A Survey on the Current Practices in Clearing Various Interchange and Intersection Configurations

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ABSTRACT
Interchanges and intersections are the most complex part in a roadway network and are very challenging for snow plowing operators. Currently, no detailed practice manuals are available for clearing interchanges and intersections. To address the needs for practical winter maintenance operations, ClearRoads initiated a research project to develop a training video based on the best practices for snow removal and ice control on interchange and intersection layouts. As part of the project, a survey study was conducted to gather information on the current practices of agencies in the U.S. on clearing ten types of interchange and intersection layouts. This paper presents the survey results and findings. The findings indicate that single and tandem-axle trucks with front plows are the commonly used by agencies. Tow plows were reported to be successful in clearing diverging diamond interchanges and directional T interchanges, but have limitations in clearing roundabouts. Diagram depicting example plowing patterns were provided for comments from survey respondents. The majority of the respondents accepted the examples, therefore, they will be considered as the best practices to be included in the training video. Although the best practice example for each interchange/intersection is different, some general rules were summarized from the survey findings: e.g. avoid plowing snow into highly elevated side to mitigate melting and freezing of snow across the road and square the plow at intersections and overpasses to avoid dragging snow onto already cleared lanes.

Keywords: Snow Plowing, Interchange, Intersection, Survey, Plowing Pattern, and Plow Configuration, Snow Plow Truck
1 Introduction

Winter weather operations, or snow and ice control, consists of two fundamental activities: plowing snow off the roadway and applying various materials for anti/de-icing and traction improvement. Both approaches, whether performed as plow-only, spread-only, or simultaneously (plow-and-spread) require trucks of various sizes and equipage. The travel patterns for the trucks operating in these different modes are influenced by a number of factors such as: roadway classification, priority ranking, defined Level of Service (LOS), number of lanes and shoulders, lane widths, route length and cycle time parameters, bridges and overpasses, topography, pavement types, traffic volumes, roadway geometrics, traffic control systems and restrictions, presence of railway tracks and crossings, transit stops, etc.

Every agency (municipal, county, tribal, state, provincial, special district) divides its road and street system into routes. Most arterial routes have a number of intersections, median breaks, pull-outs, dedicated turn lanes, etc. Innovative configurations such as Continuous Flow Intersections (CFI), roundabouts, “jug-handles” and Michigan Lefts are wonderful for reducing traffic congestion and collisions, but make the work of plow truck operators a lot more complicated. Likewise, limited - access highways have interchanges of different configurations, such as full and half diamond, diverging diamond, cloverleaf, single point urban interchange, extended on-off ramps, stacks and fly-overs, and “Texas turn-arounds.” Additionally, freeways have median crossovers, safety pull-outs, and rest area parking lots that need to be plowed and turnpikes must deal with toll plazas and service islands as well. All these configurations add complexity to determining route patterns.

Compounding the problem is the composition of an agency’s vehicle fleet; single-axle and tandem-axle dump trucks fitted with front plows and material spreader beds are most common. However, some agencies have trucks with only plows and some with only spreader bodies (sometimes referred to as “sandbodies”). A number of agencies use other vehicles such as road graders, front-end loaders, skid-steer loaders, and even sanitation trucks fitted with plows (Milwaukee, WI and NYC). Smaller trucks ranging from ½ ton to 1-ton pickups with plows and/or spreaders are often used. Larger trucks can also be fitted with wing-plows (right or left sides or even both) and underbelly plows. Tow-plows are relatively new and gaining wider use primarily with echelon plowing on multi-lane expressways. "V" plows on construction equipment and snow-blower attachments are used in areas with heavy snows. The type, size, and number of plows and blades on each truck are factors that influence route configurations.

Though there are standard guidelines for plowing and spreading, detailed practice manuals are needed for clearing interchanges and intersections due to the complexity of various configurations. Route planners and managers develop a recommended pattern of travel, but operators need latitude for adjusting to external conditions and the capabilities of their equipment. Individual operators who are familiar with assigned routes develop their own techniques for handling intersections, interchanges, roundabouts, cul-de-sacs, crossovers, and other challenging situations. The current traffic, pavement, and storm conditions may necessitate temporary deviation from prescribed routing.
Because a manual for clearing interchange/intersections is lacking, Clear Roads initiated a research project to address the needs for practical winter maintenance operations. The goal of this project is to provide comprehensive, clear, and concise training materials (videos, manual, and reference cards) based on best practices for snow removal and ice control on interchange and intersection layouts that are applicable for agencies of any size and in all regions of the U.S. and Canada. As part of the project, a survey study was conducted to gather information on the current best practices and techniques in clearing different interchange and intersection configurations as well as agencies’ needs and expectations on the training video that Clear Roads is now developing. This paper summarizes the survey study results.

Identifying the best practices in clearing various interchange and intersection layouts can aid in designing and modifying routes for improved efficiency and effectiveness. This information can also be used to support requests for new technology, more vehicles with enhanced capabilities, additional personnel or contractors, expanded training and better material selection. It can also convey to agency executives, elected officials, and the public the need for changes in Levels of Service, route configurations, and priorities.

2 Literature Review

Snow plowing problems have not been widely addressed in the literature. It can be attributed to the complexity of the problems and the fact that the problems are often site-specific and numerous operational constraints have to be taken into account. Some literature has been found on plowing route optimization that mostly focuses on the general roadway network; very few, if any, specifically on clearing complex interchanges and intersections. This section presents the literature review of recent research on related topics.

Over the past over 40 years, an impressive array of models and algorithms have been developed to integrate snow plowing operational constraints into the optimization procedure. Quirion-Blais et al. (2014) developed an adaptive large neighborhood search metaheuristic to design the snow plowing and salt spreading routes in a hybrid rural and urban network. Operational constraints include turn restrictions, network hierarchy, and equipment availability.

Similarly, Liu et al. (2014) proposed a MA-CARP algorithm to solve the Capacitated Arc Routing problem (CARP) through minimizing the total distance traveled by a fleet of vehicles. It is a memetic algorithm embedded with a similarity based parent selection scheme. According to the authors, roadway network size and complexity don’t affect the algorithm performance, which can be used for networks with multiple lanes, one-way/two-way roads and varying degree of connectedness. Other recent work on snow plow route optimization models and algorithm can be found in Perrier et al. (2008), Holmberg (2014), Fu et al. (2009), Perrier et al. (2006), Soler et al. (2008), Jang et al. (2011), Campbell et al. (2001), etc.

Besides mathematical models and algorithms, many agencies use available geographic and positioning systems to solve snow plow route problems. Allen (2006) outlines the public works
applications of Geographic Information Systems (GIS) specifically in terms of route
optimization and automatic vehicle location (AVL). The GIS optimizes plowing routes based on
the real-time depiction of the fleet obtained from GPS. This optimization is designed to
minimize plowing time. The Ohio Department of Transportation (ODOT) recently employed a
snow plowing route optimization model developed in a GIS based program (Holik et al. 2014).
The model is validated using global positioning system (GPS) units placed in several snowplow
trucks.

Based on route optimization algorithms and models, many Commercial Off-The-Shelf
(COTS) software applications have been developed and used by agencies to configure snow
plowing routes. For instance, GIRO developed GeoRoute software for route optimization of
snow plowing, material spreading, and snowblowing. It accommodates service time windows,
service frequency, vehicle capacities, spreading rates, turn restrictions, street segment
dependencies, and both-sides service restrictions. GeoRoute has been used in Ottawa, Lavela,
Charlesbourg, and Pepean, Canada for snowplowing; Suffolk County, UK for salt spreading
(Perrier et al. 2007).

Another example is FleetRoute™ developed by CIVIX L.L.C., which has many
applications including snowplow routing. This software considers many operating constraints,
can update the routes as required; and utilizes ArcGIS technology for its interface and mapping
platform. It has been used in Canada, England, Northern Ireland, Portugal, Scotland, U.S.A,
Wales (FleetRoute™, 2016).

The literature review results show that most of the literature on the snow plow routing
focuses on optimization of entire roadway networks. To the best knowledge of the authors, no
research, studies, or summary of practices are reported in the open literature specifically on how
to clear various interchanges and intersections. These layouts are the most complex parts of
roadway networks and very challenging for snow plow operators. Guidelines on vehicles, plow
configurations, and techniques used for clearing various interchanges and intersections are
needed. However, due to the small scale and complexity of various interchange/intersection
layouts, optimization models and algorithms are not feasible and practical. Thus, a practitioner
survey was conducted to identify the best practices by various agencies. This information will
then be used to develop guidelines and training material for snow plow operators.

3 Methodology

The survey, using the online tool Survey Monkey, gathered information on the current best
practices and techniques in clearing different interchanges and intersections configurations as
well as agencies’ needs and expectations on the training video for Clear Roads. Given the large
variety of interchange/intersection layouts, the survey focused on ten typical configurations:
Roundabout Intersections, Four-leg Intersections, Displaced Left Turn Intersection, Median U-
turn Intersections, Roundabout Interchanges, Single Point Interchanges, Diverging Diamond
Interchanges, Cloverleaf Interchanges with C/D Lanes, Diamond Interchanges, and Directional T Interchanges.

The survey questionnaire gathered:
1) Respondents’ information;
2) Current practice (types of vehicle/equipment used and plowing patterns for each type of interchange/intersection)
3) Comments and suggestion for the training video to be developed.

Given the difficulty to collect plowing pattern through the regular survey questions format, an innovative approach was developed by the research team and the project committee. Based on the experience of the research team and project committee, an example of plowing pattern for each configuration was plotted in a diagram. Those examples were provided to the survey respondents for their comments. Blank diagrams were provided so that the respondents could illustrate if they used different methods for any of the ten configurations. In order to distinctly show multiple passes and trucks in those plowing patterns, individual truck numbers, pass numbers, and plow configurations were depicted as shown in Figure 1 (a). Figure 1 (b) presents two different models for a typical pass, with 11’ clear width for a front plow only and 14’ for a front plow and a wing plow.

![Figure 1](image_url)

Figure 1 Truck and Pass Number Indication and Snow Plowing Widths

The example snow plowing patterns were developed based on the current practices from research team and project committee member’s agencies and were agreed by the team and committee. The intention of the survey is to gather respondents’ opinions on those example plowing patterns and other tips/considerations for clearing each configuration. If a large majority of the survey respondents accepts the example plowing patterns, then those plans will be considered as the best practices. If not, new best practice plowing patterns will be developed based on respondents’ comments. The identified best practice provides a commonly accepted approach to clear each layout, but it doesn’t mean agencies have to use the same vehicle, plow configuration, and plowing pattern as shown in the best practices. Often times, the number/types of trucks and plow configurations used as well as where to push/store snow depend on specific situations and agencies’ policies. But the plowing patterns, vehicle/equipment,
tips/considerations presented in the best practices will provide guidelines for agencies to achieve
safe and efficient operations in clearing various interchanges and intersections.

The survey was distributed among Clear Roads member states and the Snow and Ice
Listserv on March 22, 2016. Reminder emails were sent on April 15, 2016 to get more
responses. Follow up emails were sent to collect missing information of some responses. The
survey was closed on April 27.

4 Results and Discussion

A total of 76 respondents from 21 states within the U.S. participated in the survey. Those
respondents are mainly from state/province DOT (89.4%); others include municipal public works
(5.9%), federal agencies (1.3%), and tribal and territorial agencies (1.3%), as well as a former
DOT employee and a current employee from Detroit metropolitan airport.

This section presents the survey results in regard to the current practices (vehicle/equipment
and plowing patterns). Due to the number of words constraint for TRB papers, seven typical
intersection and interchange layouts were selected from the ten configurations in the survey and
their results were compile in the following subsections.

4.1 Vehicle and Equipment

Table 1 shows the various vehicle/equipment and plow configurations used by respondents’
agencies to clear snow and ice for any of the ten interchange/intersection types within their
respective jurisdiction. Front plow only was the most commonly used configuration followed by
front plow with right wing and then front plow with left wing. An underbody plow with left
wing and front plow with tow-plow were used by a few agencies. Front plow with both left and
right wing plows, underbody plow with tow-plow, and underbody plow with left and right wing
plows were rarely used by agencies. Interestingly, none of the agencies used underbody plow
with blower.

As to type of vehicle/equipment used, tandem-axle dump and single-axle dump trucks are
the most common. Moreover, 1 ton dumps, graders, front-end loaders, and snow blowers were
also used by some agencies. Other vehicle/equipment types such as triple-axle dumps, 1/2 and
3/4 ton pickups, flatbed trucks, back-hoe loaders, skid-steers and tractor, all with plows, were
used by only a few agencies. Some additional vehicle/equipment configurations mentioned by
respondents include front end loaders with bucket and front plow with underbody blade.
Table 1  Various Vehicle/equipment used by agencies to clear snow and ice (number of responses)

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Front plow</th>
<th>Front plow with right wing</th>
<th>Front plow with left wing</th>
<th>Front plow with tow-plow</th>
<th>Front with left and right wing deployed</th>
<th>Underbody plow with left wing</th>
<th>Underbody plow with tow-plow</th>
<th>Underbody plow with left and right wing deployed</th>
<th>Underbody plow with blower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-axle dump</td>
<td>41</td>
<td>40</td>
<td>32</td>
<td>2</td>
<td>4</td>
<td>26</td>
<td>1</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Tandem axle dump</td>
<td>45</td>
<td>48</td>
<td>33</td>
<td>19</td>
<td>8</td>
<td>22</td>
<td>11</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Triple-axle dump</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1 ton dump</td>
<td>20</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1/2 and 3/4 ton pickup</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flatbed trucks</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Graders</td>
<td>14</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Front-end loaders</td>
<td>25</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Back-hoe loaders</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Skid-steers</td>
<td>13</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
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<tr>
<td>Snow blowers</td>
<td>17</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Tractor</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
4.2 Roundabout Intersections

Based on 30 responses, agencies used most of the available vehicle and plow configurations to plow roundabout intersections; single and tandem axle trucks with front plow were most commonly used. Figure 2 shows the example four-pass plowing pattern for roundabout intersections using one truck with a reversible front plow and both right and left wings plows. The roundabout circle is plowed first, then the lanes on each leg.

![Plowing Pattern for Roundabout Intersections](image)

Regarding the opinion on the plowing pattern example, the majority of the 31 responses (74.2%) accepted the plowing route and only about 25% of the responding agencies did not. One of the main concerns with the plowing pattern provided in Figure 2 is plowed snow blocking the entrances and exits. It is unrealistic to expect to remove 100% snow from a roundabout with only one truck. The goal here is to remove as much snow as possible and keep traffic moving. It is also acknowledged that most agencies do not have trucks equipped with a front plow and wing plows on both sides. Additional passes and or trucks will be needed to completely clear all the snow.
Some respondents reported different ways to plow this configuration. For instance, using gang plow (two or more trucks); using three center passes with front plow, underbody and wing down, followed by a single pass on each leg and a final single pass in the center; only using a front plow; using an articulating motor grader with a front plow and a right wing and push the snow to right, etc.

Based on the responses and the discussion within the project team and committee, some good practices and considerations to clear roundabouts are summarized as below:

1) Avoid plowing snow onto the elevated inner part, or apron, of the roundabout; this will prevent subsequent melt-water running across the roundabout lanes and re-freezing.
2) Don’t use wing plows along roundabout circle;
3) When plowing the inner lane of each leg, tuck in the left wing and dump the snow before entering the roundabout, square the front plow while passing through the roundabout.

4.3 Four-leg Intersections

Four-leg Intersections are the most commonly maintained by agencies, 29 respondents responded to this module. Results show that agencies used most of the available vehicle and plow configurations to plow four-leg intersections. All used single and tandem axle vehicle and front plow configurations.

Figure 3 shows the example plowing pattern for four-leg intersections. Only one truck with front plow and right wing plow is used in 8 passes. The truck plows the main-line first and then the minor road. The plowing starts from left lane and then to right lane. The shoulders are plowed after all the through and turn lanes are cleared. Snow is pushed to right.

The majority of the 29 respondents (79.3%) accepted this plowing pattern as a standard approach. Different ways reported in the survey are mainly about the number of trucks used. Several respondents reported using two trucks, one even suggested using two trucks for both Major and minor roads. Another respondent recommended using three trucks to include the center lane. Gang plowing and tow plows were also suggested by respondents to reduce number of passes and work time. Two respondents reported using front plow only to clear four-leg intersections.

Several respondents highlighted the importance to have the trucks communicate when using multiple trucks. It is suggested to have trucks communicate and time it that they can team up and cover the intersection together.
4.4 Median U-Turn Intersections

According to the 15 responses, single and tandem-axle vehicles with front plow configuration are the most commonly used to clear Median U-Turn Intersections. A respondent from ND reported using a tow plow for this layout, as the number of passes can be dramatically reduced because it can plow a variable path 10' to 24' wide. Also noted is that only a few agencies use left wings.

Figure 4 shows the example plowing pattern for a typical median U-turn intersection using two trucks: truck #1 with reversible plow and right wing to plow the mainline using six passes and truck #2 with front plow and right wing to clear the minor road using two passes.

A total of 18 respondents commented on the example; most (72.2%) accepted it, while about 27.8% didn’t. Different approaches reported by respondents are mainly about where to push the snow and the plow configurations used. One respondent reported plowing all snow to the right (away from the median) and one respondent stated using a front plow only to plow median U-turn intersections. Contradicting responses were received regarding when to plow U-turn ramps. One respondent suggested plowing U-turn ramps at the beginning for the ease of use.
of tractor trailers, while another respondent mentioned that they plow the U-turn towards the end of the event.

A couple of considerations were summarized for clearing median U-turn intersections:
1) Square the plow while passing through the intersections to avoid dragging snow to cleared lanes; and
2) Be careful not to push ramp snow into previous cleared main lane when clearing the U-turn ramps.

Figure 4  Plowing Pattern for Median U-Turn Intersections

4.5 Diverging Diamond Interchanges
Diverging diamond interchanges are not that common; only 12 responses were received for this layout. Respondents indicated using single-axle trucks with front and wing plows; tandem-axle trucks with front and wing plows and tandem-axle trucks with tow plows.
Figure 5  Plowing Pattern for Diverging Diamond Interchanges
Figure 5 shows the example plowing pattern for diverging diamond interchanges. Due to the complexity of this layout, two diagrams were generated to illustrate the plowing pattern. Highlighted parts in diagram #2 (Figure 5 (b)) show the lanes cleared by the passes in diagram #1 (Figure 5 (a)). Three trucks are used in the example. Truck #1 and Truck #2 clear the mainline first, pushing snow to both left and right. Then Truck #3 clear all the loops, ramps, and bridges. All trucks have reversible front plows and wing plows.

The majority of the responses (66.7%) accepted the plowing example, while 33.3% didn’t. Clearly, some respondents didn’t agree simply because they overlooked the second diagram. Several respondents pointed out that more passes are needed on n/s route to clear the full width and that the areas at the signals are bypassed. In fact, those passes and areas are taken care of in diagram #2. Considering this circumstances, the actual percentage of respondents who accepted this plan should be higher than 66.7%.

One respondent reported using tow plow to clear the diverging diamond interchanges. The respondent commented that the tow plow works great for this because of the width of coverage it provides. Another respondent suggested plowing and winging all snow to the right for easy removal of snow for storage at the end of event.

4.6 Diamond Interchanges

There are 8 responses to the questions on the vehicle and plow for clearing diamond interchanges. Most reported using single and tandem-axle vehicle with front and right wing plow configuration.

Figure 6 shows the example plowing pattern for diamond interchanges. Three trucks are used to clear this configuration. Truck #1 and Truck #2 clear the mainline first and then clear the ramps. Truck #3 clears the cross route. Truck #1 has front plow only, while Truck #2 and Truck #3 have front and right wing plow. Snow is pushed to right in the example.

A total of 11 respondents commented on the plowing pattern. Eight of them (72.7%) accepted it. One respondent reported pushing snow to left for all left lanes. Another one stated using only one truck with front plow only to clear the mainline with more passes. One respondent suggested adding passes to clear the shoulder on mainline before clearing the ramps. Also one respondent highlighted that the main-line is the priority and ramps are not plowed until late in the storm.
4.7 Directional T Interchanges

Figure 7 is the example for plowing directional T interchanges using two trucks with front and right wing plows. Truck #1 plows the main-line and Truck #2 plows the ramps. For the main-line (N-S road), the inner lane is plowed first and then the outer lane. Snow is pushed to right except for the elevation parts of ramps, where plow is switched from right to left to push snow to left. It is to avoid to plow snow onto elevated right side of the ramp to mitigate freezing of snow melt-water across the ramp.

A total of 12 respondents commented on the example. About two-thirds of the respondents (66.7%) accepted it. One respondent reported pushing snow to the left when plowing the left, or insider, lanes. Another respondent reported using a tow plow with variable widths that can plow all to the left, both left and right, and all to the right when needed.
Eight reported using single-axle and tandem-axle trucks with front plow and wither left or right wing plows. One respondent also used two plows for plowing Directional T Interchanges.

### 4.8 Cloverleaf Interchanges with C/D Lanes

There are 15 respondents who responded to the questions about cloverleaf interchanges with C/D lanes. Very commonly, agencies use single- and tandem-axle trucks with front and wing plows. One respondent used a tow plow too.

Figure 8 presents the example plowing pattern for cloverleaf interchanges with C/D lanes using three trucks with reversible front and right/left wing plows. Truck #1 plows E-W bound, Truck #2 plows N-S bound, and Truck #3 plows ramps and C/D lanes. The main-line shoulders are plowed prior to ramps. The first ramp pass cleans up gore areas.

The majority of the 15 respondents accepted the plowing example. Those who disagreed mentioned the use of more trucks and tow plows. Two respondents suggested adding extra trucks on N-S and E-W bounds to reduce the number of passes. One respondent highlighted that tow plow works great for cleaning all the legs and loops in one pass.
Several notes and considerations for plowing cloverleaf interchanges with C/D lane are listed below:

1) Never back up plow trucks;
2) Never drive wrong way on ramps;
3) Always plow ramps from high side and then to the low side to prevent a snow build up that could cause issues during a freeze/thaw event.

5 Conclusions

This paper presents the partial results of the survey on the current practices of clearing ten different interchanges/intersection layouts in the U.S. The findings indicate that single and tandem-axle trucks with front plows are most commonly used by agencies. Additionally, tow plows were reported to be successful in clearing diverging diamond interchanges and directional T interchanges. They have great potentials for complex interchanges due to their ability to clear variable widths and plow all-left, all-right, and both ways and as needed. However, it should be noted that tow plows have limitations in clearing several specific layouts, such as roundabouts.
Also, the findings show that reversible front plows are very commonly used by agencies. Most agencies use right wing plows and only a few agencies use left wing plows.

Diagram depicting plowing patterns were provided for comments from survey respondents. The results for seven interchanges/intersections are presented in the paper. The majority of the respondents accepted the examples, therefore, they will be considered as the best practices to be included in the training video. Although the best practice example for each interchange/intersection is different, some general rules were summarized from the survey findings:

1) Avoid plowing snow onto the elevated side of the road or ramp to mitigate freezing of snow melt-water across the roadway; (e.g. push snow to right along roundabout circles and push snow towards the inside along curves);
2) “Square” the plow at intersections and overpasses to avoid dragging snow onto already cleared lanes.

Acknowledgment

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Reference


