	75	
2/28/2011	16 N	asp.w/chp seal		10	Scattered drifts										1	90	
3/1/2011	16 N	asp.w/chp seal		-5	Scattered snow										3	90	
3/3/2011	16 N&S	asp.w/chp seal		-5											1	120	winged off shoulder
3/7/2011	16 N	asp.w/chp seal		-10	Scattered snow										3	90	
3/8/2011	16 N	asp.w/chp seal		5	Scattered drifts										1	90	
													Total		208	6001	

Cutting Edge Testing

Section *Dickinson*
Edge Type *Traditional*
Unit *9625*
Install Date *12/9/2010*
Edge Height
New

						Cutting Edge Heights (inches)											
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Drivers Edge			Middle Edge			Passenger Edge			Hours Plowed	Miles Plowed	Observations
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
12/20/2010	22 south	asphalt	dry	15	pillow drifts then light snow cover	4 7/8	4 7/8	5	25 15/16	25 15/16	4 7/8	4 7/8	4 7/8	25 13/16	10	96	started out as pillow drifts then changed to light snow cover before being cleared off.
12/23/2010	22 south	asphalt	dry	21	scattered snow drifts	4 7/8	4 7/8	415/16	415/16	415/16	4 7/8	413/16	4 7/8	413/16	8	75	there was scattered drifts and finger drifts along the shoulder with light compact on west business loop
12/29/2010	22 south	asphalt	dry	14	fluffy, scattered pillow drifts	4 7/8	4 7/8	415/16	415/16	4 7/8	4 7/8	4 3/4	413/16	413/16	3	20	scattered pillows and scattered compact on loops and I-94 thru town. And up and down ramps.
12/30/2010	22 south	asphalt	dry	12	scattered snow drifts	413/16	4 7/8	4 7/8	415/16	4 7/8	4 7/8	4 3/4	413/16	413/16	4	15	scattered drifts in sheltered areas and compact on ramps .
1/9/2011	22 south	asphalt	dry	7	snow covered	4 3/4	413/16	413/16	413/16	4 3/4	413/16	411/16	413/16	413/16	7	106	Road was completely covered, when we turned around you could'nt tell we plowed.
1/18/2011	22 south	asphalt	wet	12	continous ice	4 3/4	4 3/4	411/16	25 2/3	4 3/4	25 2/3	411/16	413/16	413/16	3	32	continous ice from rain Sunday, scraped to get whatever would come off.
1/21/2011	22 south	asphalt	wet	31	scattered ice										12	160	Road had scattered ice, temp. went to 33, ice was melting ,then blowing snow stuck in areas and became ice.
						New	Edges										
1/22/2011	22 south	asphalt	wet	13	scattered ice	4 7/8	4 7/8	4 7/8	5	5	5	4 7/8	4 7/8	4 7/8	3	64	There was scattered ice, with some snow cover in sheltered areas.
1/23/2011	22 north	asphalt	wet	32	scattered ice, snow stuck	4 7/8	4 7/8	4 7/8	5	5	5	4 7/8	4 7/8	4 7/8	2	12	There was patches of solid thick ice and snow sticking in different areas.
1/24/2011	22 south	asphalt	wet	16	scattered ice and snow	413/16	413/16	413/16	415/16	415/16	415/16	413/16	413/16	413/16	4	60	We had icy patches and snow sticking, The visibilty was about 50 feet at times. At about 9:00 the wind let up and the sun came out. Then things started to melt and clean off.
2/5/2011	22south	asphalt	wet	-3	scattered ice and snow	413/16	413/16	413/16	415/16	415/16	415/16	413/16	413/16	413/16	4	16	We had snow and ice here and there
2/11/2011	22south	asphalt	wet	26	continous ice/snow cover	4 3/4	4 3/4	4 3/4	411/16	411/16	411/16	411/16	4 3/4	4 3/4	8	80	There was continous ice with some snow cover in the open spaces where drifting was happening.
						Newe	Edges										
2/20/2011	22south	asphalt	dry	-5	pillow drifts	415/16	5	411/16	411/16	4 5/8	## ###	411/16	415/16	5	9	128	We had pillow drifts in certain areas where they are one after another and areas that did't have nothing.
3/22/2011	22south	asphalt	wet	34	wet,heavy snow covered	4 3/4	4 3/4	4 3/4	411/16	411/16	411/16	411/16	4 3/4	4 3/4	10	240	It started as rain,then turned to heavy, wet snow. The wind was out of the east, which made seeing tough.
3/23/2011	22 south	asphalt	wet	28	snow covered, compacted,	Put	new	edges	on	at	end	of	day		8	185	We had some open areas of pavement, mostly covered, with compacted snow or ice spots.
						New	Edges										
3/24/2011	22 south	asphalt	wet	32	sticking, blowing snow	415/16	415/16	415/16	415/16	415/16	415/16	415/16	415/16	415/16	3	4	Had spots of sticking snow from one end of routeto the other, so did more driving then scraping.
3/25/2011	Hwy 200	asphalt	wet	27	blowing, compacted snow										8	1125	Their was snow covered stretches and compacted areas.
3/27/2011	I-94 east	concrete	wet	30	blowing and sticking snow										3	60	We had heavy snow with strong east winds.
3/28/2011	I-94 east	concrete	wet	30	blowing and sticking snow										8	120	The conditions were the same as the previous day. Did't seem like we did anything .
3/29/2011	22 south	asphalt	wet	28	scattered ice	5	5	4 7/8	4 15/16	4 7/8	4 7/8	4 15/16	5	4 15/16	3 1/2	24	Scattered compact and light ice
														Total	120.5	2622	

Cutting Edge Testing

Section Hettinger
Edge Type
Unit 9441
Install Date 12/3/2010
Edge Height New 5"

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
12/23/2010	12	chip seal	Dry	18	snowdrifts	5"	5"	5"	5"	5"	5"	5"	5"	5"	4	120	Noise and vibration reduced substantially due to adaptor.
23-Dec	8	chip seal	Dry	18	snowdrifts	5"	5"	5"	5"	5"	5"	5"	5"	5"	4	120	
12/30/2010	12	Chip seal	Dry	5	snowdrifts	5"	5"	5"	5"	5"	5"	5"	5"	5"	4	120	
12/30/2010	8	chip seal	dry	10	snowdrifts	5"	5"	5"	5"	5"	5"	5"	5"	5"	4	120	
1/9/2011	12	chip seal	dry	10	snowcovered	5"	5"	5"	5"	5"	5"	5"	5"	5"	3	90	Roadway had a 6" snowcover
1/9/2011	8	chip seal	dry	10	snowcovered	5"	5"	5"	5"	5"	5"	5"	5"	5"	5	150	Roadway had a 6" snowcover
01/14/2011-01/26/2011	12	chip seal	Dry	15-30	compact snow	43/4"	5"	5"	5"	5"	5"	5"	5"	43/4"	15	450	
01/14/2011-01/26/2011	8	chip seal	Dry	15-30	compact snow	43/4"	5"	5"	5"	5"	5"	5"	5"	43/4"	50	1500	
01/27/2011-02/03/2011	12	chip seal	Dry	15-30	compact snow	43/4"	5"	5"	3"	3"	3"	5"	5"	43/4"	12	360	02/03/2011-Center edge was replaced at 3274 hrs.
01/27/2011-02/03/2011	8	chip seal	Dry	15-30	compact snow	43/4"	5"	5"	3"	3"	3"	5"	5"	43/4"	36	1080	02/03/2011-Center edge was replaced at 3274 hrs.
01/29/11-02/07/11	12	chip seal	Dry	15-30	compact snow	43/4"	5"	5"	5"	5"	5"	5"	5"	43/4"	5	150	
01/29/11-02/07/11	8	chip seal	Dry	15-30	compact snow	43/4"	5"	5"	5"	5"	5"	5"	5"	43/4"	23	690	
														Total	165	4950	

Cutting Edge Testing

Section *Richardton*
Edge Type *Tungsten*
Unit *9724*
Install Date *12/13/2010*
Edge Height
New *5*

						Cutting Edge Heights (inches)											
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Drivers Edge			Middle Edge			Passenger Edge			Hours Plowed	Miles Plowed	Observations
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
12/15/2010	8-I-94	conc/asph	wet	10	SNOW GLAZE	5	5	5	5	5	5	5	5	5	6	99	
12/20/2010	I-94	conc/asph	dry	14	ON AND OFF SNOW	5	5					5	5	5	4	102	
12/20/2010	I-94	conc/asph	dry	10	scatter snow	5	5	5	5	5	5	5	5	5	7	45	
12/23/2010	I-94	conc/asph	WET	28	THIN ICE	5	5	5	5	5	5	5	5	5	3	20	
12/24/2010	I-94	conc/asph	WET	25	DRIFTS ON SHOULDERS	5	4.85	4.85	4.65	4.65	4.65	4.65	4.85	5	3.5	35	STARTING TO SEE EDGES START WEARING A LITTLE 32 OF A INCH
1/7/2011	I-94	conc/asph	dry	18	snow drifts	0	0	0	0	0	0	0	0	0	2	15	
1/9/2011	I-94	coc/asph	dry	11	snow covered	4.5/8	4.5/8	4.9/16	4.65	4.65	4.65	4.5/8	4.7/8	4.15/16	7	145	
1/10/2011	I-94	coc/asph	wet	-3	scatter snow	4.9/16	4.5/8	4.5	4.5/8	4.5/8	4.5/8	4.5/8	4.7/8	4.15/16	7	115	drivers edge really starting to wear.
1/14/2011	I-94	coc/asph	wet	25	scatter ice	4.9/16	4.5/8	4.5	4.5/8	4.5/8	4.5/8	4.5/8	4.7/8	4.15/16	2	52	really wearing
1/16/2011	I-94	coc/asph	wet	10	ice	4.1/2	4.9/16	4.5	4.1/2	4.9/16	4.9/16	4.9/16	4.7/8	4.15/16	2	30	
1/17/2011	I-94	coc/asph	wet	5	ice	4.1/2	4.9/16	4.5	4.1/2	4.9/16	4.9/16	4.9/16	4.7/8	4.15/16	8	120	
1/19/2011	I-94	coc/asph	dry	9	scatter snow	4.1/4	4.1/4	4.1/8	4.3/16	4.1/2	4.1/2	4.1/2	4.7/8	4.15/16	5	112	cutting edges are to be replaced
														Total	56.5	890	

Cutting Edge Testing

Section ***Dickinson***
Edge Type ***Joma***
Unit ***9768***
Install Date ***11/22/2010***
Edge Height
New ***6 inches***

						Cutting Edge Heights (inches)											
						Drivers Edge			Middle Edge			Passenger Edge					
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt	Hours Plowed	Miles Plowed	Observations
12/3/2010	I-94	concrete	N/A	10	Compact Ice	6	6	6	6	6	6	6	6	6	9	80	Road was light compacted ice. Edges showed no visible wear when I was finished
24-Dec-10	I-94	concrete	N/A	15	blowing and drifting snow froming slick roads	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	12	200	road was snow covered indriving lane scattered snow passing lane wind blowing causing sticking snow road was treated with brine and salt to keep it from icing over got control late in day after the wind went down 27 dec. 2010 scattered snow treated with salt plowed off to keep from icing over got control late in day plowing mostly on wet roads thin ice
12/29/2010	N22	Asphalt	Dry	5	Scattered snow	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	5	80	Road was scattered snow drifts north bound but not on south bound lane. Moved snow both directions on structures.
12/30/2010	I-94	Concrete	Dry	-5	Scattered snow	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	3	40	Moved snow just around structures!
1/1/2011	I-94	Concrete	Dry	0	Scattered snow	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	8	80	East bound passing lane had scattered snow drifts. West bound driving lane scattered snow drifts!
1/2/2011	I-94	Concrete	Dry	5	Scattered snow	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	9	100	East bound passing lane had scattered snow drifts. West bound driving lane scattered snow drifts! Dickinson to Belfield did both lanes on scattered snow drifts!
1/3/2011	I-94	Concrete	Dry	15	Scattered snow	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	8	120	Passing lane had continous scattered ice and wide shoulder just structures. West bound from Richarton to Dickinson. Passing lane and driving lane plowed scattered snow drifts!
1/9/2011	I-94	Concrete	Dry		Snow Covered	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	10	200	Snow cover both lanes! Cleaned much better than traditional edges once again. They bonded to the contour of the road better than traditional edges.
1/21/2011	I-94	Concrete	Wet	28	Snow Covered	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	7	160	Roads were snow covered with wet slushy snow continuous! Plowed clean except compact was I was plowing with under body.
1/22/2011	I-94	Concrete	Dry	0	Snow Covered	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	10	160	Plowed continous snow cover. Plowed clean again except compact I had to plow with under body.
1/23/2011	I-94	Concrete	Dry	30	Scattered snow	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	11	200	Roads were scattered snow drifts. Didn't plow continous so not so much wear on edges today!
1/26/2011	22	asphalt	wet	30	scattered compact	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	1	14	scattered ice compact plow down in spots on the hwy . Wheel tracks open spots in the same areas.
1/29/2011	I-94	Concrete	Dry	10	Scattered Snow	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	5	40	Snow covered road. Continuous plowing clean with consistant snowfall. No wear to edges on todays event.
1/30/2011	I-94	Concrete	Dry	5	Scattered Snow	5.68	5.75	5.68	5.68	5.5	5.5	5.56	5.56	5.5	6	80	Snow covered roads. Continous plowing 4-5 inches of snow with no wear to edges.
1/31/2011	I-94	Concrete	Dry	-10	Scattered Snow	5.37	5.43	5.37	5.68	5.5	5.37	5.31	5.56	5.19	12	200	Snow Covered roads. Continuous plowing for 12 hours straight. A very rough shoulder with continous plowing. I saw my first sign of wear to bolts and cutting edges.
2/5/2011	94	concrete	Wet	28	scattered snow east bound snow covered west	5.37	5.43	5.37	5.68	5.5	5.37	5.31	5.56	5.19	1.5	30	appling product to road before storm to prevent icing upsnowing at the time so had plow down during operation to have as clean as possible while appling salt
2/11/2011	N22	Asphalt	Wet	40	Scattered snow . Blowing snow on roadway	4.94	4.75	4.5	4.19	4.25	4.94	5	5.18	5.14	11	100	Plowed scattered snow due to blowing snow. Plowed continously at times on wet, warm road on a chip seal.
2/20/2011	I-94	Concrete	Dry	-5	Scattered snow on roadway										8	120	Plowed scattered snow continuously. Checked edges halfway through the day. Had to replace them with traditional edges. Wore them out.
3/22/2011	I-94	Concrete	Wet	34	Snow Covered	6	6	6	6	6	6	6	6	6	16	280	Temperatures were above freezing and snow covered.

Cutting Edge Testing

Section Dickinson
Edge Type Joma
Unit 9768
Install Date 11/22/2010
Edge Height
New 6 inches

						Cutting Edge Heights (inches)											
						Drivers Edge			Middle Edge			Passenger Edge					
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt	Hours Plowed	Miles Plowed	Observations
3/23/2011	I-94	Concrete	Wet	26	Scattered ice	6	6	6	6	6	6	6	6	6	12	200	Temperatures right about freezing mark with scattered ice.
3/26/2011	22	asphalt	wet	26	scattered ice										0.5	10	plowing 22 N.blowing and drifting
3/26/2011	94	concrete	wet	21	scattered ice												plowing 94 W. scattered snow early in the day
3/26/2011	94	Concrete	Wet	21	scattered snow and ice										3	60	scattered snow ice blowing and drifting snow east bound out of Belfield
3/27/2011	94	concrete	wet	28	scattered slush										9	100	scattered slush 4 rounds blowing and drifting thawing and sticking on all afternoon appling product at the same time as plowing I 94 E.
3/27/2011	94	concrete	wet	26	scattered slush										4	90	plowing driving lane and wide shoulders from Belfield to Dickinson appling salt and plowing to prepare road for the end of the day.setting up the road for treatment the next day.
3/28/2011	94	Concrete	wet and dry	22-30	solid compact snow to scattered slush										6	100	started plowing snow and compact snow early in the morning appling product and then the road strrted to turn to slush and scattered compact by 3:00 the major problem was in the east bound lane from Gladstone to Richardton with a little build up in the passing lane west bound roads ended up dry west bound and scattered wet spots east bound all in all a very productive day.
						5.56	5.56	5.5	5.5	5.56	5.62	5.5	5.5	5.5			
4/15/2011	94	Concrete	wet	28	snow covered and compacted snow	5.5	5.5	5.5	5.75	5.75	5.75	5.5	5.5	5.5	7	176	Started plowing wet heavy snow, the Interstate was snow covered. Plowed the driving lane first and put down product. I made 4 rounds back and forth to Richardton.
4/18/2011	94	concrete	wet	27	continous ice with a light snow on top of ice in passing lane.										1	22	I used the front plow on the narrow shoulder to scrape snow off from the yellow line.
4/19/2011	94	concrete	wet	36	passing lane was snow covered										9	176	The passing lane was snow covered and the driving lane was blown clean from traffic.
														Total	204	3218	

Cutting Edge Testing

Section ***Beulah***
Edge Type ***Joma 6000***
Unit ***9788***
Install Date ***12/3/2010***
Edge Height
New ***6"***

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
12/3/2010	49	Chip Seal	Dry	21	Scattered snow	6			6			6			7	25	Blades are quite- Did a good job of clearing snow off road.
12/4/2010	49	Chip Seal	Dry	14	Scattered snow	6			6			6			1.5	10	No visable wear on blades
12/4/2010	1806	Chip Seal	Dry	20	Snow covered	6			6			6			2.5	50	Plowed behind tungsten blades, Joma removed more snow from road than tungsten.
12/10/2010	49	Chip Seal	Dry	24	Scattered snow	6			6			6			3	10	Blades removed all snow except what was down in the rocks of the chip seal.
12/11/2010	49	Chip Seal	Dry	11	Scattered snow	6			6			6			2	15	I feel Joma 6000 blades remove more snow than the tungsten blades do.
12/11/2010	200	Asphalt	Dry	16	Scattered snow	6			6			6			4	30	
12/13/2010	49	Chip Seal	Dry	9	Scattered snow	5 3/4			5.75			5.75			2	7	Blades remove snow down to pavement.
12/13/2010	200	Asphalt	Dry	15	Scattered snow	5.75			5.75			5.75			2	20	
12/20/2010	49	Chip Seal	Dry	0	Snow covered	5.75			5.75			5.75			2	12	Plowed behind Polar king blades. Joma 6000 removed more snow. Pictures in shared directory.
12/20/2010	200	Asphalt	Dry	4	Snow covered	5.75			5.75			5.75			4	42	
12/21/2010	49	Chip Seal	Dry	6	Scattered snow	5.75			5.75			5.75			3	5	Blades have been in contact with road surface for 39.5 hours.
12/21/2010	200	Asphalt	Dry	12	Scattered snow	5.75			5.75			5.75			5	22	
12/24/2010	49	Chip Seal	Dry	11	Scattered snow	5.75			5.75			5.75			2	18	I feel by using the Joma blade, we will use less product for ice control due to the fact that they remove more snow.
12/24/2010	1806	Chip Seal	Dry	16	Scattered snow	5.75			5.75			5.75			4	36	
12/29/2010	49	Chip Seal	Dry	9	Scattered snow	5.75			5.75			5.75			2	18	
12/30/2010	200	Asphalt	Dry	-1	Scattered snow	5.75			5.75			5.75			5	30	
12/30/2010	1806	Chip Seal	Dry	2	Scattered snow	5.75			5.75			5.75			6	42	
12/31/2010	200	Asphalt	Dry	-9	Scattered snow	5.75			5.75			5.75			1	4	
12/31/2010	1806	Chip Seal	Dry	-11	Snow covered	5.75			5.75			5.75			4.5	66	
1/1/2011	200	Asphalt	Dry	0	Scattered snow	5.75			5.75			5.75			2	6	
1/1/2011	1806	Chip Seal	Dry	-4	Snow covered	5.75			5.75			5.75			5	44	
1/7/2011	49	Chip seal	Dry	4	Scattered snow	5.75			5.75			5.75			5	44	
1/7/2011	1806	Chip Seal	Dry	4	Scattered snow	5.75			5.75			5.75			4	60	
1/9/2011	49-200	hip seal&Aspha	Dry	8	Scattered snow	5 3/4			5.75			5.75			10	110	
1/10/2011	49	Chip seal	Dry	5	Scattered snow	5.75			5.75			5.75			7	68	
1/11/2011	49	Chip seal	Dry	4	Scattered snow	5.75			5.75			5.75			4	30	
1/14/2011	49-200	Chip seal	Dry	2	Scattered snow	5.75			5.75			5.75			10	150	
1/15/2011	49	Chip seal	Dry	9	Scattered snow	5.75			5.75			5.75			6.5	56	
/16-1/17/201	49-200	Chip seal	Dry	0-10	Scattered snow	5.75			5 1/2			5.75			9.5	100	
/19-1/20/201	49-200	Chip seal	Dry	0-10	Scattered snow	5.75			5.5			5.75			14	170	Clayton changed the tungsten blades on 9743 on 1/20/2011
1/21/2011	49	Chip Seal	Wet	29-35	Slush	5.75			5.5			5.75			12	110	Blades removed slush as well as most water.
1/22/2011	49	Chip seal	Dry	10	Scattered snow	5.75			5.5			5.75			8	44	
1/24-1/25/11	49-200	Chip seal	Dry	5-Jan	Scattered snow	5.75			5.5			5.75			16	100	Blades remove more snow and are quitier than tungsten.
26-Jan	49	Chip seal	Wet	38	Scattered slush	5.75			5.5			5.75			5	44	
1/28/2011	49	Chip seal	Wet	35	Scattered slush	5.75			5.5			5.75			6	40	
2/5/2011	49-200	Chip seal	Wet	36	Scattered slush	5.75			5.5			5.75			6	35	
2/6/2011	200	Asplalt	Dry	22	Snow covered	5.75			5.5			5.75			4	45	
2/7/2011	49	Chip seal	Wet	34	Scattered shush	5.75			5.5			5.75			3	20	
2/11/2011	49-I-94-200	Asphalt	Wet	38	Slush covered	5.75			5.5			5.75			8	150	
														Total	207.5	1888	

Cutting Edge Testing

Section *Belfield*
Edge Type *JOMA 6000*
Unit *9756*
Install Date *12/2/2010*
Edge Height
New *6"*

						Cutting Edge Heights (inches)											
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Drivers Edge			Middle Edge			Passenger Edge			Hours Plowed	Miles Plowed	Observations
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
12/3/2010	94	Slurry Seal	Wet	19	Snow covered	6	6	6	6	6	6	6	6	6	9	216	These blades clean better on the first pass. They are also much quieter.Slight burning rubber smell.
12/4/2010	94	Slurry seal	Wet	5	Scattered snow	6	6	6	6	6	6	6	6	6	5	144	They don't cut wheel tracks compacted very well. Very quiet even when hitting a dry spot.
12/11/2010	94	Slurry Seal	Dry	9	Scattered snow	5 7/8	5 7/8	5 7/8	5 7/8	5 7/8	5 7/8	5 7/8	5 7/8	5 7/8	3.5	72	Blades are starting to wear a little. They still cut good and are quiet.
		Chip seal															
12/13/2010	94	Slurry Seal	Dry	12	Scattered snow	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	3	102	They still make a clean first cut. They are wearing evenly.
		Chip Seal															
12/20/2010	94	Slurry Seal	Dry	19	Scattered snow	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	9	144	Still make clean first pass. No new wear evident.
		chip seal															
12/21/2010	94	Slurry Seal	Dry	10	Scattered snow	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	6	146	Plowed to Dickinson, on new concrete, and slurry seal..Noticed no difference in the wear pattern.
		Chip seal															
12/22/2010	94	Slurry Seal	Wet	27	Scattered snow	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	4	60	Still clean first cut. Still wearing even.
		Chip seal															
1/3 2011	94	Slurry Seal	Wet	9	Scattered snow	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	3	61	Does not show sign of wear. Seems to wear littkle on wet roads
		Chip Seal															
1/8/2011	94	Slurry Seal	Dry	8	Scattered snow	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	3	54	
		Chip Seal															
1/9/2011	94	Slurry Seal	Dry	12	Snow covered	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	7	196	Still cleans good. Shows a little wear. Blade is wearing even.
		Chip Seal															
1/10/2011	94	Slurry Seal	Dry	2	Scattered snow	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5	120	The blades are still performing excellent.
		Chip Seal															
1/14/2011	94	Slurry Seal	Dry	20	Scattered snow	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	6	140	
		Chip Seal															
15-Jan	94	Slurry Seal	Dry	8	Snow covered	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	4.5	72	
		Chip Seal															
1/16/2011	94	Slurry Seal	Dry	12	Ice	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	5 5/8	4	57	
		Chip Seal															
1/17/2011	94	Slurry Seal	Dry	8	Ice	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	8	145	Shows a little wear. Cut ice for 2 days. Still holding up good.
		Chip Seal															
1/18/2011	94	Slurry Seal	Dry	18	Ice	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	10	140	
		Chip Seal															
1/19/2011	94	Slurry Seal	Dry	23	Scattered snow										10	140	No change in wear. Still 5 1/2"
		Chip Seal															
1/20/2011	94	Slurry Seal	Dry	12	Scattered ice										8	120	
		Chip Seal															
1/21/2011	94	Slurry Seal	Wet	32	Scattered snow										9	140	
		Chip Seal															
1/22/2011	94	Slurry Seal	Dry	8	Snow covered										9	144	Still wearing the same. Cleaning exellent.
		Chip Seal															
1/23/2011	94	Slurry Seal	Dry	25	Snow covered										6	96	
		Chip Seal															
40567	94	Slurry Seal	Wet	32	Snow covered										12	256	

Cutting Edge Testing

Section *Belfield*
Edge Type *JOMA 6000*
Unit *9756*
Install Date *12/2/2010*
Edge Height
New *6"*

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
		Chip Seal															
40572	94	Slurry Seal	Dry	18	Scattered Snow										5	103	
		Chip Seal															
1/30/2011	94	Slurry Seal	Dry	-2	Snow covered										10	212	
		Chip Seal															
1/31/2011	94	Slurry Seal	Dry	-8	Snow covered										5	76	
		Chip Seal															
2/3/2011	94	Slurry Seal	Dry	28	Scattered Snow										10	196	
		Chip Seal															
4-Feb	94	Slurry Seal	Dry	26	Scattered Snow										4	62	
		Chip Seal															
2/5/2011	94	Slurry Seal	Dry	28	Scattered Snow										5	76	
		Chip Seal															
2/6/2011	94	Slurry Seal	Dry	23	Scattered Snow										10.5	232	Blades are still at 5 1/2 in. They are wearing even.
		Chip Seal															I swapped the left for the right to even out the corners
2/10/2011	94	Slurry Seal	Dry	26	Scattered Snow	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	12.5	248	
		Chip seal															
2/11/2011	94	Slurry Seal	Dry	28	Scattered Snow	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	10.5	208	No new wear noted. The blades clean slush extremely well.
		Chip Seal															
					Total										216.5	4178	

Cutting Edge Testing

Section Dickinson
Edge Type JOMA
Unit 9442 Glen Lewis
Install Date 29 Nov. 2010
Edge Height New 6"

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
3 Dec.2010	22	asphalt	dry	10	snow covered	6	6	6	6	6	6	6	6	6	15.5	90	edges seemed to a very good on the colg and very fluffy snow, edges were very quite,running with a very tight chain they still did avery good job hope the proform as well in compact conditions no noticable ware yet.
4Dec. 2010	94	concrete	dry	15	scattered snow	6	6	6	6	6	6	6	6	6	3.5	60	plowed passing lane and wide shoulder they seemed to work as well on concrete as on asphalt no noticable ware.
11Dec. 2010	22	asphalt	dry	10	scatteres snow										2	40	plowed two rounds on 22 north of dickinson scattered snow so a lot of the plowing was done on particaly dry bare road.
11Dec. 2010	22	asphalt	dry	10	scattered snow										2	25	plowed mostly south bound 22 from Killdeer to Manning same conditions as 22 north of Dickinson
11 Dec. 2010	200	asphalt	dry	10	scattered snow										1	20	plowed mostly on the west bound lane same conditions as hwy. 22
11 Dec. 2010	8	asphalt	dry	8	snow covered										2	40	plowed snow almost all the way from Halliday to end of hwy. 8 both directions.
13 Dec. 2010	22	asphalt	dry	15	scattered snow drifts	5.75	5.63	5.75	5.75	5.75	5.75	5.75	5.75	5.75	0.5	5	mostly plowed with the wing very little with the front plow only on the bridges and supers
																	I feel that most of the ware that occurred on these edges happened on the weekend plowing when I was on the seal job section north of Dickinson from mile 73-88 I kept a real tight chain so as to minimise ware as much as I could and still do a good job plowing the road
20 21 Dec. 2010	22	asphalt	dry	10	scattered snow	5.75	5.63	5.63	5.68	5.63	5.63	5.75	5.63	5.63	6	45	plowed scattered snow on hwy. 22 north to Manning plowed mostly eith the wing on the shoulders north bound plowed the outside 4 foot of the driving lane and the wide shoulder south bound.
	94	concrete	dry	10	scattered snow										4	80	plowed wide shoulders on the 21st and the 22nd mostly snow covered not much ware this storm used a real tight chain to reduce ware still did a good job with this cold fluffy snow.
23-24 Des. 2010	94	concrete	dry	22	snow covered										5	40	snow covered wide shoulders both direction both lanes plowed while applying brine light fluffy snow drove real slow because of snow fog and low visibility air temp. in the 20's. some plowing on the 24'th was scattered snow with wet roads.b lades seemed to do a good job so far wating to see how they proform on some compact snow.

Cutting Edge Testing

Section Dickinson
Edge Type JOMA
Unit 9442 Glen Lewis
Install Date 29 Nov. 2010
Edge Height New 6"

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
24-26 Dec.2010	94	concrete	dry	15	snow covered 24 Dec. 2010	5.69	5.63	5.63	5.63	5.63	5.63	5.69	5.63	5.63	20	400	scattered snow driving lane snow covered passing lane plowed most of a 13 hr. dat put down product salt water to keep the road from icing up filled in under structures wind blowing all day didn't get handle on road till late in the day after the wind went down. 24 Dec. 2010
					scattered snow 26 Dec . 2010												
																	26 Dec. 2010 no plowing 26 Dec.2010 11 hr day scattered snow icy spots put down salt at 400 #/lane mile plow off to cool road temp and get the road to dry up .
12/20/2011	22	asphalt	dry	5	scattered snow	5.63	5.63	5.56	5.56	5.56	5.56	5.56	5.63	5.63	2	5	30 dec.2010 went north on 22 for a after storm road clean up not very much on the road because fo the fact that Christ went up the night before ehen the storm first came thru and pushed back the finger drifts and opened up the bridges letting the wind do it's job and keep the road clean over night
1/14/2011	22	asphalt	dry	18	scattered snow										1	20	scattered snow not much plowing with the front plow
1/14/2011	94	concrete	wet	18	scattered snow and soild ice										3	60	scattered snow and solid ice plow down about half of the time kept a good tight chain plowed west on wide shoulder and in town both lanes, ramps and overheads
1/15 2011	22	asphalt	dry	20	scattered snow										1	20	scattered snow Jesse plowing as trainee used plow alittle more than may have been needed
1/15/2011	94	concrete	dry	20	snow covered										2	40	plowed snow on the wide shoulder plow down almost all the time used a tight chain Jesse plowing
1/16/2011	94	concrete	dry	20	scattered snoe										2	25	plowed wide shoulders plow down about half of the time
1/16/2011	22	asphalt	dry	20	scattered snow	5.69	5.69	5.63	5.63	5.56	5.56	5.56	5.63	5.63	1	10	plowed south intermittened snow drifts used mostly the wing on this round of plowing.
1/22/2011	22	asphalt	dry	13	scattered snow										1.5	25	ploeing back the shoulders using the front plow when needed

Cutting Edge Testing

Section Dickinson
Edge Type JOMA
Unit 9442 Glen Lewis
Install Date 29 Nov. 2010
Edge Height New 6"

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
1/22/2011	94	concrete	dry	25	snow covered										5	88	plowing wide shoulde, shoulders snow covered used front plow almost continously
1/23/2011	94	concrete	dry	30	scattered snow										5	120	plowed driving and passing lanes from Dickinson to Belfield and 3 rounds on the west loop Tryler used this truck today
1/24/201	22	asphalt	dry	22	scattered snow										2	35	plowed north in morning befor daylight to dress up road after a night of wind
1/24/2011	94	concrete	dry	28	snow covered										2	20	plow back wide shoulders from Dickinson to Belfield
1/24/2011	22	asphalt	wet	30	compact snow and ice										2	35	plow off drifted snow preparing to apply brine
1/24/2011	22	asphalt	wet	25	scattered compact										3	25	plowing compact ice during and after appling brine mostly on the chip seal section of hwy 22. N rp. 73-88 very hard on the cutting edges as the road has a lot of bare spots with compact snow .
						5.62	5.56	5.56	5.56	5.43	5.5	5.5	5.5	5.63			
1/29/2011	94	concrete	dry	20	scattered snow east bound soild snow west bound from Dickinson to Belfield										1.5	30	plowed wide shoulders from Dickinson to Belfield
1/29/2011	22	asphalt	dry	20	scattered snow north bound soild south bound										2	46	plowed and winged north 22
1/29/2011	22	asphalt	dry	25	scattered snow										1.5	25	plowed wide shoulder and supers
1/30/2011	22	asphalt	dry	-4	scattered snow										1.5	35	plowed and winged scattered snow both directions
1/30/2011	94	concrete	dry	5	snow covered										2	38	plowed and winged wide shoulder from Dickinson to Belfield
1/30/2011	22	asphalt	dry	8	scatteered snow and compact										2	25	north bound plow down 1.5 hrs. south plow down .5 hrs scattered snow both directions 1/2 of the was uncovered most of the round
1/31/2011	22	asphalt	dry	-15	snow covered south bound scattered north bound										1.5	30	north bound very little front plow south bound snow covered and compact snow used front plow with the underbody
1/31/2011	94	concrete	dry	-3	snow covered										2.5	42	wide shoulder plowing
1/31/2011	94	concrete	dry	0	scattered snow both directions	5.44	5.5	5.38	5.38	5.31	5.38	5.44	5.44	5.44	4	65	scattered snow wide shoulder both directions from Dickinson to Belfield windy snow blowing on and building up sometimes as high as 18 to 24 inches on the wide shoulder
2/1/2011	94	concrett	dry	-20	scattered snow										1.5	25	plow back shoulders and wing back banks

Cutting Edge Testing

Section Dickinson
Edge Type JOMA
Unit 9442 Glen Lewis
Install Date 29 Nov. 2010
Edge Height New 6"

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
2/1/2011	22 N	asphalt	dry	-20	scattered snow										0.5	10	plow bridges and supers
2/1/2011	22 S	asphalt	dry	-10	scattered snow	5.44	5.5	5.38	5.38	5.38	5.38	5.44	5.44	5.44	0.5	10	plow back shoulders and wing back banks
2/3/2011	22N	asphalt	dry	20	scattered snow										0.2	10	plowed back shoulders scattered snow
2/3/2011	94	concrett	Wet	25	scattered snow										1.5	30	plowing shoulders scattere3d snow
2/3/2011	22	asphalt	wet	35	scattered snow										2	40	scrape and plow after applying brine
2/4/2011	22	asphalt	wet	25	scattered ice										15	1	plowed scattered snow and ice applied water on icy spots
2/5/2011	94	concrete	dry	30	scattered snow										30	1.5	plowed shoulders scattered snow
2/6/2011	22 N.	asphalt	dry	26	snow covered and compact snow										25	1.25	snow covered south bound lane plow down al the way in from Manning
2/6/2011	94	concrete	dry	28	snow covered										85	4	wide shoulders all of our section Richardton to Belfield
2/6/2011	22N.	asphalt	wet	25	slush and wet compact snow	5.38	5.38	5.31	5.38	5.25	5.38	5.31	5.38	5.5	45	2.5	plowed 22N. Second round after we had scraped it with unit 9685 eroad was wet scattered slush and compact snow with blowing and drifting snow just before the road got to cold to remove any more snow.
2/10/2011	22 N.	asphalt	wet	28	scattered snow and slush										75	3	plowed in the morning scattered sluhh and snow wind blowing and snow sticking to the road
2/10/2011	I 94	concrete	wet	30	snow covered										84	4	plow down on the wide shoulder with wing down also to get the snow from blowing back on the road
						5.38	5.38	5.31	5.31	5.25	5.31	5.31	5.38	5.5			
2/20/2011	22 N & S.	asphalt	dry	9	scattered snow										90	4.5	plow from rp. 17- 95
2/20/2011	12	asphalt	dry	10	scattered snow										60	3	scattered snow between hwy. 22 and state line east bound snow covered from state line and Hettinger
2/20/2011	8	asphalt	dry	10	scattered snow										10	0.5	scattered snow south bound snow covered north bound from stste line to Hettinger
2/21/2011	22	asphalt	dry	8	scattere3d snow										20	1	plowed wide shoulder with wing scattered snow in driving lane
2/21/2011	94	concrete	dry	-8	scattered snow	5.38	5.25	5.18	5.18	5.13	5.18	5.25	5.31	5.44	25	1	wide shoulder in town and the loops
3/1/2011	8	asphalt	dry	21	scattered snow/ ice										3	143	blowing snow

Cutting Edge Testing

Section Dickinson
Edge Type JOMA
Unit 9442 Glen Lewis
Install Date 29 Nov. 2010
Edge Height New 6"

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
3/6/2011	I94&8	con/asph	dry	16	scattered snow										2	204	Mostly ice some scattered snow drifts
					blowing												
3/11/2011	94	con/asph	wet	28	scattered compact										3	230	
					blowing												
3/12/2011	94&49	con/asph	wet/dry	16	scattered compact										8	198	
3/28/2011	94	con/asph	wet	30	scattered compact & slush	missing	5.19	5	5	4.93	5	5.06	5.19	5.44	3	60	Plowing wide & narrow shoulders. Scattered compact & slush.
												5.12	5.25	5.5			replaced left blade with one from Crist's truck
														Total	701.7	2696.25	

Cutting Edge Testing

Section *Beach*
Edge Type *Polar Flex*
Unit *9914*
Install Date *Dec.02 2010*
Edge Height
New

						Cutting Edge Heights (inches)													
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Drivers Edge				Middle Edge				Passenger Edge				Hours Plowed	Miles Plowed	Observations
						Lt	Mid	Mid	Rt	Lt	Mid	Mid	Rt	Lt	Mid	Mid	Rt			
12/3/2010	94	pavment			light compact	2	2	2	2	2	2	2	2	2	2	2	2	4	150	edges really cut when first put on I feel that a lot of this is due to the edge being new and is sharp and not conformed to the road yet.
12/4/2010	94	pavment		-5	light compact and ice	2	2	2	2	2	2	2	2	2	2	2		4	100	
12/11/2010	94	pavment		-8	light dry snow	1 7/8	2	2	2	2	2	2	2	2	2	2	1 7/8	6	200	Not a lot of wet snow for lubrication oder was higher then usual because of this
12/12/2010	94	pavment		-10	light dry snow	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8	3	25	Cleaned up through Medora
12/20/2010	94	pavement	Dry	22	light dry snow	13/4	13/4	13/4	13/4	13/4	13/4	13/4	13/4	13/4	13/4	13/4	13/4	9	450	A lot of dry snow had to plow in tandom at speeds up to 55 mph to keep from getting run into in the snow fog "Yes I understand that edges wear faster at higher speeds" But no one in beach section got hit using the higher speed. Put a price on that
12/21/2010	94	pavement	Dry	25	light dry snow	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	7	300	Edges clean well
12/22/2010	94	pavement	Dry	5-Jan	Scatterd light compact	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 1/2	4	200	
12/23/2010	94	pavement	Dry	10	Light dry snow	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 1/2	4	200	
12/24/2010	94	pavement	Dry	6	Light dry snow	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 1/2	2	5	three days of road report not much plowing
12/25/2010	94	pavement	Dry	5	Light dry snow	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 1/2	1	6	
12/26/2010	94	pavement	Dry	5	Light dry snow	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 1/2	1 1/2	1	6	
12/30/2010	94	pavement	Dry	1	Light dry snow	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 1/2	1 1/2	6	350	a lot of replowing because of wind last several snow events light dry snow
1/5/2011	94	pavement	ice	25	compact/ice	1 1/2	1 1/2	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 1/2	1 1/2	7	250	ribbon compact through Medora
1/6/2011	16	pavement	ice	20	compact/ice	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	1 3/4	1 1/2	1 1/2	8	400	sacttered compact on all of 16 that is blowing across and sticking
1/7/2011	16	pavement	ice	23	compact/ice	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	7	250	scatterd ice from blowing and sticking the night before some areas just plowed half lane of snow the other half was dry
1/9/2011	94	pavement	dry	0	compact/ice	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/8	1 1/8	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	5	200	Cold a lot of blowing and drifting
		pavement	dry	-5	compact/ice	1 1/4	1 1/4	1 1/4	1 1/4	1 1/8	1 1/8	1 1/8	1 1/8	1 1/4	1 1/4	1 1/4	1 1/4	7	260	ribbon compact spent a lot of time going very slow not a lot of debth to plow a lot of clean up much time plowing with little snow
		pavement	dry	-5	compact/ice	1 1/4	1 1/4	1 1/4	1 1/4	1 1/8	1 1/8	1 1/8	1 1/8	1 1/4	1 1/4	1 1/4	1 1/4	7	300	ribbon compact drop by Russ Mitchell
1/11/2011		pavement	dry	5	compact/ice	1 1/4	1 1/4	1 1/4	1 1/4	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/4	1 1/4	1 1/4			
1/12/2011		pavement	dry	8	compact/ice	1 1/4	1 1/4	1 1/4	1 1/4	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/4	1 1/4	1 1/4			mostly ramp and Medora cleanup
1/13/2011		pavement	dry	10	compact/ice	1 1/4	1 1/4	1 1/4	1 1/4	1 1/8	1 1/8	1.16	1 1/8	1 1/8	1 1/4	1 1/4	1 1/4	5		mostly ramp and Medora cleanup
1/14/2011		pavement	dry	7	compact/ice	1 1/4	1 1/4	1 1/4	1 1/4	1 1/8	1.16	1.16	1 1/8	1 1/8	1 1/4	1 1/4	1 1/4	5		
1/15/2011		pavement	dry	5	compact/ice	1 1/4	1 1/4	1 1/4	1 1/8	1 1/8	1 1/8	1.16	1.16	1 1/8	1 1/8	1 1/4	1 1/4	5	170	
1/17/2011		pavement	ice	5	ice	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1.16	1.16	1.16	1 1/8	1 1/8	1 1/8	1 1/8	11	500	three days of plowing
18/19/20	94/16		wet		Light dry snow	1 1/8	1 1/8	1 1/8	1 1/8	1.16	1.16	1.16	1.16	1 1/8	1 1/8	1 1/8	1 1/8	27		three days of plowing
21/22/23/24	94/16	pavement	dry	20	heavy wet	1.16	1.16	1 1/8	1 1/8	1.16	1.16	1.16	1.16	1 1/8	1 1/8	1 1/8	1 1/8	43	lots	
29/30/31/		pavement	wet	20	heavy wet	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1 1/8	1 1/8	1 1/8	24	lots	
						1"	1"	1"	1"	1.16	1.16	1.16	1.16	1.16	1 1/8	1 1/8	1 1/8	19	300	
2/3/	94	pavement				1"	1"	1.16	1.16	1.16	1.16	1"	1"	1"	1"	1.16	1.16	8	100	
4/5/	16	pavement				1.16	1.16	1.16	1.16	1.16	1.16	1"	1"	1"	1"	1.16	1.16	9	100	
																Total		248	4822	

Cutting Edge Testing

Section ***Killdeer***
Edge Type ***Polar Flex***
Unit ***9440***
Install Date ***12/3/2010***
Edge Height
New ***2 1/2"***

						Cutting Edge Heights (inches)													
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Drivers Edge				Middle Edge				Passenger Edge				Hours Plowed	Miles Plowed	Observations
						Lt	Mid	Mid	Rt	Lt	Mid	Mid	Rt	Lt	Mid	Mid	Rt			
12/3/2010	200	Asphalt	dry		Scattered snow	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	3	60	
12/4/2010	200	Asphalt	dry		Scattered snow													4	60	
12/12/2010	8	Asphalt	dry		Scattered snow													2	40	
12/13/2010	200	Asphalt	dry		Scattered snow													2	60	
12/13/2010	8	Asphalt	dry		Scattered snow													1	40	
12/20/2010	200	Asphalt	dry	8	snow covered	2	2	2	2	1 7/8	1 7/8	1 7/8	1 7/8	115/16	115/16	2	2	6	120	
21 - 31-2010	200&8	Asphalt	dry		Scattered snow	1 3/4	113/16	113/16	113/16	111/16	1 5/8	1 5/8	1 5/8	113/16	113/16	1 3/4	1 3/4			Couple hours a day plowing drifts
1/9/2011	200	Asphalt	dry	9	snow covered													5	145	
1/10/2011	200	Asphalt	dry	9	snow covered													3	60	
1/10/2011	8	Asphalt	dry	9	snow covered													2	40	
1/14/2011	200	Asphalt	dry	12	Scattered snow													3.5	75	
1/14/2011	8	Asphalt	dry	12	Scattered snow													1.5	30	
1/15/2011	200	Asphalt	dry	10	snow covered	111/16	111/16	1 5/8	## ##	19/16	1 1/2	19/16	19/16	111/16	13/4	1 3/4	1 5/8	3	60	
1/15/2011	8	Asphalt	dry	10	snow covered													2	40	
1/24/2011	200	chip seal	dry	15-20	snow covered													4	80	
1/24/2011	200	Asphalt	dry	15-20	Scattered snow	1 5/8	1 5/8	1 1/2	1 3/8	17/16	17/16	1 1/2	19/16	19/16	15/8		19/16	3	20	
1/24/2011	8	Asphalt	dry	15-20	Scattered snow										111/16			1	10	
2/5/2011	200 & 22	Asphalt	dry		Scattered snow													7	230	
2/6/2011	22&200	Asphalt	dry		snow covered	1 5/8	1 5/8	1 1/2	1 3/8	17/16	17/16	1 1/2	19/16	19/16	15/8	111/16	19/16	9	300	

Total 62 1470

Cutting Edge Testing

Section *Richardton*
Edge Type *Polar Flex*
Unit *9923*
Install Date *12/21/2010*
Edge Height
New *2 1/2*

						Cutting Edge Heights (inches)													
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Drivers Edge				Middle Edge				Passenger Edge				Hours Plowed	Miles Plowed	Observations
						Lt	Mid	Mid	Rt	Lt	Mid	Mid	Rt	Lt	Mid	Mid	Rt			
12/23/2010	I94	concrete/asphalt	Dry	20	scattered snow	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	6	164	Very quiet cuts good
12/24/2010	I94	ncrete/asphalt	Dry	19	scattered snow													7	120	
12/26/2010	I94	concrete/asphalt	Dry	eighteen	scattered snow													6	230	
1/9/2011	I94	concrete/asph	Dry	-3	snow													5	270	
1/10/2011	I94	conc/asph	Dry	3	scattered snow	2 1/4	2 1/4	2 1/4	2 1/4	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 1/4	2 1/4	2 1/4	6	109	
1/14/2011	8	asph	Dry	0	scattered snow													2	148	
1/15/2011	8	asph	Dry	10	scattered snow													4	94	
1/16/2011	I94	conc/asph	Dry	16	scattered snow													1	35	
1/17/2011	I94	conc/asph	wet/dry	4	ice	2 1/16	2 1/16	2 1/16	2 1/16	2	2	2	2	2	2 1/16	2 1/16	2 1/16	3	108	quiet and cuts good
1/19/2011	I94&8	conc/asph	dry	-5	scattered snow													4	180	starting to show some wear
1/21/2011	8	asph	dry	26	scattered snow													5	150	
1/23/2011	I94	conc/asph	wet / Dry	23	snow/sluch													6	220	blowing and sticking snow
1/24/2011	I94&8	con/asph	dry/wet	30	snow/sluch													7	195	blowing and sticking snow
1/29/2011	I94&8	con/asph	wet/dry	22	scattered snow													5	247	
1/30/2011	I94&8	con/asph	dry	-5	scattered snow													3	89	plowing half the road with fluffy snow
1/31/2011	I94&8	con/asph	dry	-16	scattered snow													6	256	blowing light fluffy snow
2/1/2011	I94&8	con/asph	dry	-28	scattered snow	1 1/8	1 1/8	1 1/8	1 1/8		1		1	1	1 1/8	1 1/8	1 1/8	4	104	wearing fairly even
2/3/2011	I94&8	con/asph	dry	28	scattered snow													10	353	
2/4/2011	I94&8	con/asph	wet/dry	31	snow/sluch													5	175	
2/5/2011	I94&8	con/asph	wet/dry	33	snow/sluch													8	214	snow drifts/sluch
2/6/2011	I94&8	con/asph	dry	18	snow													11	380	continuous plowing
2/7/2011	I94&8	con/asph	dry/wet	-3	ice/sluch													5	186	showing some wear ends are curling up some
2/10/2011	8	asph	wet	21	snow/sluch													4	152	blowing and sticking snow
2/11/2011	I94&8	con/asph	wet	31	snow/sluch	1 1/16	1 1/16	1 1/16	1 1/16	1	1	1	1	1	1 1/16	1 1/16	1 1/16	3	125	blowing and sticking snow
2/20/2011	I94&8	con/asph	dry	-21	scattered snow													8	244	blowing snow
2/21/2011	I94&8	con/asph	dry	-11	scattered snow													4	102	
2/23/2011	I94&8	con/asph	wet	24	slush/snow													4	124	
3/6/2011	I 94	concrete	dry	15	ice	1	0.75	0.75	0.75	0.75	0.75	0.87	0.87	0.87	0.87	0.87	0.87	5	100	solid ice pasing lane scattered ice driving lane east bound scattered ice both lanes west bound Dickionson to Richardton
12-Mar-11	22	asphalt	wet	18	compact ice	1	0.75	0.75	0.75	0.75	0.75	0.87	.87.	0.87	0.87	0.87	0.87	1	20	solid compact in the morning going north on 22 did not plow on the way home in the afternoon
12-Mar-11	200	asphalt	wet	35	compact ice	1	0.75	0.75	0.75	0.75	0.75	0.87	0.87	0.87	0.87	0.87	0.87	4	84	solid compact ice from hwy. 85 to Haliday plowed all the way made ice thin and road went to all wet in no time . I think that these edges are quiteter than the jomas by about 1/4 you really have to watch to see if the plow is really on the ground I don' think that clean any better .
22 march 2011	22	asphalt	wet	32	scattered snow													1	20	1st rnd. Not much snow yet did very little plowing appling saltwater
22-Mar-11	22	asphalt	wet	32	solid snow covered													3	46	snow covered wet underneath good plowing
		asphalt	wet	31	solid compact													3	46	mid storm plow down al the way from Dickinson to Maninning
22-Mar-11	22	asphalt	wet	28	solid compact													3	40	temp dropped and froze back
22-Mar-11	22	asphalt	wet	26	snow covered													2	46	1st round in the morning after the storm windy cold

Cutting Edge Testing

Section ***Richardton***
Edge Type ***Polar Flex***
Unit ***9923***
Install Date ***12/21/2010***
Edge Height
New ***2 1/2***

						Cutting Edge Heights (inches)														
						Drivers Edge				Middle Edge				Passenger Edge				Hours	Miles	
Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Lt	Mid	Mid	Rt	Lt	Mid	Mid	Rt	Lt	Mid	Mid	Rt	Plowed	Plowed	Observations
23-Mar-11	I 94	concrete	wet	24	snow covered													5	60	wide shoulders and loops and ramps
22-Mar	22	asphalt	wet	40	scattered slush	1	0.75	0.75	0.75	0.75	0.75	..81	0.81	0.81	0.81	0.87	0.87	3	50	scattered slush and compact plowing and scraping to get road back to good
3/28/2011	94&8	con/asph	wet	28	blowing sticking													5	250	compact and slush
3/29/2011	94&8	con/asph	wet	41	blowing sticking													2	180	slush
																	Total	179	5716	

Cutting Edge Testing

Section *Hettinger*
Edge Type *Stacked*
Unit *9623*
Install Date *12/6/2010*
Edge Height New *8.5"*

Date	Hwy	Surface Type	Surface Wet or Dry?	Surface Temp	Surface Conditions	Cutting Edge Heights (inches)									Hours Plowed	Miles Plowed	Observations
						Drivers Edge			Middle Edge			Passenger Edge					
						Lt	Mid	Rt	Lt	Mid	Rt	Lt	Mid	Rt			
12/23/2010	12	slurry seal	Dry	18	Snowdrifts	83/8"	83/8"	83/8"	83/8"	83/8"	83/8"	83/8"	83/8"	83/8"	7	210	They seemed to clean the road a little better than traditional edges.
12/23/2010	22	chip seal	Dry	18	Snowdrifts	83/8"	83/8"	83/8"	83/8"	83/8"	83/8"	83/8"	83/8"	83/8"	3	90	They seemed to clean road a little better than traditional edges.
12/28/10 - 01/02/11	12	slurry seal	dry	15-30	snowdrifts	8"	8"	8"	8"	8"	8"	8"	8"	8"	18	540	
12/28/10 - 01/02/11	22	chip seal	dry	15-30	snowdrifts	8"	8"	8"	8"	8"	8"	8"	8"	8"	8	240	
1/9/2011	12	slurry seal	dry	10	snowcovered	8"	8"	8"	8"	8"	8"	8"	8"	8"	5	150	Roadway had a 6" snowcover
1/9/2011	22	chip seal	dry	10	snowcovered	8"	8"	8"	8"	8"	8"	8"	8"	8"	2	60	Roadway had a 6" snowcover
01/14/2011-01/26/2011	12	slurry seal	dry	15-30	compact snow	6"	6"	6"	6"	6"	6"	6"	6"	6"	55	1650	01/26/11- Stacked edge was changed at 3655 hrs.
01/14/2011-01/26/2011	22	chip seal	Dry	15-30	compact snow	6"	6"	6"	6"	6"	6"	6"	6"	6"	27	810	01/26/11- Stacked edge was changed at 3655 hrs.
01/29/11-02/07/11	12	slurry seal	Dry	15-30	compact snow	8.5"	8.5"	8.5"	8.5"	8.5"	8.5"	8.5"	8.5"	8.5"	45	1350	
01/29/11-02/07/11	22	chip seal	Dry	15-30	compact snow	8.5"	8.5"	8.5"	8.5"	8.5"	8.5"	8.5"	8.5"	8.5"	15	450	
														Total	185	5550	

Appendix E: Survey Form

NDDOT Snow Plow Cutting Edge Evaluation

Winter 2010-2011

The NDDOT is conducting an objective evaluation of snow plow cutting edges to determine if efficiency and cost benefits in snow and ice removal could be derived from these devices. **The objective of this study is to compare the various cutting edges to the traditional carbide cutting edge.** The data you provide will be used to evaluate this equipment in the areas of:

1. Performance of Equipment
2. Transportation Technician Experience
3. Maintenance by Transportation Technician and/or Shop

Instructions:

This form is designed to be completed at the completion of each plowing activity involving the *cutting edge*. The information you provide will be used in a report to NDDOT Executive Management on the performance and cost effectiveness of cutting edges to the Department's snow and ice removal equipment. It is important that you provide as much detail as possible.

The form is divided into three parts:

> **PART I** – Completed by Transportation Technician and/or Supervisor and should include information relating to this activity.
>
> **PART II** – Completed by the Transportation Technicians and should include comments from any personnel involved with the operation or observation of the *cutting edge* during that event. Information should be recorded as close to the time of the event as possible.
>
> **PART III** – Completed by the Maintenance Supervisor and should include comments from technicians or shop mechanics as they relate to scheduled or unscheduled equipment maintenance activities. Information should be recorded as close to the time of the event as possible.

PART I: DESCRIPTION OF SNOW REMOVAL OR DEICING ACTIVITY:

Unit Number: _____

Date: _____ Location: _____

(highway.mile from - to)

Pavement Surface Type*: Concrete, Asphalt/ no surface treatment, Chip Seal, Micro-surface, Slurry Seal – (Please Circle One)*

Cutting Edge Type: _____

Name of Transportation Technician: _____

Name of Maintenance Supervisor: _____

PART II: TRANSPORTATION TECHNICIAN PROVIDED INFORMATION

1. Performance of Equipment:

a) ***Snow Removal:*** *How effective was the cutting edge in moving and clearing the snow as compared to a traditional carbide cutting edge? (how clean was the roadway, etc.)*

Worse than				Same as				Better than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____
_____
_____
_____

2. Transportation Technician Experience:

a) ***Noise Level in the Cab:*** *Rate the noise level in the cab as compared to the traditional carbide cutting edge.*

Quieter than				Same as				Noisier than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____
_____
_____
_____

b) ***Vibrations in the Cab:*** *Rate the vibration in the cab as compared to the traditional carbide cutting edge.*

Worse than				Same as				Better than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____
_____
_____
_____

c) ***Cutting Edge Odors in the Cab****: If there is an odor in the cab from the cutting edge, rate the smell as compared to the traditional carbide cutting edge.*

Less than				Same as				More than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____
_____
_____
_____

PART III: MAINTENANCE SUPERVISOR PROVIDED INFORMATION

Name of Maintenance Supervisor: _____

Maintenance by Transportation Technician and/or Shop

a) ***Installation:***

i. *Rate the effectiveness of the installation instructions for the cutting edge as compared to the traditional carbide cutting edge.*

Worse than				Same as				Better than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____
_____
_____
_____

ii. *Rate the effort required to install the cutting edge as compared to the traditional carbide cutting edge.*

Worse than				Same as				Better than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Staff Hours Requires? _____

Comments:_____
_____
_____
_____

b) ***Replacement:***

i. *What was the reason for the cutting edge replacement? What was its condition?*

Comments:_____
_____
_____
_____

ii. *What parts were replaced? What was the cost?*

Part:_____ Cost: _____
Part:_____ Cost: _____
Part:_____ Cost: _____
Part:_____ Cost: _____
Part:_____ Cost: _____
Part:_____ Cost: _____

iii. Rate the effort required for the replacement of the cutting edge as compared to the traditional carbide cutting edge?

Worse than				Same as				Better than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Staff Hours Required? _____

Equipment Downtime Hours? _____

Comments:_____
_____
_____
_____

c) ***Technical Support:***

i. Rate the quality of the manufacturer's response to questions as compared to those from the manufacturer of the traditional carbide cutting edge.

Worse than				Same as				Better than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____
_____
_____
_____

ii. Rate the effort required when ordering replacement parts as compared to ordering replacement parts from the manufacturer of the traditional carbide cutting edge?

Worse than				Same as				Better than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____
_____
_____
_____

iii. Rate the availability of replacement parts for the cutting edge as compared to the availability of parts from the manufacturer of the traditional carbide cutting edge?

Worse than				Same as				Better than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____
_____
_____
_____