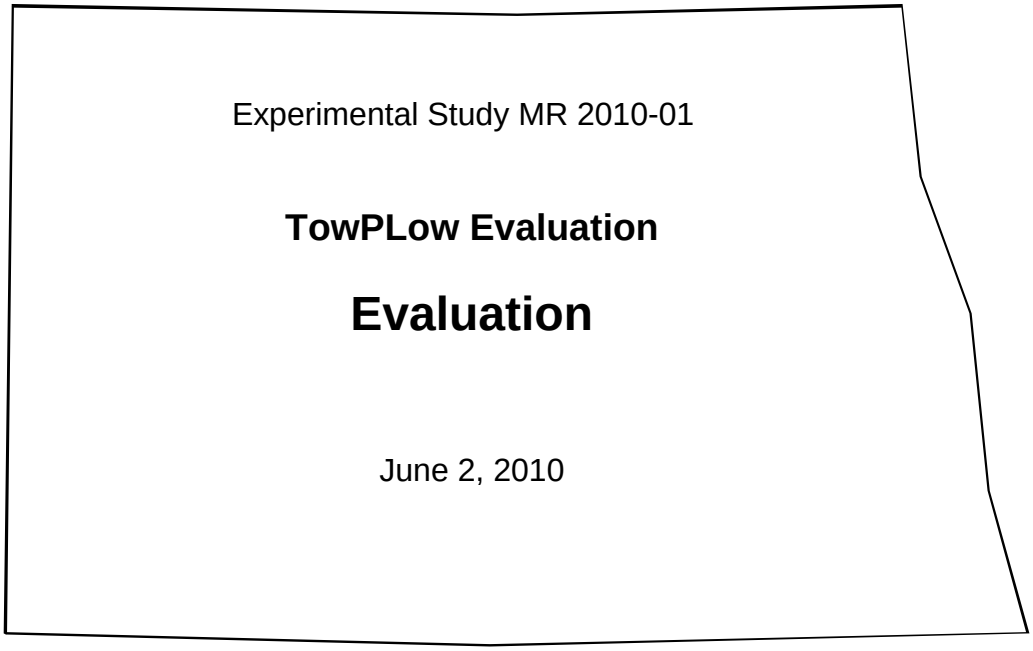
NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

MATERIALS AND RESEARCH DIVISION



Experimental Study MR 2010-01

TowPLow Evaluation

Evaluation

June 2, 2010

Prepared by

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
BISMARCK, NORTH DAKOTA
www.dot.nd.gov

DIRECTOR
Francis G. Ziegler, P.E.

MATERIALS AND RESEARCH DIVISION
Ron Horner, P.E.

Experimental Study MR 2010-01

TowPLow Evaluation

Evaluation

June 2, 2010

Written by
Kyle Evert

Disclaimer

The contents of this report reflect the views of the author or authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not reflect the official views of the North Dakota Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, Specification, or regulation.

TABLE OF CONTENTS

Work Plan
TowPLow Evaluation
MR 2010-01

Purpose and Need

As a northern state, North Dakota receives a significant amount of snowfall. The NDDOT is tasked with maintaining the roadways during snow events to allow safe travel for the public. As lanes are added to increase the capacity of roadways; there is a need to improve the effectiveness and efficiency of snow removal operations.

The Viking-Cives Midwest, Inc. TowPLow is an option to increase the efficiency of a snow plow truck. The TowPLow is a towable trailer and operates similar to a side wing on a snow plow truck. Photos of the TowPLow can be seen in Appendix A. The blade of the TowPLow is hydraulically controlled. When fully deployed, it can expand the clearing width of the snow plow truck to 25 feet. The snow plow truck with TowPLow can remove two lanes of snow. An optional tank for liquids or a hopper for granular material can be added to the TowPLow to allow for deicing of roadways. The addition of a TowPLow to a snow plow truck allows it to clear more snow from the roadway than a standard snow plow truck.

Objective

The objective is to evaluate the resources and operating skills required to operate a Viking-Cives Midwest, Inc. TowPLow. The general effectiveness and efficiency of the TowPLow will be evaluated based on operator and maintenance worker experiences. The TowPLow operator will complete a survey following a snow event in which the TowPLow was used. This survey can be found in Appendix B. Following the winter (snow removal season) the survey results will be compiled for a performance evaluation. The evaluation period will be one full snow removal season.

Scope

The Fargo district received a TowPLow in December of 2009 and the Bismarck District received a TowPLow in April of 2009. The Materials and Research Division and Maintenance Division have composed a survey for the snow plow operators to complete after using the TowPLow during a snow event. The survey consists of questions regarding the fuel, maintenance, and deicing requirements. There are also questions that involve the operator's opinions of how well the TowPLow works and the user friendliness of the TowPLow. The results from the survey will be used to determine the resources and skills required to operate and maintain the TowPLow.

Location

One TowPLow will be used in the Fargo district on rural and urban roads near the city of Fargo. The other TowPLow will be used in the Bismarck District on rural and urban roads near the city of Bismarck.

Evaluation

During the 2009-2010 winters, the TowPLow was sent away to be retrofitted with a tank to carry deicing fluids. The work was not completed until later in the 2009-2010 winter, consequently the TowPLow was not available for snow and ice removal activities. However upon its return, District personnel used the device for training activities. An interview with the TowPLow operator Steve Cowley was conducted on March 2, 2010. The operator's comments listed below relate to his experiences training in the operation of the TowPLow, and lessons learned during the connection of the TowPLow to the snow plow truck:

Performance

Pros

- With TowPLow and plow mounted truck, 25' 3" of snow can be cleared.
- Deicing system can spray 3 lanes at one time.
- Cuts compacted snow well.

Operations

Pros

- Laser guide works well in dark.
- Can adjust how fast TowPLow swings with hydraulic adjustments.
- Startup time for TowPLow takes an additional 5 minutes longer than regular truck.

Cons

- Dump on truck hits tongue of TowPLow when raised. A radius dump would work better with sand distribution.
- Mechanical jack has difficulty lifting TowPLow with tank filled with deicing liquid, hydraulic jacks are needed when tank is full.
- Controls – operator can operate only one function at a time.
- Laser guide tough to see on sunny day.

Maintenance

Pros

- Pumps used by the deicing system had easy access for maintenance and repairs.
- Missouri DOT claims tires last 3-5 years

Cons

- Flexible hoses near hitch on truck are located in poor location. Hoses were stressed with sharp turns, causing them to break.
- Hydraulic valves required restructuring to have the truck work with TowPLow. Operator said this could be corrected when ordering TowPLow and truck.

Appendix A

Photo 1 - An overview of TowPLow attached to vehicle

Photo 2 - Blue and red hoses broke during turning motions,

Photo 3 – Hydraulic valves required restructuring to have truck work with TowPLow.

Photo 4 – Tongue of TowPLow attached to truck

Photo 5 – Controls used to operate the truck and TowPLow.

Photo 6 – Photo is displaying deicing spray bar on the rear of TowPLow.

Photo 7 – Photo is displaying deicing bar for adjacent lanes of roadway.

Photo 8 – Mechanical jack for the TowPLow.

Photo 9 – Photo of the TowPLow fully deployed.

Photo 10 – Photo of TowPLow wheels rotated when fully deployed.

Appendix B

NDDOT Tow Plow Evaluation

Winter 2009-2010

The NDDOT is conducting an objective evaluation of the *Tow Plow* to determine if benefits could in snow and ice removal could be derived from this device. **The data being collected will be used to compare the *Tow Plow* to current snow and ice removal equipment.** The data you provide will be used to evaluate this equipment in the areas of:

1. **Performance of equipment**
   a) effectiveness of snow removal activities
      i. mainline
      ii. ramps/interchanges
      iii. shoulders and guardrails
   b) effectiveness of deicing activities
   c) impact of speed on performance
      i. clearing snow
      ii. deicing

2. **Operation of equipment**
   a) operator controls,
   b) equipment operation
   c) maneuverability
      i. mainline
      ii. ramps/interchanges
      iii. bridges
   d) training requirements
   e) experience/time required to become proficient

3. **Safety of operator and public**
   a) generation of snow fog
   b) visibility of *Tow Plow*
      i. by Operator
      ii. by Public
   c) effectiveness of warning and hazard lights

4. **Maintenance by operator and shop**
   a) availability and effectiveness of vendor support
   b) recommended maintenance activities
      i. frequency and types
      ii. availability of replacement parts
      iii. costs of parts and labor
      iv. out-of-service or downtime
   c) non-scheduled repair activities
      i. frequency and types
      ii. availability of replacement parts
      iii. costs of parts and labor
      iv. out-of service or downtime

5. **Cost Benefit Comparison – study of time and efficiency**
   a) compare *Tow Plow* to single truck and gang plow operations
      i. hours of operation during a snow and ice event
      ii. fuel consumption
      iii. cost of operator labor

Instructions:
This form is designed to be completed at the completion of each snow removal and/or deicing activity involving the *Tow Plow*. The information you provide will be used in a report to NDDOT Executive Management on the performance and cost effectiveness of adding Tow Plows 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 Operator and/or Supervisor and should include the environmental and equipment information as it relates to the snow removal or deicing activity
>
> **PART II** – Completed by the Equipment Operator and should include comments from any personnel involved with the operation or observation of the *Tow Plow* 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 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:

Date: _____ Location: _____
(highway.mile, interchange, bridge)

Type of Activity: snow removal, deicing,
(circle all that apply)

Weather Conditions:

- Precipitation Type: frost, freezing rain, sleet, snow
  (circle all that apply)
- Rate of Snow Fall: _____
- Accumulation: _____
- Temperature: _____
- Wind Speed: _____
- Visibility: _____

Start Time of Activity _____ Stop Time of Activity _____

Gallons of Fuel Consumed: _____ Total Miles for Activity: _____

Name of Operator: _____

Name of Observer: _____

PART II: EQUIPMENT OPERATOR PROVIDED INFORMATION

1. Performance of Equipment

a) SNOW REMOVAL: How effective was the Tow Plow in <u>moving and clearing the snow</u> as compared to a snow plow with wing? (how clean was the roadway, how far did it push the snow, etc.)

<u>Mainline & Shoulders:</u>

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

Comments: _____

_____

_____

_____

<u>Ramps/Interchanges:</u>

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

Comments: _____

_____

_____

_____

<u>Bridges & Guardrails:</u>

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

Comments: _____

_____

_____

_____

b) *DEICING: How effective was the Tow Plow in <u>applying deicing treatments</u> as compared to the current deicing equipment being used? (how evenly does it distribute, does it cover the required area, etc.)*

<u>Mainline & Shoulders:</u>

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

Comments:_____

_____

_____

_____

<u>Ramps/Interchanges:</u>

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

Comments:_____

_____

_____

_____

<u>Bridges & Guardrails:</u>

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

Comments:_____

_____

_____

_____

c) *SPEED of OPERATION:*

i. *How did the speed you traveled with the Tow Plow to move and clear snow compare to a snow plow with wing?*

Mainline & Shoulders:

Slower than				Same as				Faster than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____

_____

_____

_____

Ramps/Interchanges:

Slower than				Same as				Faster than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____

_____

_____

_____

Bridges & Guardrails:

Slower than				Same as				Faster than
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____

_____

_____

_____

ii. How did the speed you traveled with the Tow Plow when <u>applying deicing treatments</u> compare to current deicing equipment being used?

<u>Mainline & Shoulders:</u>

Slower than				Same as			Faster than	
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____

_____

_____

_____

<u>Ramps/Interchanges:</u>

Slower than				Same as			Faster than	
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____

_____

_____

_____

<u>Bridges & Guardrails:</u>

Slower than				Same as			Faster than	
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____

_____

_____

_____

2. Operation of Equipment

a) OPERATOR CONTROLS: How "user friendly" are the Tow Plow <u>operator controls</u> as compared to a snow plow with wing? (location to operator, control identification, visibility and lighting, responsiveness, etc.)

Less friendly — Same as — More friendly

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

Comments:_____

_____

_____

_____

b) EQUIPMENT FUNCTIONALITY: How effectively do the various Tow Plow systems function as compared to current snow plow/deicing equipment? (hydraulics, blades, spray nozzles, etc. Please provide details in the comments)

Worse than — Same as — Better than

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

Comments:_____

_____

_____

_____

c) MANEUVERABILITY:

i. Describe the maneuverability of the Tow Plow as compared to the <u>current snow plow with wing</u>.

<u>Mainline & Shoulders:</u>

Worse than — Same as — Better than

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

Comments:_____

_____

_____

_____

<u>Ramps/Interchanges:</u>

Worse than — Same as — Better than

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

Comments:_____

_____

_____

_____

Bridges & Guardrails:

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

Comments:_____

_____

_____

_____

ii. Describe the maneuverability of the Tow Plow as compared to the <u>current deicing equipment</u>.

Mainline & Shoulders:

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

Comments:_____

_____

_____

_____

Ramps/Interchanges:

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

Comments:_____

_____

_____

_____

Bridges & Guardrails:

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

Comments:_____

_____

_____

_____

d) *TRAINING REQUIREMENTS: In terms of <u>time</u>, how much <u>operator training</u> will the Tow Plow require, as compared to operator for current snow plow with wing / deicing equipment?*

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

Comments:_____

_____

_____

_____

e) *OPERATOR PROFICIENCY: In terms of <u>time</u>, how much <u>operator experience</u> will the Tow Plow operator require to become proficient, as compared to the time to become proficient on current snow plow with wing / deicing equipment*

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

Comments:_____

_____

_____

_____

3. Safety of Operator and Public

a) SNOW FOG: How does the generation of snow fog by the Tow Plow compared to a snow plow with wing? (as observed by Tow Plow Operator or shadow vehicle)

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

Comments:_____

_____

_____

_____

b) VISIBILITY of TOW PLOW:

i. The Operator's visibility of the Tow Plow when deployed is :

Poor				OK				Excellent
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____

_____

_____

_____

ii. The Public's visibility of the Tow Plow when deployed is (vehicles following the Tow Plow):

Poor				OK				Excellent
☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9

Comments:_____

_____

_____

_____

c) WARNING AND HAZARD LIGHTS: How effective are the warning and hazard lights as compared to a snow plow with wing/ deicing equipment?

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

Comments:_____

_____

_____

_____

Name of Maintenance Supervisor: _____

PART III: MAINTENANCE SUPERVISOR PROVIDED INFORMATION

4. Maintenance by Operator and Shop

a) PRODUCT SUPPORT: How does the availability and effectiveness of Tow Plow product (vendor) support compare to current snow plow with wing / deicing equipment?

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

Comments:_____
_____
_____
_____

b) SCHEDULED MAINTENANCE ACTIVITIES: How does the Tow Plow compare to current snow plow with wing / deicing equipment, in terms of:

	Tow Plow	*Snow Plow with Wing*	*Deicing Equipment*
Maintenance Type			
Frequency			
Availability of Parts			
Cost in Dollars – parts & labor			
Time to Complete – (out-of-service)			

c) *NON-SCHEDULED REPAIR ACTIVITIES: How does the Tow Plow compare to current snow plow with wing / deicing equipment, in terms of:*

	Tow Plow	*Snow Plow with Wing*	*Deicing Equipment*
Maintenance Type			
Frequency			
Availability of Parts			
Cost in Dollars – parts & labor			
Time to Repair – (out-of-service)			

5. Cost Benefit Study

a) *TIME and EFFICIENCY: Compare the Tow Plow to single snow plow with wing and Gang Plow?*

	Tow Plow	*Single Truck with Wing*	*Gang Plow*
Hours of Operation			
Fuel Consumption			
Cost of Operator Labor			
Cost of Maintenance			
Time to Complete – (out-of-service)			

b) TIME and EFFICIENCY: Compare the Tow Plow to single snow plow with wing and Gang Plow?

	Tow Plow	*Single Truck Wing*	*Gang Plow*
Hours of Operation			
Fuel Consumption			
Cost of Operator Labor			
Cost of Maintenance			
Time to Complete – (out-of-service)			