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Total Liquid Routes and Anti-Icing Liquids

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JOINT TRANSPORTATION RESEARCH PROGRAM

INDIANA DEPARTMENT OF TRANSPORTATION
AND PURDUE UNIVERSITY



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JOINT TRANSPORTATION RESEARCH PROGRAM

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16. Abstract <p>INDOT has successfully used salt brine in anti-icing efforts as a way to deliver preventative treatment before an event (e.g. bridge deck frost) occurs. In 2011 INDOT wanted to investigate the use of salt brine in de-icing operations. This study executed a comparative analysis of brine routes and salt routes during two winter seasons (2011–2012 and 2012–2013). The first winter season there were twenty-one study routes and the second winter season forty-one routes. Both winter seasons would be classified as “mild” and most winter events would be characterized with low levels of precipitation. The 2012–2013 winter was a month longer with two major events occurring in March.</p> <p>Another study item designed and fabricated a combination winter vehicle and analyzed its performance.</p> <p>Data collected during these two winter seasons and the following data analysis revealed that liquid routes are more cost effective than granular routes under most weather conditions and pavement temperature ranges. Other recommendations are included in the report findings.</p>			
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EXECUTIVE SUMMARY

TOTAL LIQUID ROUTES AND ANTI-ICING LIQUIDS

Introduction

INDOT has successfully used salt brine in anti-icing efforts as a way to deliver preventative treatment before an event (e.g. bridge deck frost) occurs. In 2011, INDOT wanted to investigate the use of salt brine in de-icing operations. Therefore this study executed a comparative analysis of brine routes and salt routes during two winter seasons (2011–2012 and 2012–2013). There were 21 study routes in the first winter season and 41 routes in the second winter season. Both winter seasons would be classified as “mild” and most winter events would be characterized with low levels of precipitation. The 2012–2013 winter was a month longer with two major events occurring in March.

Another study item designed and fabricated a combination winter vehicle and analyzed its performance.

Various data was collected from different sources and used in the analysis. Data sources used were: Work Management System, weather data, and After Action Truck reports. In any comparative analysis study, the comparative variables need to be minimized as much as possible; this was done by using comparative routes in the same geographical location with similar route characteristics.

The study attempted to provide answers on:

- Liquid routes effectiveness
- Cost comparisons
- Liquid route characteristics
- Combination unit effectiveness

Findings

Findings or conclusions are based on data collected during the two winter seasons. These findings are:

- Interstate routes can save with an approach of alternating brine and salt in successive treatments.
- Brine making equipment and handling costs influence its unit cost. Best practices should be documented and shared with all districts.
- Liquid routes have a smaller cost range variance, indicating that it may be easier to control material distribution rates.
- Liquid routes are economical more times in a direct comparison with salt routes.
- When normal distribution rates are used, liquid (20–40 gallons/mile), salt (#200–#250/mile); liquid routes are more economical in all types of weather events and when pavement temperatures are higher than single digit temperatures.
- Due to the cost of designing and fabricating a combo unit, it may be more economical to use the approach of alternating between salt and liquid treatments on a route.
- The LaPorte District has the most economical brine routes. These route characteristics should be used when designing other brine routes.
- The online After Action Report website proved to be very useful for managers in winter Operations. A mobile version for smart phones is recommended for the 2013–2014 winter season.

Implementation

The findings can be implemented before the 2013–2014 winter season. Implementation in the form of training can lower costs and improve operations. Cost data indicate some areas are experiencing lower costs with brine; these practices and route characteristics should be used to direct an expansion of brine routes. Another fact data revealed is that brine routes are more cost-effective in most weather conditions experienced in Indiana. Therefore, an expansion of this program is warranted and should be aggressively pursued by winter Operations.

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1. INTRODUCTION

In 2011 the Indiana Department of Transportation (INDOT) wanted to investigate the use of salt brine in de-icing operations. INDOT had previous success with using brine in anti-icing efforts on roadways and bridge decks. Through this experience and the corresponding investment in brine making resources; INDOT requested a research study to determine if brine would be effective in de-icing operations. One other study item was to fabricate a combination unit and analyze its value. A combination unit is a winter vehicle that can distribute brine and salt simultaneously.

The study determined the following:

- Liquid routes effectiveness
- Cost comparison between brine and granular routes
- Liquid route requirements
- Combination unit effectiveness

The study encompassed two winter seasons; 2011–2012 and 2012–2013 and the rest of the report describes the findings from these two winter season data and derived conclusions.

2. WINTER 2011–2012

For this winter season 21 study routes were established at nine unit locations. A breakdown on the route types is as follows:

- Combo routes (alternated between salt and brine): 3
- Salt routes: 10
- Brine routes: 4
- Multi-lane (brine on passing and salt on driving): 4

Table 2.1 describes these study routes.

TABLE 2.1
2011–2012 Study Routes

Unit Location	Route #	Route Description	Type
Monticello	42-1-1	421 SR 24 to SR 18 and SR 18 Delphi to Brookston	Alternate liquid and granular
Monticello	42-1-4	SR 39 Monticello to Buffalo and SR 16 Monon to SR 119	Granular – control for #1
Monticello	42-1-5	43 from Brookston to Reynolds	Alternate liquid and granular
Monticello	42-1-6	US 421 from Reynolds to Monon	Granular – control for #5
Chesterton	41-6-1	I 94	Liquid lanes 1 and 3, granular lane 2
Michigan City	41-3-6	I 94 Michigan City to MI state line	Granular – all three lanes – control route for Chesterton
Winamac	46-1-4	SR 119 Winamac to SR 16	Liquid
Winamac	46-1-5	SR 14 Winamac to Rochester	Liquid
Winamac	46-1-7	SR 14 Winamac to SR 39 and SR 39 to SR 16	Granular – control route for #5
Winamac	46-1-3	US 35 Unit to Royal Center	Liquid
Winamac	46-1-1	US 35 Unit to SR 8	Granular – control route for # 3
Logansport	42-2-7	US 24 Logansport to US 31	Alternate liquid and granular
Wabash	25-1-202	US 24 SR 13 to Miami CR 400W	Granular route – control route for Logansport
Cambridge City	33-D-2-2	US 40	Liquid route on passing lane and granular on driving
Cambridge City	33-F-2-2	US 40	Liquid route on passing lane and granular on driving
Cambridge City	33-B-1-1	US 40	Granular route – control route for Cambridge City
Vincennes	66-N-211	US 41, SR 67, SR 441, SR 150	Liquid route
Vincennes	66-M-211	Interchanges and ramps on 66-N-211 routes	Control route
Washington	66-I-311	SR 57 Washington to Vincennes including US 41 interchange	Granular driving lane
Washington	66-J-311	SR 57 Washington to Vincennes including US 41 interchange	Liquid passing lane
Washington	66-K-311	SR 257 to SR 56 and SR 57 to Plainville	Control Route

At each of the nine locations, data was collected from INDOT’s Work Management System (WMS) and the following analyses performed. Weather hours, calculated by INDOT, are used to represent the level of winter weather activity experienced. Hours vary by location.

2.1 Monticello

Table 2.2 is an analysis of the Monticello routes. At this location the lowest salt consumption occurred on the route where materials alternated between brine and salt. To contradict this, the highest salt consumption occurred on a similar route type.

The lowest cost/mile was on the salt routes.

On routes 42-1-1 and 42-1-4; 42-1-1 consumed less salt but had a higher cost/mile. 42-1-1 had higher equipment and labor costs of \$2582 and \$1138 respectively which caused the higher unit cost.

2.2 Chesterton and Michigan City

Table 2.3 is an analysis of the Chesterton and Michigan City routes. Brine and salt combination route on I-94 experienced significantly lower salt usage and unit cost than the all salt route. Salt usage was approximately 40% less.

2.3 Winamac

Table 2.4 is an analysis of the Winamac routes. This location is another contradiction: the lowest salt usage is on the brine route while the lowest cost/mile is on the salt route.

TABLE 2.2
Monticello Analysis (2011–2012)

Route #	Type	Salt (lbs.)/Mile	Total Cost (\$)/Mile	Weather Hours
42-1-1 – US 421 and SR 18	Alternate brine and salt	58	6.15	121
42-1-4 – SR 39 and SR 16	Salt	67	5.12	121
42-1-5 – SR 43	Alternate brine and salt	91	6.04	121
42-1-6 – US 421	Salt	61	5.40	121

TABLE 2.3
Chesterton and Michigan City Analysis (2011–2012)

Route #	Location	Type	Salt (lbs.)/Mile	Total Cost(\$)/Mile	Weather Hours
41-6-1 – I-94	Chesterton	Brine lanes 1 and 3, salt lane 2 (I-94)	121	6.77	157
41-3-6 – I-94	Michigan City	Salt all lanes (I-94)	190	8.73	157

2.4 Logansport and Wabash

Table 2.5 is an analysis of the Logansport and Wabash routes. In these locations, the salt usage is the same per mile and the salt route has the lowest cost/mile.

2.5 Cambridge City

Table 2.6 is an analysis of the Cambridge City routes. In this location, the lowest salt usage occurred on the brine route.

2.6 Vincennes

Table 2.7 is an analysis of the Vincennes routes. In this location, the salt route had lowest usage and cost/mile.

2.7 Washington

Table 2.8 is an analysis of the Washington routes. In this location, the brine routes had the lowest and highest salt usage and the salt route the lowest cost/mile.

2.8 Summary

Figure 2.1 graphs the salt usage (lbs./mile) by route type at each study location. This figure shows a wide range of values, from less than 60 lbs./mile to 190 lbs./

mile. Also, there is no consistency with the route types in usage, this is dependent on location.

- Lowest salt usage per mile was on a brine route in Winamac, 57 lbs./mile
- Highest salt usage is on interstate route I-94, 190 lbs./mile. Brine route is considerably lower than all salt on the interstate.

Figure 2.2 graphs the average cost per mile by route type at each study location.

- Lowest cost/mile is on salt route in Vincennes. Weather has to be an influence. Vincennes had 56 weather hours compared to 157 hours at Michigan City and Chesterton.
- In Winamac the lowest cost per mile was on a salt route.
- Lower per mile costs were at the southern units Vincennes and Washington; however Winamac compared favorably.

Brine routes had lower salt consumption but higher unit cost (\$/mile). This may indicate that brine making and handling costs influence the unit costs and need evaluating in order to lower this cost. An analysis was performed to determine the difference in labor and equipment costs at the various study locations for the complete winter season and these are shown in Table 2.9. The table values show the cost differences between the route options at a location. For example, at Monticello, the combination route equipment cost \$2,422 more than the salt route for the 2011–2012 winter. The labor cost was \$1,046 higher as well.

The largest cost differential was in equipment cost on the combo and liquid routes at Monticello, Winamac

TABLE 2.4
Winamac Analysis (2011–2012)

Route #	Type	Salt (lbs.)/Mile	Total Cost(\$)/Mile	Weather Hours
46-1-4 – SR 119	Brine	57	5.56	136
46-1-5 – SR 14	Brine	76	6.09	136
46-1-7 – SR 14	Salt	88	5.60	136
46-1-3 – US 35	Brine	88	6.48	136
46-1-1 – US 35	Salt	70	4.46	136

TABLE 2.5
Logansport and Wabash Analysis (2011–2012)

Route #	Location	Type	Salt (lbs.)/Mile	Total Cost (\$)/Mile	Weather Hours
42-2-7 – US 24	Logansport	Alternate between brine and salt	107	7.85	131
25-1-202 – US 24	Wabash	Salt	107	6.89	131

TABLE 2.6
Cambridge City Analysis (2011–2012)

Route #	Type	Salt (lbs.)/Mile	Total Cost (\$)/Mile	Weather Hours
33-d-2-2 – US 40	Brine on passing, salt on driving	106	8.56	97
33-f-2-2 – US 40	Brine on passing, salt on driving	154	9.14	97
33-b-1-1 – US 40	Salt on both lanes	154	9.27	97

TABLE 2.7
Vincennes Analysis (2011–2012)

Route #	Type	Salt (lbs.)/Mile	Total Cost (\$)/Mile	Weather Hours
66-N-211 US 41, SR 67, SR 441, SR 150	Brine	75	4.72	56
66-M-211 – Interchanges and ramps	Salt	62	4.41	56

TABLE 2.8
Washington Analysis (2011–2012)

Route #	Type	Salt (lbs.)/Mile	Total Cost (\$)/Mile	Weather Hours
66-I-311 – SR 57	Brine	99	5.54	56
66-J-311 – SR 57	Brine	134	6.57	56
66-K-311 – SR 257	Salt	108	5.35	56

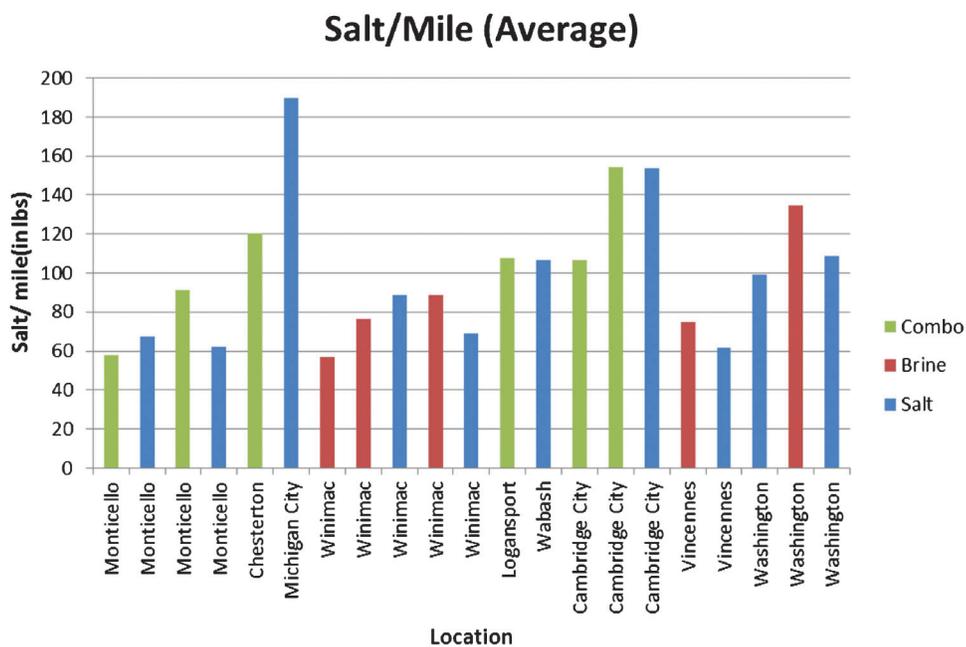


Figure 2.1 Salt usage per mile (2011–2012).

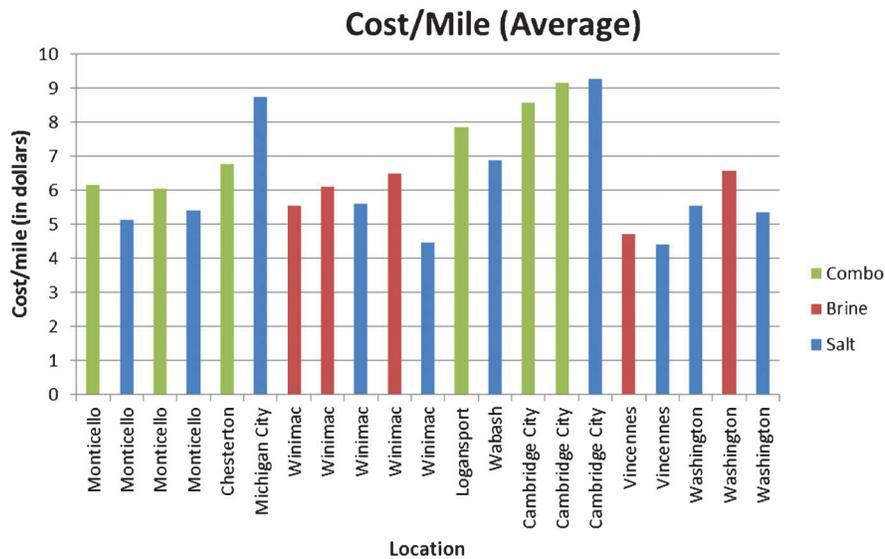


Figure 2.2 Cost per mile (2011–2012).

TABLE 2.9
Labor and Equipment Cost Analysis

Location	Route	Equipment Cost Differential	Labor Cost Differential	Notes
Monticello	42-1-1 (combo)	2422	1046	Combo more costly
Monticello	42-1-4 (salt)			
Monticello	42-1-5 (combo)	803		Combo
Monticello	42-1-6 (salt)		106	Salt
Chesterton	41-6-1(combo)		129	Combo
Michigan City	41-3-6 (salt)	837		Salt
Winamac	46-1-5 (liquid)	1241	476	Liquid
Winamac	46-1-7 (salt)			
Winamac	46-1-3 (liquid)			
Winamac	46-1-1 (salt)	1760	458	Salt
Logansport	42-2-7 (combo)	2900		Combo
Wabash	25-1-202 (salt)		152	Salt
Cambridge City	33-D-2-2 (combo)	2784	117	Combo
Cambridge City	33-B-1-1 (Salt)			
Cambridge City	33-F-2-2 (combo)	2054	18	Combo
Cambridge City	33-B-1-1 (salt)			
Vincennes	66-N-211 (liquid)			
Vincennes	66-M-211 (salt)	544	222	Salt
Washington	66-J-311 (liquid)			
Washington	66-I-311 (salt)	315	74	Salt
Washington	66-J-311 (liquid)			
Washington	66-K-311 (salt)	126	146	Salt

(both combo and salt), Logansport, and Cambridge City. Using this information, only the Winamac liquid route had higher equipment and labor costs compared to the salt route.

TABLE 2.10
Equipment and Labor Cost Comparisons

Route Type	Higher Equipment Costs	Higher Labor Costs
Salt	5	6
Liquid/combination	6	5

There are eleven direct comparisons between a granular route and liquid/combination route. In these comparisons there almost an even distribution between granular routes and liquid/combination routes with the equipment and labor cost differential. More precisely Table 2.10 summarizes the comparisons.

At the southern locations salt routes had higher equipment and labor costs and at the northern locations liquid routes had higher costs.

Table 2.11 data indicates the cost variance is better contained with liquid routes even though the average cost per mile is identical.

TABLE 2.11
Study Routes Summary Table (2011–2012 Winter)

District	Liquid Routes (11 Routes*)			Control Routes (10 Routes)		
	Salt Used	Total Cost	\$/Service Mile	Salt Used	Total Cost	\$/Service Mile
Fort Wayne	NA			145	\$9,273	\$6.88
Greenfield	356	\$27,522	\$5.21	134	\$16,141	\$9.27
LaPorte	1007	\$130,377	\$5.88	840	\$101,197	\$5.78
Vincennes	108	\$12,484	\$5.15	222	\$25,763	\$5.03
State totals	1471	\$170,383	\$5.41**	1341	\$152,374	\$5.40**

*Liquid routes include brine, and combo routes.

**Average cost/mile for all districts.

TABLE 2.12
Cost Comparison by Event Type

Weather Event Type	# of Events	Salt	Brine	Combo
Light snow (<0.5"/hr)	18	29	11	23
Medium snow (0.5"–1"/hr)	4	8	1	5
Heavy snow (>1"/hr)	3	10	3	12

2.9 Event Type Comparison

There were 25 measureable winter events that were recorded. The first was on November 29 and the last on March 5, 2012. A description of these events is in Appendix A. Table 2.12 shows by each weather event (light, medium, heavy) which route type was the most economical at locations that experienced the weather event. Not all locations experienced these 25 weather events. One missing factor that influences these results is pavement temperatures which were not recorded. A pavement temperature analysis is included in the 2012–2013 data analysis.

- Most economical route type by weather event type.
- Combination routes (alternate brine and salt) had lower costs than brine routes in all event types.
- I-94 route, combination route (brine lanes 1 and 3, salt lane 2) was most economical in all event types. This option on interstates should be considered for expansion.
- All event types, salt routes were the most economical. Pavement temperatures are not included in this analysis.

Figure 2.3 shows the range in costs for the three different route types.

- Salt: \$4–\$10/mile
- Brine: \$6–\$8/mile
- Combo: \$6–\$8/mile

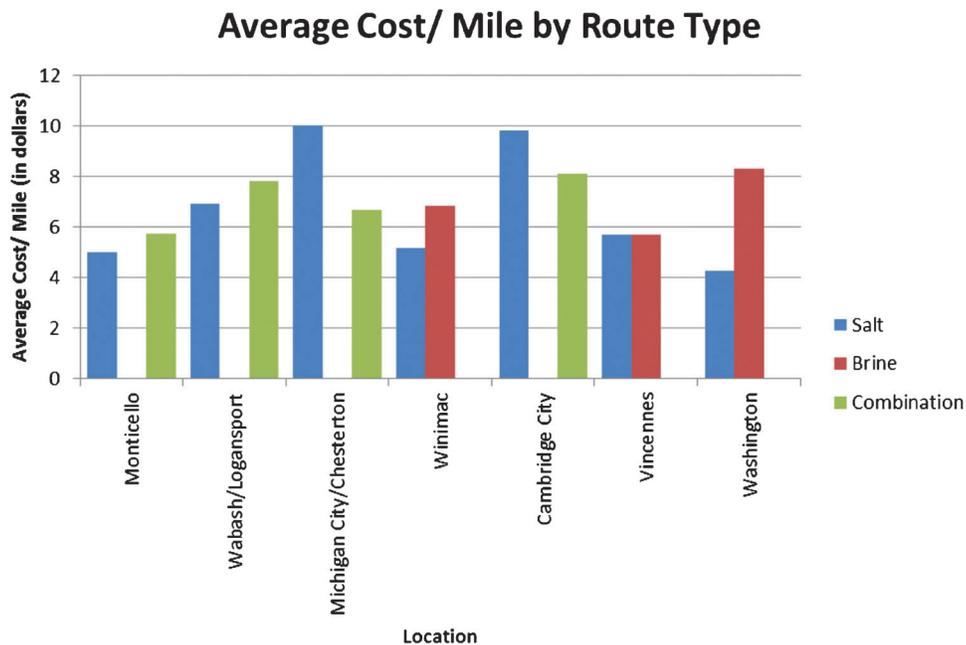


Figure 2.3 Light snow event cost data.

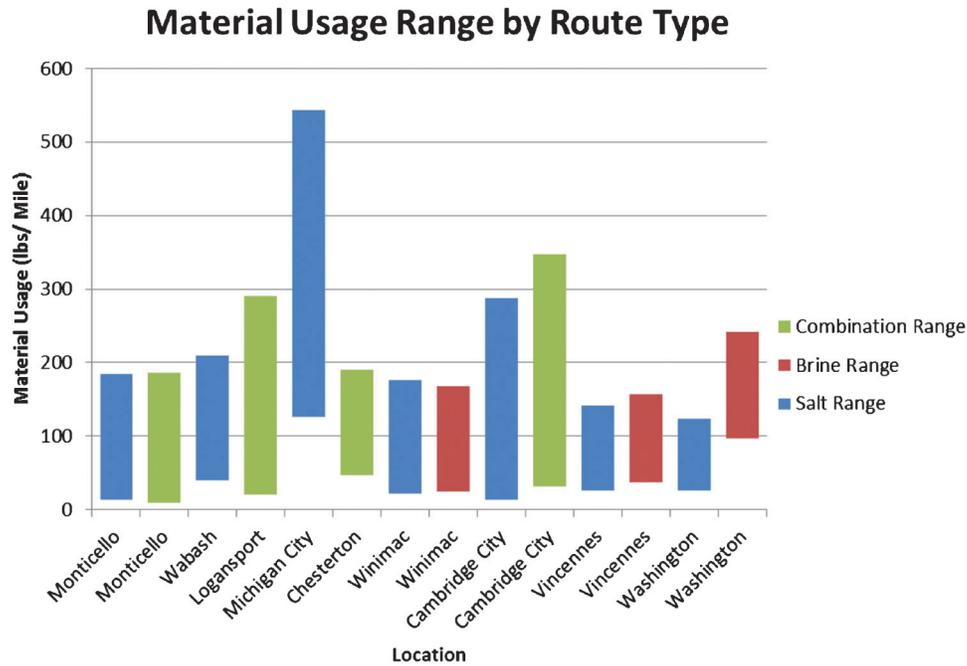


Figure 2.4 Material usage by route type.

Salt routes have the lowest and highest cost/mile and the largest range in costs. Brine and combination routes have a smaller cost range. This may infer that material distribution rates may be easier to control with liquids.

Figure 2.4 shows a wide range in material usage rates by route type and location. A general observation is brine routes had fairly consistent ranges and the upper usage rate was lower than the other route types. Salt routes had the lowest and highest material usage rates.

3. COMBINATION UNIT

A combination unit was designed, fabricated and implemented. The unit was fabricated at the Indianapolis sub and made available at the end of February 2012. After that date there were two winter events so an evaluation could not be performed for that winter. Below is an image of the combination unit. It is comprised of a 2400 gallon brine tank and a 4 cubic yard hopper for salt (see Figure 3.1). The material cost for this unit was \$14,011.

The combo unit was used in the Greenfield District on route 31-H-1-1 during the 2012–2013 winter season.

Materials used and cost data during the 2012–2013 winter are listed in Table 3.1.

This compares to Greenfield granular route cost of \$11.02 and liquid route cost of \$9.36.

Drivers of the unit were interviewed and their comments are summarized as follows:

- “Worked well and did a good job of keeping the road clear”
- “Recommend a larger salt storage capacity”
- “Adding a spinner is recommended”
- “Worked better in dry snows than wet ones”



Figure 3.1 Combination truck.

TABLE 3.1
Combination Unit Data

Brine (Gallons)	Salt (Tons)	Service Miles	Cost	\$/Service Mile
40000	103	2198	\$21,235	\$9.66

4. WINTER 2012–2013

The study was expanded for the 2012–2013 winter to consist of 41 routes with a breakdown of 22 liquid routes, 18 granular routes, and one route using the combo unit. Table 4.1 describes the study routes.

The following sections describe the activities executed during this winter and the data analysis performed.

4.1 Online After Action Report

One product developed and used for this study and winter operations was an online site that contains forms for recording truck and liquid study data and corresponding reports. The truck data form is shown in Figure 4.1. This form is used by units to record truck activity information.

From this data, three reports can be generated and used by winter operations managers to monitor current and past activities. Figure 4.2 is an example of the sub-district report which shows current truck numbers by activity type.

Figure 4.3 is an excerpt of the Unit report showing current number of trucks out, out time, expected return time, type of activity, and any notes associated with the activity.

Figure 4.4 is a portion of the archived report which displays unit truck information that was saved or archived.

The other input form is for recording weather information, a portion of the form is shown in Figure 4.5. Weather data reporting was inconsistent by date and location. Recorded weather data was used in the study analysis.

The final report on the site is archived weather data. An example is shown in Figure 4.6. Figures 4.7 and 4.8 are companion bar charts for the data shown in Table 4.2.

4.2 Liquid Routes Analysis

Bi-weekly reports were produced starting with the first winter action on December 10, 2012 as a lake effect event. Eight bi-weekly reports were created with the last two week period ending on March 30. Table 4.2 is a summary table of the study routes during the December 10, 2012 to March 30, 2013 time period.

Since there are four more liquid routes than granular routes in the 2012–2013 data the overall costs are higher, while less salt is used. The cost per service mile is an equitable comparison. Except for the Seymour District, the liquid routes were less costly on a service mile basis compared to the granular routes in a particular District. The average service mile cost across all study routes indicate that liquid routes cost less to operate.

4.2.1 Biweekly Tables

Table 4.2 was developed by combining bi-weekly data over that time period. Individual bi-weekly tables and their corresponding weather events are contained in Appendix C.

4.3 Weather Influences

Table 4.3 summarizes the weather events experienced during the 2012–2013 winter season.

There are 26 different weather events described. Appendix B contains a more detailed description of these weather events. One unique characteristic about this winter was air temperatures and corresponding pavement temperatures were fairly consistent, there were no long periods where pavement temperatures dropped below double digit values.

Table 4.4 shows a comparison between liquid and granular routes at specific locations experiencing different weather events going from small to increasing snow amounts with varying pavement temperatures.

4.3.1 Table 4.3 Observations

The following are some observations of the data.

- Pavement temperatures range from 10 to 35 degrees. Within this range liquid routes are more economical if normal material distribution rates are used. Normal distribution rates are 40 gallons/mile for liquids and 200#/mile for salt. When salt distribution rates are below 100 #/mile then salt routes can be more economical.
- When salt distribution rates are between 100–200 #/mile the lane mile costs typically fall in the \$5–\$6 range.
- When brine distribution rates are between 20–40 gallons/mile the lane mile costs typically fall in the \$4–\$7 range.

4.3.2 Observations about Bi-weekly Reports

There were 8 bi-weekly report periods and the data collected for each is reported in Appendix C. The following analysis uses the assumption that the same weather events and corresponding pavement temperatures were experienced in each District.

One analysis is a direct cost comparison within a District between liquid and salt routes for each bi-weekly period. Table 4.5 summarizes this comparison.

This comparison shows that for these direct comparison periods, Liquid routes were most economical 27 times and 17 times for the salt routes. The cost range for liquid routes was \$3.27–\$12.21 and for salt routes \$4.21–\$14.68.

TABLE 4.1
2012–2013 Study Routes

District	Unit Location	Route #	Route Description	Type
LaPorte	Monticello	42-1-1	421 SR 24 to SR 18 and SR 18 Delphi to Brookston	Alternate liquid and granular
	Monticello	42-1-4	SR 39 Monticello to Buffalo and SR 16 Monon to SR 119	Granular – control for #1
	Monticello	42-1-5	43 from Brookston to Reynolds	Alternate liquid and granular
	Monticello	42-1-6	US 421 from Reynolds to Monon	Granular – control for #5
	Chesterton	41-6-1	I 94	Liquid lanes 1 and 3, granular lane 2
	Michigan City	41-3-6	I 94 Michigan City to MI state line	Granular – all three lanes – control route for Chesterton
	Winamac	46-1-4	SR 119 Winamac to SR 16	Liquid
	Winamac	46-1-5	SR 14 Winamac to Rochester	Liquid
	Winamac	46-1-7	SR 14 Winamac to SR 39 and SR 39 to SR 16	Granular – control route for #5
	Winamac	46-1-3	US 35 Unit to Royal Center	Liquid
	Winamac	46-1-1	US 35 Unit to SR 8	Granular – control route for # 3
	Logansport	42-2-7	US 24 Logansport to US 31	Alternate liquid and granular
Fort Wayne	Wabash	25-1-202	US 24 SR 13 to Miami CR 400W	Granular route – control route for Logansport and Wabash
	Wabash	25-5-201	SR13	Liquid route
	Bluffton	26-1-105	SR1	Liquid
	Bluffton	26-2-106	US 224	Granular – control route
	Bluffton	26-1-103	SR1	Liquid
	Fort Wayne	23-2-101	US 27	Liquid
	Fort Wayne	23-2-104		Granular – control route for 101
Greenfield	Cambridge City	33-D-2-2	US 40	Liquid route on passing lane and granular on driving
	Cambridge City	33-F-2-2	US 40	Liquid route on passing lane and granular on driving
	Cambridge City	33-B-1-1	US 40	Granular route – control route for Cambridge City
	Brookville Road	31-H-01-1	US 52 from I465 east leg east to Hancock Co. Road 500 West	Combo unit
	Brookville Road	31-I-01-1	US 40 from I465 east leg east to Marion/Hancock Co. line	Liquid
	65th St.	31-H-4-1	SR 67 I465 east leg north to SR 13	Granular – control route for 31-H-01 and 31-I-01-1
Vincennes	Vincennes	66-N-211-L	US 41, SR 67, SR 441, US 50	Liquid route
	Vincennes	66-M-211	Interchanges and ramps on 66-N-211 routes	Control route
	Washington	66-H-312-L	SR 50 Washington to Vincennes including US 41 interchange	Liquid passing lane
	Washington	66-I-311	SR 50 Washington to Vincennes including US 41 interchange	Granular driving lane
	Evansville – Boyle Unit	63-A-212-L	I-64 driving lane	Liquid route
	Evansville – Boyle Unit	63-F-2	I-64 passing lane	Granular – control route
	Bedford	64-A-312-L	SR 37 driving lane	Liquid route
	Bedford	64-J-3	SR 37 passing lane	Granular – control route
Seymour	Aurora	51-03-108	US 50; SR 101 to Ohio St. Line, Passing Lane	Liquid
	Aurora	51-3-103	US 50; SR 101 to Ohio St. Line, Driving Lane	Granular – control route
	Penntown	51-01-04	I74; CR 850E (New Point) to SR 101 Passing Lane	Liquid
	Penntown	51-01-03	I74; CR 850E (New Point) to SR 101 Driving Lane	Granular – control route includes ramps
Crawfordsville	Terre Haute	"11-3-09	SR 63 passing lane – US 41 to SR 163	Liquid – 24.3 miles
	Terre Haute	"11-3-04	SR 63 driving lane – US 41 to SR 163	Granular control route – 24.3
	Cloverdale	15-1-04/15-1-07	US 40 passing lane – 11/67 Co. Line to SR 75	Liquid – 40.6 miles
	Cloverdale	15-1-04	US 40 driving lane – 11/67 Co. Line to SR 75	Granular control route – 40.6 miles



Winter Operations

Truck Data

Unit Location:	6400 PAOLI SUBDISTRICT (PSC <input type="text"/>)
Number of Trucks	None <input type="text"/>
Event Type - Anti-icing, Patrolling, or Storm	<input type="radio"/> Anti-Ice Bridge <input type="radio"/> Anti-Icing <input type="radio"/> Patrolling <input type="radio"/> Storm <input type="radio"/> No Activity
PLANNED START (date and time)	Date: <input type="text" value="03"/> - <input type="text" value="13"/> - <input type="text" value="2013"/> Time: <input type="text" value="14"/> : <input type="text" value="27"/>
PLANNED END (date and time)	Date: <input type="text" value="03"/> - <input type="text" value="13"/> - <input type="text" value="2013"/> Time: <input type="text" value="14"/> : <input type="text" value="27"/>
Notes:	<div style="border: 1px solid gray; height: 60px;"></div>
<input type="button" value="Submit Truck Data"/>	
<input type="button" value="View Truck Report"/>	
<input type="button" value="Liquid Route Study Form"/>	

Figure 4.1 Online truck report screen.

Current
Total Number of Trucks is: 198

District	Sub-District	Anti-ice-Bridge	Anti-Icing	Patrolling	Storm	No Activity	Number of Trucks
CRAWFORDSVILLE	TERRE HAUTE	0	0	0	0	0	0
CRAWFORDSVILLE	CRAWFORDSVILLE	0	0	0	9	0	9
CRAWFORDSVILLE	FOWLER	0	0	3	0	0	3
CRAWFORDSVILLE	FRANKFORT	0	0	0	0	0	0
CRAWFORDSVILLE	CLOVERDALE	0	0	4	0	0	4
FORT WAYNE	ELKHART	0	0	0	19	0	19
FORT WAYNE	FORT WAYNE	0	0	5	0	5	10
FORT WAYNE	ANGOLA	0	0	10	0	0	10
FORT WAYNE	WABASH	0	0	3	0	0	3
FORT WAYNE	BLUFFTON	0	0	0	0	0	0
GREENFIELD	INDIANAPOLIS	0	0	40	0	0	40
GREENFIELD	GREENFIELD	0	0	17	0	0	17
GREENFIELD	CAMBRIDGE CITY	0	0	0	0	0	0
GREENFIELD	TIPTON	0	0	0	0	0	0
GREENFIELD	ALBANY	0	0	0	20	0	20
LAPORTE	LAPORTE	0	0	6	0	0	6
LAPORTE	MONTICELLO	0	0	3	0	0	3
LAPORTE	PLYMOUTH	0	0	0	22	0	22
LAPORTE	RENSSELAER	0	0	0	0	0	0

Figure 4.2 Sub-district truck report screen.

Current
Total Number of Trucks is: 193

Unit Name	Number of Trucks	Out Time	In Time	Activity	Notes
1300 FOWLER SUBDISTRICT (PS065130)	3	2013-03-13 07:45:00	2013-03-13 15:30:00	Patrolling	
1500 CLOVERDALE SUBDISTRICT (PS065132)	4	2013-03-13 12:32:00	2013-03-13 15:30:00	Patrolling	
2301 FORT WAYNE UNIT 1 (PS065415)	5	2013-03-13 07:30:00	2013-03-13 16:00:00	Patrolling	Treating any icy patches found
2401 ANGOLA UNIT 1 (PS065418)	5	2013-03-13 07:30:00	2013-03-13 16:00:00	Patrolling	Treating any areas that may need it.
2403 WATERLOO UNIT 3 (PS065420)	5	2013-03-13 07:30:00	2013-03-13 16:00:00	Patrolling	Treating any areas that need it
2500 WABASH SUBDISTRICT (PS065147)	3	2013-03-13 11:54:00	2013-03-13 15:30:00	Patrolling	blow in's
3100 INDIANAPOLIS SUBDISTRICT (PS065158)	40	2013-03-13 12:05:00	2013-03-13 16:05:00	Patrolling	patrolling
3200 GREENFIELD SUBDISTRICT (PS065159)	17	2013-03-13 10:56:00	2013-03-13 15:30:00	Patrolling	
4100 LAPORTE SUBDISTRICT (PS065174)	6	2013-03-13 12:32:00	2013-03-13 16:00:00	Patrolling	Still getting lake effect snow in the northeast and having issues with blowing and drifting snow.
5100 AURORA SUBDISTRICT (PS065190)	15	2013-03-13 12:17:00	2013-03-13 15:30:00	Patrolling	
5500 MADISON SUBDISTRICT (PS065194)	3	2013-03-13 12:00:00	2013-03-13 15:30:00	Patrolling	
1200 CRAWFORDSVILLE SUBDISTRICT (PS065129)	9	2013-03-13 13:06:00	2013-03-13 15:30:00	Storm	

Figure 4.3 Unit truck report.

Unit Name	Number of Trucks	Truck Start Time	Truck End Time	Activity	Notes
2500 WABASH SUBDISTRICT (PS065147)	0	2013-03-13 11:53:00	2013-03-13 12:00:00	Storm	
1402 LEBANON UNIT 2 (PS065399)	2	2013-03-13 11:34:00	2013-03-13 12:30:00	Patrolling	
1402 LEBANON UNIT 2 (PS065399)	0	2013-03-13 11:33:00	2013-03-13 12:30:00	Patrolling	
1403 ROMNEY UNIT 3 (PS065400)	1	2013-03-13 11:33:00	2013-03-13 12:30:00	Patrolling	
1402 LEBANON UNIT 2 (PS065399)	1	2013-03-13 11:32:00	2013-03-13 12:30:00	Patrolling	
1402 LEBANON UNIT 2 (PS065399)	2	2013-03-13 11:31:00	2013-03-13 12:30:00	Patrolling	
1401 FRANKFORT UNIT 1 (PS065398)	6	2013-03-13 11:31:00	2013-03-13 12:30:00	Patrolling	
1403 ROMNEY UNIT 3 (PS065400)	1	2013-03-13 09:35:00	2013-03-13 11:30:00	Patrolling	
1402 LEBANON UNIT 2 (PS065399)	2	2013-03-13 09:35:00	2013-03-13 11:30:00	Patrolling	
1401 FRANKFORT UNIT 1 (PS065398)	7	2013-03-13 09:34:00	2013-03-13 11:30:00	Patrolling	
1200 CRAWFORDSVILLE SUBDISTRICT (PS065129)	6	2013-03-13 09:19:00	2013-03-13 11:30:00	Patrolling	
1200 CRAWFORDSVILLE SUBDISTRICT (PS065129)	11	2013-03-13 09:04:00	2013-03-13 12:00:00	Storm	

Figure 4.4 Archived truck report.

Route#	<input type="text"/>
Unit Location:	<input type="text"/>
Driver:	<input type="text"/>
Equipment Commission #	<input type="text"/>
Start Mileage:	<input type="text"/>
End Mileage:	<input type="text"/>
BRINE USED	<input type="text"/> GALLONS
SALT USED	<input type="text"/> TONS
Other Liquid Deicer Used	Calcium Chloride <input type="text"/> GALLONS
Event Type - Anti-icing or Storm (select one)	<input checked="" type="radio"/> Anti-icing <input type="radio"/> Storm
STORM START (date and time)	Date: <input type="text"/> - <input type="text"/> - <input type="text"/> Time: <input type="text"/> : <input type="text"/>
PLANNED END (date and time)	Date: <input type="text"/> - <input type="text"/> - <input type="text"/> Time: <input type="text"/> : <input type="text"/>
PAVE TEMP at STORM START	<input type="text"/>
AIR TEMP at STORM START	<input type="text"/>
PAVE TEMP at STORM END	<input type="text"/>

Figure 4.5 Weather form.

Unit Location:

Unit Location	driver	route	stormStart	stormEnd	paveTempStormStart	airTempStormStart	paveTempStormEnd	airTempStormEnd	percipType	amount
Wabash	Brandon Whitcraft	25-5-201	2012-12-31 13:30:00	2012-12-31 24:00:00	33	32	31	31	Snow	1.0
Wabash	Brandon Whitcraft	25-5-201	2012-12-29 19:15:00	2012-12-29 24:00:00	25	26	21	23	Blowing Snow	
Wabash	Todd Wheatley	25-5-201	2012-12-29 12:00:00	2013-12-30 10:17:00	27	28	25	26	Snow	.5
Wabash	Brandon Whitcraft	25-5-201	2013-01-27 14:00:00	2013-01-27 23:30:00	31	31	34	35	Freezing Rain	.1
Wabash	Brandon Whitcraft	25-5-201	2013-01-25 05:30:00	2013-01-25 16:30:00	22	19	25	26	Snow	.5
Wabash	Test	25-1-202	2013-01-16 11:37:00	2013-01-16 11:37:00	1	1	1	1		1
Wabash	0	25-1-202	01/16/2013 - 01:00:00AM	01/16/2013 - 01:00:00PM	0	0	0	0		0
Wabash	2	25-5-201	02/02/2013 - 02:02:00AM	02/02/2013 - 02:02:00PM	2	2	2	2	Sleet	2
Wabash	Test	25-1-202	01/16/2013 - 01:01:00AM	01/16/2013 - 12:59:00PM	1	1	1	1	Freezing Rain	1
Wabash	Todd Wheatley	25-5-201	12/21/2012 - 01:00:00AM	12/21/2012 - 12:01:00PM	27	27	29	28	Snow	1
Wabash	Brandon Whitcraft	25-5-201	12/21/2012 - 12:01:00PM	12/21/2012 - 05:18:00PM	28	29	29	30	Snow	1
Wabash	Todd Wheatley	25-5-201	12/21/2012 - 01:00:00AM	12/21/2012 - 12:01:00PM	27	27	28	29	Snow	1

1

Figure 4.6 Archived weather data.

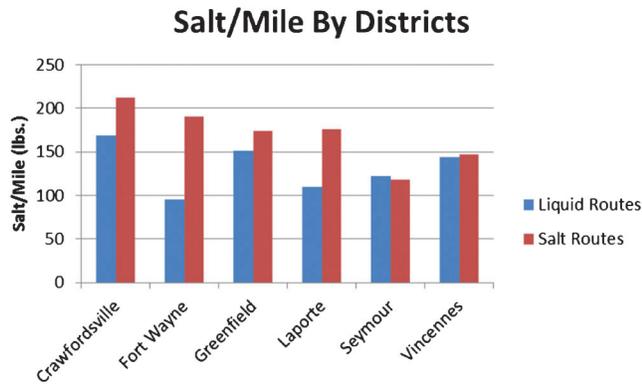


Figure 4.7 Salt consumption per mile (2012–2013 winter).

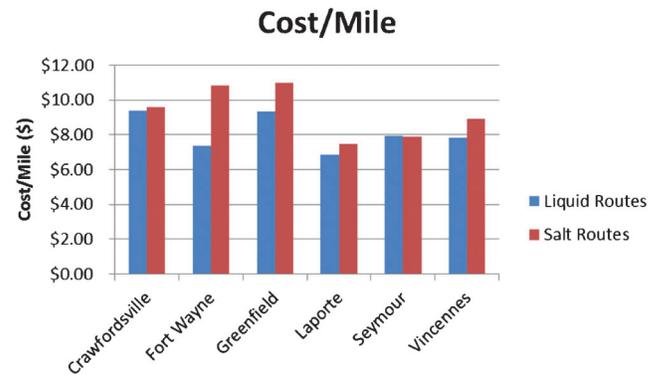


Figure 4.8 Cost per mile (2012–2013 winter).

TABLE 4.2
Study Routes Summary Table (2012–2013 Winter)

District	Liquid Routes (22 Routes)			Control Routes (18 Routes)		
	Salt Used	Total Cost	\$/Service Mile	Salt Used	Total Cost	\$/Service Mile
Crawfordsville	620.8	\$68,933	\$9.39	622.9	\$56,344	\$9.62
Fort Wayne	946.6	\$146,381	\$7.39	962.2	\$109,179	\$10.84
Greenfield	833.1	\$102,975	\$9.36	493.6	\$62,653	\$11.02**
LaPorte	1694.81	\$213,021	\$6.88	2061	\$174,180	\$7.46
Seymour	459.73	\$59,574	\$7.92	492.82	\$65,778	\$7.90
Vincennes	421.9	\$46,089	\$7.87	556.2	\$67,570	\$8.95
State totals	4976.94	\$636,973	\$8.14*	5188.72	\$535,704	\$9.30*

*State average.

**Excluded 1-7-13 \$/lane mile due to inflated \$/service mile.

TABLE 4.3
2012–2013 Winter Weather Events

Date	Event Type
12/10/2012	Lake effect snow
12/20–21/2012	Statewide snow event – trace amounts to 4"
12/25-26/2012	Statewide snow event – up to 12" in some locations
12/27–29/2012	Lake effect – Up to 3"
12/29/2012	Snow event – flurries to 6"
12/31/2012	Snow event across state
1/13/2013	Light snow event across north half of state
1/15–16/2013	Freezing rain, sleet, snow event across southern portions
1/21/2013	Lake effect – up to 4" in areas and snow squalls
1/22/2013	Lake effect
1/23/2013	Light snow event across north central region
1/24/2013	Lake effect
1/25/2013	Light snow event across northern half
1/27/2013	Freezing rain event
1/31/2013	Scattered snow showers across state
2/1–2/2013	State snow event – 1–3"
2/3/2013	Scattered snow showers across state
2/4/2013	Snow event across state – up to 3" in some locations
2/15/2013	Light snow event in NW
2/19/2013	Lake effect
2/21/2013	Snow, sleet, freezing rain event across state
2/26/2013	Freezing rain and sleet across northern areas
3/1–2/2013	Lake effect
3/5–6/2013	Snow event – 1" south to 10" north
3/12–13/2013	Lake effect
3/24–25/2013	Statewide snow event – 1" to 10"

TABLE 4.4
Study Routes Comparisons

Location	Date	Snow Amount (in.)	Route	Pavement Temp.	Route Type	Gallons/Mile	Salt-lbs./mile	\$/Service Mile
Fort Wayne	12/31/2012	0.5	25-5-201	28	Liquid	37	42	7.28
Fort Wayne	12/31/2012	0.5	25-1-202	28	Salt	NA	72	5.78
Chesterton	1/25/2013	0.75	41-6-1	26	Liquid	21	24	4.6
Chesterton	1/25/2013	0.75	41-3-6	26	Salt	NA	167	7.20
Chesterton	1/24/2013	1	41-6-1	10	Liquid	19	22	3.88
Chesterton	1/24/2013	1	41-3-6	10	Salt	NA	296	11.16
Winamac	12/28/2012	1	46-1-3	31	Liquid	14	16	2.40
Winamac	12/28/2012	1	46-1-1	31	Salt	NA	74	4.30
Winamac	2/2/2013	2	46-1-3	16	Liquid	48	112	7.21
Winamac	2/2/2013	2	46-1-1	16	Salt	NA	120	5.94
Winamac	12/26/2013	3	46-1-3	28	Liquid	52	120	7.42
Winamac	12/26/2012	3	46-1-1	28	Salt	NA	112	5.58
Chesterton	2/4/2013	4	41-6-1	25	Liquid	10	30	5.10
Chesterton	2/4/2013	4	41-3-6	25	Salt	NA	122	11.44
Winamac	3/24–25/2013	5	46-1-4	35	Liquid	26	61	6.91
Winamac	3/24–25/2013	5	46-1-1	35	Salt	NA	99	5.2
Fort Wayne	3/5/2013	9.5	25-2-201	30	Liquid	7	38	4.00
Fort Wayne	3/5/2013	9.5	25-1-202	30	Salt	NA	931	36.68
Chesterton	3/5/2013	9	41-6-1	28	Liquid	15	44	2.7
Chesterton	3/5/2013	9	41-3-6	28	Salt	NA	50	2.6

TABLE 4.5
Economical Route Type per Period

Bi-weekly Period and Weather Events	Liquid Route Cost Range	Salt Route Cost Range	Liquid Route	Salt Route
12/10/2012 – 12/23/2012 Lake effect events and 1 snow event	\$3.45–\$11.15	\$4.82–\$10.52	4	2
12/24/2012 – 1/6/2013 Lake effect events and 3 snow events	\$6.65–\$10.17	\$5.81–\$10.66	2	4
1/7/2013 – 1/20/2013 2 light snow events	\$3.27–\$6.73	\$4.21–\$7.89	2	2
1/21/2013 – 2/3/2013 Lake effect and light snow events	\$5.98–\$12.21	\$6.37–\$12.14	4	2
2/4/2013 – 2/16/2013 Lake effect events and light snow events	\$5.51–\$7.50	\$5.08–\$14.68	4	1
2/17/2013 – 3/2/2013 Lake effect events and 2 sleet and freezing rain events	\$4.27–\$10.75	\$6.32–\$12.00	4	0
3/3/2013 – 3/16/2013 Lake effect event and 1 snow event (1–10")	\$5.99–\$11.71	\$6.94–\$18.84	4	2
3/17/2013 – 3/30/2013 1 heavy snow event	\$5.96–\$11.12	\$4.32–\$10.94	2	4
Totals	\$3.27–\$12.21	\$4.21–\$14.68	26	17

5. CONCLUSIONS

Study data collected during two winter seasons, 2011–2012 and 2012–2013, produced some interesting findings. These findings are:

- On the one interstate route on I-94, the approach of alternating between brine and salt treatments was considerably lower than an all salt route. This approach should be considered for interstate routes.
- Brine making equipment and handling costs influence its unit cost. Best practices should be documented and delivered at the annual fall training event.
- Liquid routes have a smaller cost range variance, indicating that it may be easier to control material distribution rates.
- Liquid routes are economical more times in a direct comparison with salt routes.
- When normal distribution rates are used, liquid (20–40 gallons/mile), salt (#200–#250/mile); liquid routes are more economical in all weather event types and when pavement temperatures are higher than single digit temperatures. Lower pavement temperature analysis could not be performed.
- LaPorte District had lower unit costs for brine and salt routes. Best practices should be documented and presented at the fall training event.
- The combo unit in the Greenfield district cost over \$14,000 in material costs to fabricate and install. Its unit costs were within the range of the brine and salt unit costs experienced in Greenfield District. Driver endorsement was lukewarm. In lieu of a combo unit it may be more economical to use the approach of alternating between salt and liquid treatments on a route.
- The LaPorte District has the most economical brine routes. These route characteristics should be used when designing other brine routes.
- The online After Action website proved to be very useful for managers in Winter Operations. A mobile version for smart phones is recommended for the 2013–2014 winter season.

APPENDIX A. 2011–2012 WINTER WEATHER EVENTS

November 29–30, 2011

Day started off with rain turning into snow around 10:00 am in south central part of the state and moving northeast. Air temperatures started in the upper 30's and dropped into the low thirties by early evening and then rose in the afternoon. Heavy, wet snow. Ground temperatures above 32.

The snow started around 11 am in SW Indiana and spread across most of the state. It exited the state in a west to east direction and finally exited around 4 am on the 30th.

Northwest Indiana did not receive snow according to radar images.

The Fort Wayne District had more than 10 inches of snow and it caused them major problems.

There was a lot of moisture from rain and wet snow throughout the 29th. The night of the 29th and early morning on the 30th some of this moisture froze. See RWIS images on the 30th.

This storm cost \$500,000 in materials.

December 8–9, 2011

Light snow event across northern Indiana. Entered northern part of the state around 9:00 pm on the 8th and moved eastward across the state. Exited the state the afternoon of the 9th. The system moved west to east. Most of the accumulation occurred north of Indianapolis and were small amounts, from 1 to 3 inches. Need to verify with weather stations.

December 17, 2011

Light snow event in the morning across the northern part above Indianapolis. Fort Wayne and South Bend recorded snow accumulations. Gary did not report snow. Lafayette had a dusting.

MDSS radar did not record any winter weather.

December 27, 2011

Heavy event from 2 ~ 3 am, warm temperature so snow does not accumulated. It will be snowy all morning. Soon snow will stop this afternoon. By 8 pm about 1 inch of snow had fallen, other parts of the state will have between 2–4 inches of snow.

January 2, 2012

Overall light snow and windy so not accumulated. Light snow and freezing fog on South bend. Wind from N-NW created a big lake effect event across a large portion of the state.

January 12, 2012

Event started around 8:30 AM in SW part of state as an ice event, then snow started in Lafayette around 11 and continued off and on throughout the rest of 1/2012. Snow was scattered throughout the state. In Lafayette received approx. 3 inches of snow. Snow scattered throughout the state.

January 13, 2012

Scattered snow showers around the state with small accumulations. Lake effect snow in NW and northern counties.

January 17, 2012

Afternoon light snow around the state with small accumulations. See radar for locations.

January 18, 2012

After 6 pm, light snow events in north western area with small accumulations.

January 19, 2012

From the northwest area, heavy snow weather moves to southeast area. Snow accumulation of an inch.

January 20, 2012

Snow events about 0.5 inch in northern area.

January 21, 2012

By the early morning Snow events still effects northern area.

January 25, 2012

Ice and snow event across the northern half of the state. Started around noon and turned to rain during the evening hours.

January 27–28, 2012

Light snow event across northern half of the state. Started evening of the 27th and exited the state by noon on the 28th. The event moved west to east. Snow accumulations were less than 1 inch.

January 29, 2012

Light snow event across North central and NW. Started at 9 am and exited by 5 pm. Accumulations only recorded at South Bend and Fort Wayne.

February 4, 2012

Snow event in the morning across NE Indiana. Fort Wayne had 6 inches that started around 3 am and ended by mid-morning.

February 8, 2012

Light snow across portions of Indiana. Amounts less than 1 inch.

February 10, 2012

Light snow event across Indiana. Started around 8 am in the morning.

February 11, 2012

Light snow event continuing across the state. A lake effect event started around midnight and spread across NW Indiana and then moved across the northern part of the state toward Fort Wayne and dissipated around 5 pm. We received anywhere from half an inch to 3 inches from this storm while the lake effect band from Lake Michigan down to Indianapolis have seen totals from 4 inches to the south to near 12 inches to the north.

February 14, 2012

Statewide snow event that started in the SW and moved across the state. Started the evening of the 13th and produced amounts of

1–4 inches in various locations. Exited the state in the morning. Lafayette had 1–2 inches.

February 17, 2012

Small lake effect event in north in the morning. Trace amounts recorded. MDSS radar imagery shows no precipitation.

February 21, 2012

Small lake effect event. Trace amounts.

February 24, 2012

As we start the end of the work week we have 97 trucks being reported out as moderate snow has moved into the LaPorte District with temperatures in the mid to low 30's. We also have light snow being reported in the Fort Wayne District in Angola. Predicted snow amounts have been reduced to 2 to 4 inches across the north and tapering south to ½ an inch in northern Crawfordsville and Greenfield Districts as this system passes through. The main impact of moderate snow will be from now through early afternoon but light snow showers will continue to be persistent into the overnight hours and into tomorrow morning across the north. Temperatures will slightly rise today before falling tonight into the low to mid 20's across the north and upper 20's to low 30's in the southern regions.

March 4, 2012

5:00 PM. We have a narrow band of snow to our west that will bring rain and snow across the southern third of the state. At

this time it looks like Terre Haute will be the north edge with ½ an inch total accumulation of snow and Evansville will be on the south edge with also ½ an inch. Vincennes will see around 2¼ inches. On the east side Columbus will be the north edge with ¼ inch, Seymour with 1 inch and Corydon could see a little over 3 inches. Timing appears that the system will move into the western sections between 6 and 7 pm and stretch all the way across the southern section by 8:30 pm. Surface temperatures at this hour are in the 60's and are not expected to drop below freezing until after midnight as air temperatures drop into the upper 20's across the south. The main bulk of the snow is expected between 9 pm and 8 am throughout the overnight hours.

The northern half will continue to see scattered snow showers with little to no accumulation. The extreme northeastern section could see ½ an inch and the northwest could see lake effect develop early Monday morning.

Indianapolis area. Trace amounts 9 am–3 pm and 11 pm into the next day.

7:30 PM. We also have light snow now in Gary as the lake effect begins to form. In the north we have an air temperature of 32 with a surface temperature of 36 degrees.

March 5, 2012

7:30 AM. With temperatures in the mid to upper 20's we find that the southern system has exited the state as temperatures will rise into the 40's with mainly sunny skies. The northern region and east central region will continue to see the widely scattered snow showers for a bit longer. It still appears the lake effect snow will bring an additional inch to the northern section before ending this afternoon.

Indianapolis area. Trace amounts midnight to 9 am.

APPENDIX B. 2012–2013 WINTER WEATHER EVENTS*

December 10, 2012

Lake effect event in Northern Indiana. Overnight the lake effect snow in LaPorte District spread to the east and to the south affecting the roads in the Fort Wayne and Greenfield Districts after midnight. Overall LaPorte had 35 drivers in, Fort Wayne had 12 drivers in, and Greenfield had 13 drivers in. There were some traffic accidents reported due to the weather overnight. No other issues were reported.

December 20–21, 2012

12/20: 10:29 PM. The past two hours conditions continue to approach the mark that winter hazards could increase on our roadways as temperatures continue to plummet into the 20's. We have had reports of downed trees and debris on the roadway from the strong winds as well. Our current truck out total has nearly doubled since the previous report to 430 and will increase more after midnight. Blowing snow has already begun to become an issue and we will continue to see new snow over the night time hours before ending toward morning. However, the lake effect snow will continue in the northern and eastern districts into the day tomorrow. I have attached a map for tomorrow's predicted snowfall amounts. Daytime highs will only reach the upper 20's to near 30 degrees. Winds are expected to decrease around noon in the southern region but will continue to be strong across the northern region.

12/21: 8:00 AM. At this hour we are reporting 606 trucks out with an air temperature of 25 degrees and surface at 28 degrees. The winds are still a factor with sustained winds at 15 to 20 mph with gusts at 40 mph. Across the state, overall snow amounts range from a trace to 4 inches but the wind has really moved it around making it hard to tell. At this hour we have 3 closures reported:

- I-69 @ 256 MM
- I-65 @ 36.5 MM NBL
- US 231 @ US 40

Overnight we had 4 other closures now open:

- I-74 @ 149 MM
- I-69 @ 25 MM
- I-65 @ 146 MM
- I-65 @ 154 MM

We are on the back side of the low and will see most of the snow exit the state this morning but a few lake effect bands are expected to continue across the northern districts.

December 25–26, 2012

Lake effect event. The lake effect snow that we were receiving this morning in the LaPorte District has now shifted into Illinois and crews are planning to finish up within the hour. Winds are expected to continue from the northeast throughout the day and so further lake effect snow is not expected today. This is the final report for this winter event

* * *

The following is the email from Phil Ivy issued at 12/25/2012 8:32 am.

At this hour we are getting some light lake effect snow in the LaPorte District that is affecting the LaPorte and Gary Subs. This is a small band and is expected to shift over into Illinois. Currently we have 6 trucks deployed for this event.

I wanted to give everyone some timelines so they can begin planning. So in using the current models I am providing the following. Please keep me in mind that these can change but these should get you in the ball park for planning purposes. We are expecting temperatures in the south to be in the 30's and 20's to the north for this event. Winds will be sustained at 25 to 30 mph with 40 and 50 mph gusts. Duration is 6 to 8 hours of the main snow fall with rates reaching 1 inch an hour in the heavier snowfall regions. Ice could be a major concern in the southeastern subs. This is enough ice to result in downed tree limbs and downed power lines.

Before midnight tonight

- Evansville Sub starting at 11 pm to 12 am snow forecasted total accumulation of 6 to 9 inches
- Tell City Sub starting at 11 pm to 12 am mix possible 0.25 to 0.5 inches of ice and 1 to 2 inches of snow
- Falls City Sub starting at 11 pm to 12 am mix possible 0.25 to 0.5 inches of ice and 1 to 2 inches of snow

After midnight tonight

- Madison Sub starting at 12 am to 1 am mix possible 0.25 to 0.5 inches of ice and 1 to 2 inches of snow
- Vincennes Sub starting at 12 am to 1 am snow forecasted total accumulation of 6 to 9 inches
- Paoli Sub starting at 12 am to 1 am snow forecasted total accumulation of 6 to 9 inches
- Linton Sub starting at 1 am to 2 am snow forecasted total accumulation of 6 to 9 inches
- Bloomington Sub at 1 am to 2 am snow forecasted total accumulation of 6 to 9 inches
- Columbus Sub starting at 1 am to 2 am snow forecasted accumulation of 4 to 6 inches
- Aurora Sub starting at 2 am to 3 am snow forecasted accumulation of 4 to 6 inches
- Terre Haute Sub starting at 2 am to 3 am snow forecasted accumulation of 4 to 6 inches
- Cloverdale Sub starting at 1 am to 2 am snow forecasted total accumulation of 6 to 9 inches
- Indianapolis Sub starting at 1 am to 2 am snow forecasted total accumulation of 6 to 9 inches
- Greenfield Sub starting at 2 am to 3 am snow forecasted total accumulation of 6 to 9 inches
- Cambridge City Sub starting at 2 am to 3 am snow forecasted total accumulation of 6 to 9 inches
- Fowler Sub starting at 4 am to 5 am snow forecasted total accumulation of 2 to 4 inches
- Crawfordsville Sub starting at 4 am to 5 am snow forecasted total accumulation of 2 to 4 inches
- Frankfort Sub starting at 4 am 5 am snow forecasted total accumulation of 2 to 4 inches
- Tipton Sub starting at 3 am to 4 am snow forecasted total accumulation of 5 to 8 inches
- Albany Sub starting at 4 am to 5 am snow forecasted total accumulation of 5 to 8 inches
- Rensselaer Sub starting at 5 am to 6 am snow forecasted total accumulation of 1 to 2 inches
- Monticello Sub starting at 4 am to 5 am snow forecasted total accumulation of 2 to 4 inches
- Wabash Sub starting at 5 am to 6 am snow forecasted total accumulation of 3 to 5 inches
- Bluffton Sub starting at 4 am to 5 am snow forecasted total accumulation of 6 to 8 inches
- Winamac Sub starting at 8 am to 9 am snow forecasted total accumulation of 1 to 2 inches
- Fort Wayne Sub starting at 6 am to 7 am snow forecasted total accumulation of 3 to 5 inches
- Gary Sub starting at 12 pm to 1 pm snow forecasted total accumulation of 1 to 2 inches
- LaPorte Sub starting at 12 pm to 1 pm snow forecasted total accumulation of 1 to 2 inches

*Compiled from Phil Ivy's email messages.

- Plymouth Sub starting at 11 am to 12 pm snow forecasted total accumulation of 1 to 2 inches
- Elkhart Sub starting at 10 am to 11 am snow forecasted total accumulation of 2 to 3 inches
- Angola Sub starting at 9 am to 10 am snow forecasted total accumulation of 3 to 5 inches

12/26: 7:45 AM. The storm has arrived and we have blizzard conditions being reported in the Vincennes District and this storm continues to push to the north and east. Knox County has declared a snow emergency. You can check the counties listed by accessing the WebEOC or IDHS home page. So far the storm is tracking and producing just as forecasted as winds have become a major factor already. I have not had any reports of roads being closed or received any reports of accidents. We have had four plow trucks off into the ditch in Knox County where we are seeing the heaviest snow thus far with 6 inches plus being reported. No personnel issues have been reported and no equipment issues. We have transferred 7 heavy duty trucks and plows from LaPorte and staged them in Indianapolis. They are being deployed as needed. We have 641 trucks being reported as out:

- Crawfordsville – 112
- Fort Wayne – 54
- Greenfield – 177
- LaPorte – 7
- Seymour – 147
- Vincennes – 144

12/26: 12:28 PM. At this hour we are reporting 702 trucks out across the state I will give information as follows:

- Crawfordsville – 119 trucks out – snowfall totals are 1 inch northwest end and 7 inches southeast – Closures on I-74 and I-65 – no personnel issues or equipment issues – drifting is an issue but all roads are passable
- Fort Wayne – 129 trucks out – all roads are snow covered with 1 inch to the northwest and 4 inches to the southeast – no closures – no personnel issues – some equipment issues but working on them – drifting is becoming a problem – all roads are passable
- Greenfield – 177 trucks out – 2½ inches in the northwest and 5 inches to the southeast – no closures at this time – no personnel or equipment issues – one plow truck struck by a semi but no injuries – drifting is an issue – all roads are passable
- LaPorte – 85 trucks out – 1 to 2 inches of snow – no issues at this time
- Seymour – 147 trucks out – heavy snow and drifting is an issue
- Vincennes – 141 trucks out – 4 inches of snow to the northwest with heavy snow to the south – no closures at this time – no personnel issues or equipment issues – some plow truck slide offs earlier – drifting is an issue – all roads are passable
- Hoosier Helpers have 1 working in Falls City – 4 working in Gary – 5 working in Indianapolis
- Knox and Daviess counties have declared snow emergencies

Radar indicates that we still will receive additional snowfall as the system moves to the east and we will see wrap around snow and the winds will continue to be an issue into the night time hours. I will report again around 4:00 pm. Please let me know if you need any assistance, have any questions, suggestions, or comments.

12/26: 4:18 PM. At this hour the main storm has moved to our east and we now have wrap around snowfall that could range from a ½ and inch to 2 inches tonight. We also have the possibility of seeing some lake effect snow as the winds shift. I have attached three screen shots from MDSS that show snowfall totals from 8 am, 2 pm, and the current observed totals. We range from a dusting in the northwest to 10 and 12 inches through our south central region. We may also have some freezing drizzle as

we get into the evening and night time hours across the state. Winds will continue to decrease tonight except for the northeast and east central regions where blowing snow will continue to be an issue. We have had some trouble mainly with the ramps around the Indianapolis area. At this time I have no roads reported as closed. A few have reported some truck issues but they have stated that repairs are being made and they expect most to be done yet today. No major personnel issues have been reported. We did have a couple of snowplow trucks struck in the Greenfield District by POV with minimal damage to the plow trucks. Greenfield District also shifted drivers and trucks from the Tipton Sub to help out around Indianapolis with all the ramps. No injuries have been reported. We currently have 770 trucks out across the state:

- Crawfordsville – 144
- Fort Wayne – 138
- Greenfield – 177
- LaPorte – 73
- Seymour – 147
- Vincennes – 130

12/26: 8:21 PM. At this hour we have air temperatures in the upper 20's to low 30's and surface temperatures are about the same which means we can still have good melting action with materials being applied going into the overnight hours. Winds currently are north northwest at 10 to 15 mph sustained with 20 to 25 mph gusts. Most have indicated that they plan to continue shift work throughout the night. The Tell City Sub is the only Sub that has reported that they have shut down operations. No accidents or injuries have been reported. No personnel issues reported. Minor equipment issues have been reported but are not an immediate problem. Currently we have SR 550 closed in the Vincennes District due to an overturned semi. We currently are reporting 751 trucks deployed:

- Crawfordsville – 143
- Fort Wayne – 120
- Greenfield – 177
- LaPorte – 93
- Seymour – 120
- Vincennes – 98

At this time it appears that we are making improvements but we still have hard pack areas from the blowing and drifting. I will report again tomorrow morning and hopefully with plans in sight that indicates the final cleanup operations have begun. As always if you need any assistance, have any questions, suggestions, or comments please let me know.

See 12/26/2012 radar images.

December 27, 2012

Light lake effect event in LaPorte.

December 28–29, 2012

12/28: 8:45 AM email from Phil Ivy. We currently have light snow being reported in the LaPorte District. I have attached some projected weather maps from Meridian Environmental and from Weather Underground. By this afternoon we will see light rain begin in the southwest. The precipitation will spread across the southern and central districts into the evening hours. We could see some mix before the changeover to all snow. Light snowfall will continue on and off throughout the period in the northwest during the day and overnight with lake effect snow starting tomorrow. Snow will taper off from west to east during the early morning hours on Saturday when we could see some freezing drizzle. We are looking at 1 to 3 inches with the possibility of up to 4 inches in the southeast.

12/28: 3:55 PM email from Phil Ivy. We will now focus on the approaching storm system that is heading towards us at this hour.

I have attached screen shots from Meridian Environmental MDSS that show a projection of the coverage area for tonight's storm. This storm is expected to start along the Ohio River as rain this afternoon and could change to a period of mix before becoming all snow by early evening. Temperatures will start off in the low 30's to upper 20's across the state and surface temperatures will be in the 20's and 30's as well during this event which will allow material to work well. Wind is not expected to be an issue. Tomorrow we expect some lake effect snow but should be no more than an inch in the band area. Overall accumulations predicted are as follows:

- Crawfordsville – ½ an inch northwest and 3 inches southeast
- Fort Wayne – ½ an inch northwest and 3 inches southeast
- Greenfield – 3 inches northwest and 6 inches southeast
- LaPorte – ½ an inch with an additional 1 inch lake effect band
- Seymour – 3 inches west and 6 inches east
- Vincennes – 2 inches northwest corner and 3 inches rest of district

Currently radar indicates that this storm is in southern Illinois and we will be affected within the next 2 to 3 hours.

12/29: 2:30 AM email from Phil Ivy. At this hour the snow continues to fall with the heaviest band from Sullivan to Portland where we have around 6 inches on the ground. Air and surface temperatures are in the upper 20's to low 30's so materials are still able to work well. At this hour we have 566 trucks reported out across the state:

Snow will taper off by daylight as it continues to move out of the state. Temperatures will continue to fall throughout the day as we dip down into the teens and lower 20's tonight. Winds today are forecasted to pick up out of the west northwest at 15 to 20 mph which could cause some drifting. Then this evening we expect some lake effect snow to startup with 1 to 2 inches of accumulation in the northern region. I have attached two screen shots from Meridian Environmental MDSS. The first shows the observed snowfall thus far across the state. The other shows the projected lake effect snow at 8:00 pm tonight. I will update again by 12:00 noon today.

12/29: 11:45 PM. Overall we received anywhere from flurries to 6 inches across the state. Crews are continuing to make progress as many have begun reducing and cutting back to patrols. We will see some lingering light snow across the state but no additional accumulation for the most part. We are seeing some lake effect across the northern region and that area could see accumulating snow and we could have some wrap around along the Ohio border in our central and southern region tonight that could also see some accumulating snow.

December 31, 2012

8:51 AM. At this hour we find that we have 91 trucks out across the state that are anti-icing or plowing back some drifts from the west southwest wind that is sustained at 15 to 20 mph with 25 mph gust that is coming in ahead of the approaching storm. I have attached a Winter Weather Advisory that was issued by the NWS forecasting 2 to 4 inches of snow and for wind chills near 0 degrees by Tuesday evening as the cold front pushes through behind this storm. I also have attached screen shots of forecasted projections as the day progresses from Meridian Environmental MDSS. The main precipitation period for this storm will be from 1:00 pm today through 1:00 am tonight.

3:20 PM. At this hour we have several counties under a Winter Weather Advisory issued by the NWS until 7 am Tuesday morning. We are expecting 2 to 4 inches across south central Indiana with 1 to 2 inches north of the I-70 corridor. We could see periods of freezing rain and wintery mix mainly south of US 50.

We have crews out all across the state and we currently have 508 trucks reported out:

- Crawfordsville – 73
- Fort Wayne – 20

- Greenfield – 166
- LaPorte – 60
- Seymour – 94
- Vincennes – 65

Temperatures will slowly fall into the 20's tonight with 15 to 20 mph winds. We will see a lull in the snow activity this evening before another wave continues into Tuesday morning.

January 13, 2013

Ice and light snow event across the northern half of the state.

3:17 PM. We are now receiving some significant ice across areas of the state. SR 912 in East Chicago has been closed due to ice. South of Terre Haute I have observed ice building up on tree branches and power lines which could result in down power lines and tree limbs across the roadway. Please remind your crews that extra care is necessary for overhead hazards in freezing rain conditions as well as icing pavements. Remind them to always investigate for downed power lines with trees and tree limbs. Currently we have 99 trucks out.

January 15, 2013

At this hour we have 9 trucks out patrolling as precipitation threatens to enter our state from the south along the Ohio River region. Our plan is to patrol and treat trouble spots as needed throughout the night. Additional crew members have been notified and are ready to report should it become necessary. I have attached forecast maps from Meridian Environmental. We have received reports of sleet falling in the Derby area. No accidents and no issues are being reported at this time.

8:00 AM. At this hour we have 19 trucks reported out in the Vincennes District and reports that the Falls City Sub is going to a full call-out due to the southern storm system lifting to the north bringing a wintery mix. A narrow band has the potential of shifting to the north and this area will see up to 0.60 inches of snow and 0.11 inches of ice. The counties currently affected or that could be affected are: Perry, Harrison, Crawford, Floyd, Dubois, Orange, Washington, Clark, Scott, Jefferson, and Switzerland. We will continue to monitor this storm and I will report again at 10:00 pm.

10:05 PM. At this hour we still have a wintery mix of freezing rain, sleet, and snow along the Ohio River and it appears that it will continue for a few more hours. At this time we have 54 trucks reported out:

- Evansville Sub – 4 (plans to shut down at 11:00 pm)
- Tell City Sub – 13
- Falls City Sub – 31
- Aurora Sub – 6

January 16, 2013

6:00 AM. At this hour we have 46 trucks reported out that have patrolled and treated the roads due to a southern storm that came across the Ohio River region with a wintery mix:

This storm has now ended and no precipitation is being reported or indicated on radar. We have the chance for some light wintery mix tonight along our northern border. I will be on the road today with meetings scheduled so I will not update until later this afternoon or early evening.

January 21, 2013

We are currently experiencing a few light snow squalls that are passing through our central region. We are seeing the lake effect snow beginning to become more active as well. Most will only see flurries to a dusting across the central regions. The northern

region in the lake effect area could see 1 to 4 inches with a few heavier pockets possible. At this time I have received communications from some of the subs in the LaPorte and Greenfield Districts of plans to have a patrol or to deploy trucks. We currently have 50 trucks deployed at this hour:

- Indianapolis Sub: 24
- Greenfield Sub: 10
- Tipton Sub: Patrol
- Cambridge City Sub: patrol
- Albany Sub: no action needed
- Gary Sub: patrol
- LaPorte Sub: 1 truck and a patrol
- Plymouth Sub: 16

4:00 PM. The snow squalls in our central region are passing on through the state however we could see a few scattered squalls and some blowing with the sustained 15 to 25 mph west/northwest wind that has also reported gusts at 35 mph. We are still seeing the lake effect snow staying active overnight into midday tomorrow. Parts of the central region have reported that 1 to 2 inches of snow has fallen in areas. The northern region with the lake effect area will see accumulations in the 1 to 4 inch range with the potential of a few heavier pockets near 6 inches. At this time I have received communications from Crawfordsville, Fort Wayne, Greenfield, LaPorte, Seymour, and the Vincennes Districts of plans to have a patrol, deploy trucks, or to monitor the weather conditions and call-out as needed. The Daily Activity Truck Report indicates that we have 36 trucks deployed at this hour:

- Crawfordsville – 2
- Fort Wayne – 2 plus a patrol
- Greenfield – 10
- LaPorte – 22
- Seymour – 0
- Vincennes – 0

9:00 PM. We are still expecting the lake effect snow to stay active during the overnight hours and into midday tomorrow. Parts of the central region have reported that 1 to 2 inches of snow had fallen in some of their areas. The northern region with the lake effect area will see additional accumulations of 1 to 2 inches during the overnight hours and into tomorrow. We currently have a 10 to 15 mph sustained west/northwest wind with 25 mph gusts that could cause some blowing snow issues. The Daily Activity Truck Report indicates that we have 14 trucks deployed at this hour:

- Crawfordsville – 0
- Fort Wayne – 0
- Greenfield – 0
- LaPorte – 14 (lake effect snow)
- Seymour – 0
- Vincennes – 0

January 22, 2013

Lake effect event.

6:30 AM. We are still expecting the lake effect snow to stay active with an inch an hour possible through midday today. We are then expecting the snow to become lighter but it will continue into tomorrow. The Daily Activity Truck Report indicates that we have 37 trucks deployed at this hour:

- Crawfordsville – 0
- Fort Wayne – 17 (lake effect snow)
- Greenfield – 0
- LaPorte – 20 (lake effect snow)
- Seymour – 0
- Vincennes – 0

5:00 PM. The lake effect snow is lighter but continues to stay active. We are now watching a weak frontal system that will enter the state from our northwest and sweep across the central region

with the possibility of 1 to 2 inches of snow tomorrow. I have attached projected radar maps from Meridian Environmental MDSS showing the projected track of this system. The Daily Activity Truck Report indicates that we currently have 34 trucks deployed at this hour:

- Crawfordsville – 0
- Fort Wayne – 9 (lake effect snow)
- Greenfield – 0
- LaPorte – 25 (lake effect snow)
- Seymour – 0
- Vincennes – 0

January 23, 2013

Light snow event.

3:00 PM. Current radar and reports indicate that we have light snow across the north central region and additional light bands to our west in Illinois. This system will slowly move across the state but so far the amount of moisture associated with this system has been very light. After midnight it does appear that this will cause a shift in the winds and allow the lake effect band to become active again and into tomorrow. Winds are expected to shift overnight to the northeast which will move these bands to the west. We will continue to watch and monitor these weather events and report as details become available. I have attached some projected forecast maps from Weather Underground. Crews are monitoring the weather and we have a few patrols planned this evening and during the overnight. At this hour we have 17 trucks reported on winter activities:

- Crawfordsville – 3
- Fort Wayne – 2
- Greenfield – 0
- LaPorte – 8
- Seymour – 3
- Vincennes – 1

7:30 PM. At this time we still have some light snow showers and flurries stretching from Lafayette to Muncie that is mainly just blowing around with no accumulation. We have some light lake effect snow at this time and it is expected to intensify after midnight especially in the LaPorte County as winds shift to a north/northeast wind. We will continue to watch and monitor these weather events and report as details become available. Crews are monitoring the weather and we have a few patrols planned this evening and during the overnight. At this hour we have 20 trucks reported out on winter activities:

- Crawfordsville – 0
- Fort Wayne – 9
- Greenfield – 4
- LaPorte – 7
- Seymour – 0
- Vincennes – 0

9:00 PM. The lake effect band has started earlier than we anticipated. We currently have 56 trucks out and this number could increase over night depending on the movement of the bands. Current predictions are showing accumulations in the 3 to 6 inch range.

- Fort Wayne – 21
- LaPorte – 35

January 24, 2013

Lake effect event.

7:30 AM. The lake effect snow at this hour is still active in the LaPorte District but overnight it managed to affect both Fort

Wayne and the Greenfield Districts. At this hour we have the 158 trucks out:

- Crawfordsville – 0
- Fort Wayne – 44
- Greenfield – 32
- LaPorte – 82
- Seymour – 0
- Vincennes – 0

January 25, 2013

Light snow event.

8:00 AM. As we expected the light snow has moved in and has spread across the state. Total accumulations of 1 to 2 inches are in the forecast along the I-70 corridor and points north. We have had some reports of some light sleet and freezing rain along the Ohio River region. This system will pass through and exit the state this afternoon. We will then see the lake effect snow bands redevelop and continue into tomorrow morning. At this hour we have 677 trucks out across the state:

- Crawfordsville – 118
- Fort Wayne – 76
- Greenfield – 171
- LaPorte – 125
- Seymour – 109
- Vincennes – 78

January 27, 2013

Freezing rain event.

8:18 AM. I have attached several projected maps and timelines from Meridian Environmental MDSS, Purdue Extreme Weather Makers, and Weather Underground. Yesterday models were indicating the precipitation to begin by 2:30 pm. New models forecast that we could see precipitation around 10:00 am. I have listed projected timelines for frozen precipitation for each sub district below:

Crawfordsville District

- Terre Haute Sub – 12 to 3
- Fowler Sub – 12 to 6
- Crawfordsville Sub – 12 to 4
- Frankfort Sub – 2 to 8
- Cloverdale Sub – 12 to 5

Fort Wayne District

- Wabash Sub – 2 to 10
- Bluffton Sub – 2 to 10
- Fort Wayne Sub – 2 to 11
- Elkhart Sub – 2 to 11
- Angola Sub – 2 to 12

Greenfield District

- Indianapolis Sub – 1 to 7
- Greenfield Sub – 1 to 8
- Cambridge City Sub – 2 to 8
- Tipton Sub – 1 to 9
- Albany Sub – 2 to 10

LaPorte District

- LaPorte Sub – 1 to 11
- Monticello Sub – 12 to 9
- Rensselaer Sub – 11 to 8
- Winamac Sub – 12 to 10
- Gary Sub – 12 to 9

- Plymouth Sub – 1 to 11

Seymour District

- Aurora Sub – 2 to 7
- Bloomington Sub – 12 to 3
- Columbus Sub – 1 to 6
- Falls City Sub – 12 to 1
- Madison Sub – 1 to 3

Vincennes District

- Linton Sub – 10 to 2
- Evansville Sub – 10 to 11
- Paoli Sub – 11 to 2
- Tell City Sub – 12 to 2
- Vincennes Sub – 11 to 2

We need to make sure that as we deploy crews that we remind them of the hazards of an ice storm such as slips, trips, and falls, and the overhead hazards that we could experience from downed tree limbs and power lines. We will continue to watch and report as this winter storm impacts our state transportation system. Yesterday Seymour had a conference call to establish plans for today's storm and the media group communicated plans for statewide news releases for INDOT. The LaPorte District has started communicating their plans for this event. I expect that more will begin communicating the plan this morning. Let me know if you need any assistance, have any questions, suggestions, or comments.

5:42 PM. At this hour radar continues to show snow, freezing rain, and rain. I have attached current air and surface temperature ranges from Scan Web. Air range is 30 degrees to 40 degrees and surface is ranging 30 to 42 degrees. I have received communications of rain, sleet and freezing rain from the following subs:

- LaPorte Sub
- Monticello Sub
- Winamac Sub
- Rensselaer Sub
- Plymouth Sub

We have 372 trucks reported out across the state at this time as follows:

- Crawfordsville – 22
- Fort Wayne – 113
- Greenfield – 71
- LaPorte – 118
- Seymour – 0
- Vincennes – 0

I have not received any reports of accidents or issues at this time. We will continue to monitor this storm and the impact that it has on our transportation system. I will report again around 10:00 pm. I would like to have communications from the districts by 9:00 pm prior to this next report. Let me know if you need any assistance, have any questions, suggestions, or comments.

10:05 PM. We continue to see wide spread rain with air and surface temperatures in the 40's to the south and around the 30 degree mark to the north and northeast. Temperatures are forecasted to rise tonight to above freezing statewide by midnight. At this hour we are reporting 323 trucks out across the state. Plans are as follows:

- Crawfordsville – Has 22 trucks out and have communicated plans of re-evaluating at midnight. Current plan is to reduce to at least 15 at midnight.
- Fort Wayne – Has 124 trucks out and have communicated plans of reducing or shutting down by midnight if conditions will allow.
- Greenfield – Has 30 trucks out and have communicated plans of reducing or shutting down by midnight if conditions will allow.

- LaPorte – Has 147 trucks out and have communicated plans of reducing or shutting down by midnight if conditions will allow.
- Seymour – Has communicated that they have no trucks out.
- Vincennes – Has communicated that they have no trucks out.

I have not had any issues reported during this event and I anticipate that we will scale back to just patrols after midnight. We will continue to monitor the future weather that could impact us this week. If you need any assistance, have any questions, suggestions, or comments please let me know.

The icing predicted never really materialized.

January 31, 2013

Scattered snow showers across the state. Had major accident on I-70 west of Indianapolis which created a 6 hour closure and on I-65 near Frankfort which closed southbound for several hours.

8:24 AM. We will continue to see the scattered light snow showers throughout the day. Temperatures dropped into the teens and 20's across the state and will not warm much today. The winds are expected to stay strong at 10 to 15 mph sustained with 30 mph gusts. A weak disturbance will push through the south late this afternoon into early evening increasing the chances for light snow across the south. Light accumulation to a dusting is expected. Lake effect snow will be a factor as well.

At this hour we have 172 trucks reported out:

- Crawfordsville – 8
- Fort Wayne – 60
- Greenfield – 40
- LaPorte – 43
- Seymour – 15
- Vincennes – 6
- Hoosier Helpers – 11

9:00 PM. Today we have experienced very deceitful weather. Across the state we have had snow squalls with white out conditions and sunny skies that warmed the pavement enough to allow the snow that fell to melt and then freeze on the pavement as cold air pockets passed through with these squalls. This pattern resulted in a pile up on I-70 west of Indianapolis this afternoon. Then we had the southern system come through this evening and again the roads still retained enough heat to allow the roads to become wet before becoming a layer of black ice which resulted in several more accidents across our southern region.

With very gusty winds and light snow across the south we have 365 trucks reported out:

- Crawfordsville – 20
- Fort Wayne – 36
- Greenfield – 86
- LaPorte – 28
- Seymour – 103
- Vincennes – 92
- Hoosier Helpers – Regular crews working

We are expecting the lake effect snow to start back up with an additional 1 to 3 inches possible. The southern storm should exit the state by midnight. However blowing snow will be a factor anywhere we have snow on the ground tonight as temperatures plummet into single digits. We are expecting another system tomorrow evening into Saturday that could bring us accumulating snow. I will report again tomorrow morning by 8:00 am. Let me know if you need any assistance, have any questions, suggestions, or comments.

February 1–2, 2013

8:12 AM. We start today with single digits for much of the state and below 0 wind chills as winds continue at 10 to 15 mph

with 25 mph gusts we will see blowing snow most of the day but winds are forecasted to decrease this afternoon. Temperatures will be slow to rise today as we watch the next clipper system approach that will affect us tonight and into tomorrow. I have attached projected radar images from Meridian Environmental MDSS for tonight. At this time we are expecting snow to enter the state around 10:00 pm and intensify in coverage by 4:00 am with 1 to 3 inches of snow accumulation expected.

At this hour we have 345 trucks reported out across the state:

- Crawfordsville – 0
- Fort Wayne – 16
- Greenfield – 55
- LaPorte – 53
- Seymour – 112
- Vincennes – 109
- Hoosier Helpers – Working normal shift work

8:14 AM. We are seeing some of the steady snow beginning to clear out in areas but we can expect to see periods of scattered snow and wintery mix during the rest of the day and into tonight as this system moves through. We will continue to see the chance for the lake effect snow. At this hour we have 871 trucks reported out across the state:

- Crawfordsville – 110
- Fort Wayne – 142
- Greenfield – 175
- LaPorte – 142
- Seymour – 137
- Vincennes – 108

1:41 PM. We currently have scattered snow showers across the state and we expect this pattern to continue throughout the day and into the overnight. We could see an additional inch in the north and east from these scattered snow showers. Another fast moving system will push through early tomorrow morning around 4:00 am across the southern region entering into the Vincennes District with the potential for another inch of accumulation. Winds tomorrow morning will become west/northwest and will increase which could cause the lake effect to redevelop and could cause a few blowing snow issues. We have another cold night in store with temperatures dropping into the teens and low 20's.

We have not had any issues or problems reported at this time. We currently have 548 trucks reported out across the state:

- Crawfordsville – 73
- Fort Wayne – 130
- Greenfield – 123
- LaPorte – 134
- Seymour – 86
- Vincennes – 2

5:11 PM. We still have areas of scattered snow showers across the state and we expect this pattern to continue into the overnight. We could see an additional inch in the north and east from these scattered snow showers. Another fast moving system will push through early tomorrow morning around 4:00 am across the southern region entering into the Vincennes District with the potential for another inch of accumulation. Winds tomorrow morning will become west/northwest and will increase which could cause the lake effect to redevelop and could cause a few blowing snow issues. We have another cold night in store with temperatures dropping into the teens and low 20's.

We have not had any issues or problems reported at this time. We currently have 429 trucks reported out across the state:

- Crawfordsville – 68
- Fort Wayne – 100
- Greenfield – 102
- LaPorte – 116
- Seymour – 41
- Vincennes – 2

9:00 PM. We continue to see the scattered light snow showers across the state and we expect this pattern to continue overnight and into the day tomorrow. We could see an additional inch in the north and east from these scattered snow showers as this system slowly moves to the south. Another fast moving system will push through after midnight tonight across the Vincennes and Seymour Districts with the potential for another inch of accumulation. Winds tomorrow morning will become west/northwest and will increase which could cause the lake effect to redevelop and could also cause a few blowing snow issues.

We have had a few truck issues but the shops have been doing a good job getting them back onto the road. We have not had any other issues or problems reported at this time. We currently have 283 trucks reported out across the state:

- Crawfordsville – 47
- Fort Wayne – 56
- Greenfield – 61
- LaPorte – 76
- Seymour – 41
- Vincennes – 2

February 3, 2013

8:28 AM. We continue to have these fast moving clipper systems with small cells that move quickly across the state but can cover up a road and leave an inch of snow. Winds are forecasted to increase this afternoon which could create some drifting issues. This pattern is expected to continue throughout the day and into tomorrow. Currently we have the following trucks reported out:

- Crawfordsville – 0
- Fort Wayne – 35
- Greenfield – 34
- LaPorte – 20
- Seymour – 55
- Vincennes – 89

12:18 PM. We continue to see these scattered snow storms across the state and total accumulations throughout the period continues to increase. We also are seeing lake effect snow and blowing snow concerns. At this hour we have 115 trucks reported out across the state:

- Crawfordsville – 23
- Fort Wayne – 29
- Greenfield – 0
- LaPorte – 52
- Seymour – 11
- Vincennes – 0

1:36 PM. As the scattered snow showers and lake effect snow continues we see the stage being set for a more organized clipper system that will sweep across northern Indiana around midnight. This system has the potential for significant snowfall in the 6 to 8 inch range with blowing and drifting issues as well. It appears that system is tracking to the north but parts of central Indiana will see some affects as well. The NWS has issued a Winter Weather Advisory for Lake and Porter Counties at this time. We will continue to monitor these systems and the track of these storms as we prepare and plan. Let me know if you need any assistance, have any questions, suggestions, or comments.

5:19 PM. The snow squalls and blowing snow continues to be a nuisance and this will be the case until around midnight when the next clipper begins to affect our northwest region. This system will bring us additional snow accumulation. I have attached a projected snowfall total and coverage map and the time line chart from the Purdue Extreme Weather Makers Team.

At this hour we have 90 trucks reported out across the state for isolated slick spots and blowing snow:

- Crawfordsville – 21

- Fort Wayne – 19
- Greenfield – 24
- LaPorte – 26
- Seymour – 0
- Vincennes – 0

11:10 PM. At this hour radar and RWIS systems indicate that snow is starting to move back into our northwest region as a clipper system is expected to drop down across the state tonight and into tomorrow. We are expecting 4 to 6 inches in our north which could see some higher pockets with the lake effect snow. Our central region could see 1 to 2 inches with only a dusting to ½ inch across the south if any at all especially in the southwest. Tomorrow afternoon we could see a period of freezing rain or a wintery mix across our central and southern regions. We currently have 41 trucks reported out and several have indicated plans for a patrol tonight. Currently:

- Crawfordsville – 0
- Fort Wayne – 21
- Greenfield – 2
- LaPorte – 10
- Seymour – 8
- Vincennes – 0

February 4, 2013

We currently have a clipper system pushing through the state with some areas reporting new snow in the 2 the 3 inch range across the northern region that fell overnight. This snow will continue to push east and south. We also could see areas of sleet and a wintery mix before changing to rain across the southern region. At this hour we have 275 trucks out:

- Crawfordsville – 9
- Fort Wayne – 126
- LaPorte – 106
- Seymour – 0
- Vincennes – 0

February 15, 2013

8:14 AM. We currently have snow reported in our northwest region. We will continue throughout the day to see scattered snow showers across the state with most only seeing a ½ inch to no accumulation. We could see widely scattered snow showers that pop up that can quickly reduce visibility. We are expecting lake effect snow across the north where we could see around 3 inches. The Ohio River could see some rain with a wintery mix push through today. At this hour we have 77 trucks out across the state:

- Crawfordsville – 2
- Fort Wayne – 16
- Greenfield – 11
- LaPorte – 47
- Seymour – 0
- Vincennes – 1
- Hoosier Helpers – Normal crews are scheduled and working

We will see the scattered snow activity continuing throughout the day but we should see some clearing tonight for most. The lake effect snow is expected to continue into the weekend. We will continue to monitor these systems and report as needed. If you need any assistance, have any questions, suggestions, or comments please let me know.

4:20 PM. At this hour we continue to see a few flurries and snow showers but these will gradually clear as we get into the evening hours. We are expecting the lake effect snow to start up tonight and continue into Sunday morning at this time. Along our northern border we could see 4 to 8 inches of snowfall by Sunday

morning. The remainder of the state should remain cool and dry throughout the weekend. Next week it appears that we could see a very active weather pattern that we will have to continue to watch and prepare for. We will continue to monitor all of these conditions and forecasts and report as needed. At this time we have 7 trucks out with 5 in the LaPorte District and 2 in the Fort Wayne District.

February 19, 2013

10:30 PM. We continue to see lake effect snow across the north and scattered snow showers in the central region. This pattern will continue into the overnight hours. The LaPorte, Plymouth and western sections of the Elkhart Sub Districts could see around 5 inches of snow. At this hour we have 60 trucks deployed:

- Crawfordsville – 0
- Fort Wayne – 26
- Greenfield – 6
- LaPorte – 28
- Seymour – 0
- Vincennes – 0

February 20, 2013

We continue to see lake effect snow across our northern border and we are expecting snow throughout the day with 2 to 4 inches of new accumulation mainly in LaPorte, Plymouth and the Elkhart Sub Districts. We are also watching our next storm approaching from our west that we will see arrive tomorrow. At this time we have 97 trucks reported out that are anti-icing and plowing in the lake effect region:

- Crawfordsville – 1
- Fort Wayne – 33
- Greenfield – 11
- LaPorte – 44
- Seymour – 5
- Vincennes – 3

February 21, 2013

Snow, sleet, freezing rain across the state. Started around 5:00 pm in the SW.

10:13 PM. The system slowly continues to lift to the northeast. At this hour we are seeing a few dry pockets with this storm but wide spread precipitation will continue tonight and into tomorrow before we change over to all rain. At this time temperatures are below the freezing mark across the state except in our southwest corner where we are seeing some of the warmer air trying to filter in. At this hour we have 645 trucks reported out across the state treating roads as necessary.

- Crawfordsville – 119 trucks out with snow north of I-74 sleet and freezing rain to the south
- Fort Wayne – 17 trucks out patrolling, the storm has not reached this district yet
- Greenfield – 178 trucks out with snow now north of I-70 with sleet and freezing rain south
- LaPorte – 87 trucks out with snow south of US 30 and patrols to the north
- Seymour – 145 trucks out with scattered freezing rain and sleet and some dry pockets
- Vincennes – 99 trucks out with rain in Evansville now, sleet and freezing rain along US 50 north and east of I-69

We will continue to monitor these conditions and report again tomorrow morning at 8:00 am. If you need any assistance, have any questions, suggestions, or comments please let me know.

February 26, 2013

8:16 AM. We have rain wide spread across the state with reports of sleet from Fowler, Monticello, and Rensselaer Sub Districts. I have attached projected radar images from Meridian Environmental for this Storm as the freeze line is expected to lift to the north and then drop back to the south overnight. We are also expecting very windy conditions today with sustained 15 to 20 mph winds with 35 mph gusts. At this hour we have 256 trucks reported out across the state:

- Crawfordsville – 44
- Fort Wayne – 41
- Greenfield – 77
- LaPorte – 94
- Seymour – 0
- Vincennes – 0
- Hoosier Helpers – Working normal scheduled work

No issues or problems have been reported at this time. We will continue to monitor this storm and report the movement of the freeze line every 4 hours throughout the day. If you need any assistance, have any questions, suggestions, or comments please let me know.

March 1, 2013

3:09 PM. We expect lake effect in the northwest to start up and continue into tomorrow. Temperatures currently in the 30's are expected to drop into the 20's for tonight. At this time we have 48 trucks reported out across the state.

March 5–6, 2013

Statewide snow event. Started in Lafayette around 3 pm on the 5th.

3/5: 11:05 PM. We continue to see snow across the state and the wind continues to create a few issues as well. We have received reports of a plow truck being rear ended in Tipton. Both truck and driver are ok. Then we had a plow struck in Plymouth with no damage or injuries for INDOT. We have had a few accidents and slide offs reported as well. Snowfall totals are reported from 1 inch to the south and 10 inches to the north with 3 to 6 inches for most. At this hour we have 821 trucks reported out:

- Crawfordsville – 123
- Fort Wayne – 133
- Greenfield – 173
- LaPorte – 154
- Seymour – 140
- Vincennes – 98

3/6: 5:54 AM. We find the main snow is pushing off to our east/southeast this morning with temperatures in the 20's and 30's. With overcast skies we could expect a few flurries and drizzle at times across the state. Temperatures are expected to rise a few degrees today but will mainly be cold and blustery with a 10 to 15 mph north/northwest wind gusting at 30 mph causing some drifting issues. However, we will begin our cleanup operations and battle the drift areas until the wind dies down. Snow fall totals range from 10 inches to 1 inch with most getting 3 to 5 inches with a few heavier pockets in each area. At this time we have 825 trucks reported out across the state:

- Crawfordsville – 122
- Fort Wayne – 133
- Greenfield – 173
- LaPorte – 154
- Seymour – 140
- Vincennes – 98

March 12–13, 2013

Lake effect event. At this hour we continue to have scattered snow squalls across the state with lake effect to the north. Most have only received flurries to a dusting up to a half an inch with a few isolated slick spots reported. Along the northern border we have received 1 to 3 inches of lake effect snow. We are expecting the heavier squalls to decrease by noon but could continue to see flurries throughout the day and into tonight. At this time we have 217 trucks reported out across the state:

- Crawfordsville – 8
- Fort Wayne – 57
- Greenfield – 56
- LaPorte – 46

- Seymour – 48
- Vincennes – 2
- Hoosier Helpers – Working normal shifts

No problems or issues have been reported. If you need any assistance, have any questions, suggestions, or comments please let me know.

March 24–25, 2013

Statewide snow event.

Small snow event (1 inch) the morning of the 24th. Larger snow event started in the afternoon (around 5 pm) Lafayette time. Snowed until late morning on the 25th.

APPENDIX C.
BI-WEEKLY REPORTS

Period: 12/10/2012–12/23/2012

District	Liquid Routes (22 Routes)			Control Routes (18 Routes)		
	Salt Used	Total Cost	\$/Service Mile	Salt Used	Total Cost	\$/Service Mile
Crawfordsville	59	\$6,313	\$11.15	57	\$5,924	\$9.70
Fort Wayne	47	\$10,107	\$6.64	41	\$7,567	\$7.58
Greenfield	59	\$7,318	\$9.27	16	\$2,083	\$8.05
LaPorte	144	\$20,317	\$3.45	101	\$11,940	\$4.82
Seymour	46	\$5,194	\$8.12	51	\$6,363	\$9.73
Vincennes	10	\$1,025	\$9.58	13	\$1,331	\$10.52
State totals	365	\$50,274	\$5.29	279	\$35,208	\$6.87

Cost Ranges

- Liquid routes: \$3.45–\$11.15
- Granular routes: \$4.82–\$10.52

Weather Events

- Lake effect events: 12/10 and 12/20–21
- Snow event: 12/20–21

Period: 12/24/2012–1/6/2013

District	Liquid Routes (22 Routes)			Control Routes (18 Routes)		
	Salt Used	Total Cost	\$/Service Mile	Salt Used	Total Cost	\$/Service Mile
Crawfordsville	175	\$20,047.00	10.17	147	\$16,634.00	9.69
Fort Wayne	349	\$44,730.00	6.12	206	\$25,467.00	7.77
Greenfield	246	\$32,061.00	8.34	156	\$20,325.00	10.66
LaPorte	404	\$39,913.00	6.65	300	\$23,504.00	5.81
Seymour	165	\$20,908.00	9.38	143	\$17,952.00	8.19
Vincennes	183	\$21,054.00	8.02	280	\$33,289.00	7.21
State totals	1522	\$178,713.00	\$8.11	1232	\$137,171.00	\$8.22

Cost Ranges

- Liquid routes: \$6.65–\$10.17
- Granular routes: \$5.81–\$10.66

Weather Events

- Lake effect events: 12/25, 12/29
- Snow events: 12/26, 12/28–29, 12/31

Period: 1/7/2013–1/20/2013

District	Liquid Routes (22 Routes)			Control Routes (18 Routes)		
	Salt Used	Total Cost	\$/Service Mile	Salt Used	Total Cost	\$/Service Mile
Crawfordsville	0.8	\$172.00	5.06	0.9	\$181.00	5.93
Fort Wayne	4.2	\$477.00	3.27	7.2	\$805.00	7.89
Greenfield	0	\$0.00	0	0.5	\$236.00	236
LaPorte	33.61	\$3,957.00	6.29	30	\$2,907.00	5.84
Seymour	1.83	\$963.00	6.73	1.82	\$1,004.00	5.48
Vincennes	0	\$0.00	0	0.8	\$198.00	4.21
State totals	40.44	\$5,569.00	\$5.34	41.22	\$5,331.00	\$5.87

Cost Ranges

- Liquid routes: \$3.27–\$6.73
- Granular routes: \$4.21–\$7.89

Weather Events

- Ice and snow event: 1/13
- Light snow event across the southern portion: 1/15

Period: 1/21/2013–2/3/2013

District	Liquid Routes (22 Routes)			Control Routes (18 Routes)		
	Salt Used	Total Cost	\$/Service Mile	Salt Used	Total Cost	\$/Service Mile
Crawfordsville	100**	\$10,559.00	7.63	114	\$11,102.00	12.14
Fort Wayne	208	\$29,226.00	7.16	170	\$19,492.00	8
Greenfield	136*	\$18,096.00	12.21	119	\$13,708.00	10.5
LaPorte	335	\$48,531.00	5.98	504	\$48,595.00	6.37
Seymour	82	\$11,577.00	7.34	117	\$15,654.00	7.62
Vincennes	98.5**	\$10,054.00	8.92	137	\$15,792.00	7.7
State totals	625	\$128,043.00	\$9.87	1161	\$124,343.00	\$8.72

*Used only 1700 gallons of brine.

**Used no liquids.

Cost Ranges

- Liquid routes: \$5.98–\$12.21
- Granular routes: \$6.37–\$12.14

Weather Events

- Lake effect: 1/21, 1/22, 1/23, 1/24
- Snow event: 1/23, 1/25 (across northern half), 1/31 (snow showers), 2/1–2
- Freezing rain: 1/27

Period: 2/3/2013–2/16/2013

District	Liquid Routes (22 Routes)			Control Routes (18 Routes)		
	Salt Used	Total Cost	\$/Service Mile	Salt Used	Total Cost	\$/Service Mile
Crawfordsville	*	*	*	*	*	*
Fort Wayne	48.8	\$8,062.00	6.48	31	\$4,355.00	8.44
Greenfield	11.4**	\$1,306.00	7.5	5.7	\$772.00	8.39
LaPorte	97.2	\$13,969.00	6.1	217	\$18,598.00	8.74
Seymour	36.8**	\$1,084.00	5.51	35	\$5,692.00	5.08
Vincennes	10.4**	\$1,053.00	6.58	6.4	\$587.00	14.68
State totals	146	\$25,474.00	\$6.43	295.1	\$30,004.00	\$9.06

*No WMS reports for Crawfordsville.

**Greenfield, Seymour, Vincennes used no liquids on the study routes.

Cost Ranges

- Liquid routes: \$5.51–\$7.50
- Granular routes: \$5.08–\$14.68

Weather Events

- Lake effect: 2/3–4 (2–4”), 2/15 (1–3”)
- Snow event: 2/3–4 (light snow)

Period: 2/17/2013–3/2/2013

District	Liquid Routes (22 Routes)			Control Routes (18 Routes)		
	Salt Used	Total Cost	\$/Service Mile	Salt Used	Total Cost	\$/Service Mile
Crawfordsville	93**	\$10,586.00	\$8.90	106	\$1,119.00	\$9.04
Fort Wayne	105.6	\$19,491.00	\$7.81	121	\$13,173.00	\$9.00
Greenfield	129.7	\$13,880.00	\$10.75	\$78	\$9,058.00	\$12.00
LaPorte	8.85	\$1,050.00	\$4.27	92.6	\$8,886.00	\$6.32
Seymour***	0	\$0.00	\$0.00	0	\$0.00	\$0.00
Vincennes***	0	\$0.00	\$0.00	0	\$0.00	\$0.00
State totals	243.65	\$45,007.00	\$7.93*	397.6	\$32,236.00	\$9.09

*Average \$/service mile for all districts.

**Used no liquids.

***No WMS reports.

Cost Ranges

- Liquid routes: \$4.27–\$10.75
- Granular routes: \$6.32–\$12.00

Weather Events

- Lake effect: 2/19–20 (2–6”), 3/1–2 (small amounts)
- Snow, sleet, freezing rain event: 2/21
- Sleet and freezing rain: 2/26

Period: 3/3/2013–3/16/2013

District	Liquid Routes (22 Routes)			Control Routes (18 Routes)		
	Salt Used	Total Cost	\$/Lane Mile	Salt Used	Total Cost	\$/Lane Mile
Crawfordsville	102	\$10,596.00	\$11.71	74	\$8,051.00	\$9.90
Fort Wayne	75	\$15,930.00	\$7.10	277	\$24,909.00	\$18.44
Greenfield	138	\$15,620.00	\$9.40	62.4	\$7,784.00	\$8.86
LaPorte	148	\$23,695.00	\$5.99	197	\$19,802.00	\$6.94
Seymour**	49.5	\$6,833.00	\$6.60	47	\$7,357.00	\$7.24
Vincennes **	40	\$4,134.00	\$6.85	50	\$6,357.00	\$7.91
State totals	552.5	\$76,808.00	\$7.94*	707.4	\$74,260.00	\$9.88*

*Average \$/lane mile for all districts.

**Used no liquids but used salt instead.

Cost Ranges

- Liquid routes: \$5.99–\$11.71
- Granular routes: \$6.94–\$18.84

Weather Events

- Snow event: 3/5–6 (1" south to 10" north)
- Lake effect event: 3/12–13

Period: 3/17/2013–3/30/2013

District	Liquid Routes (22 Routes)			Control Routes (18 Routes)		
	Salt Used	Total Cost	\$/Service Mile	Salt Used	Total Cost	\$/Service Mile
Crawfordsville**	91	\$10,660.00	\$11.12	124	\$13,333.00	\$10.94
Fort Wayne	109	\$18,358.00	\$7.16	109	\$13,411.00	\$8.78
Greenfield	113	\$14,694.00	\$8.03	56	\$8,687.00	\$7.66
LaPorte	218	\$29,466.00	\$6.62	388	\$18,146.00	\$6.69
Seymour**	30	\$6,456.00	\$5.96	43	\$4,268.00	\$4.32
Vincennes **	51	\$5,404.00	\$7.13	20	\$2,814.00	\$5.04
State totals	612	\$85,038.00	7.67*	740	\$60,659.00	7.24*

*Average \$/service mile for all districts.

**Used no liquids but used salt instead.

Cost Ranges

- Liquid routes: \$5.96–\$11.12
- Granular routes: \$4.32–\$10.94

Weather Events

- Statewide snow event: 3/24–25 (1–10")

About the Joint Transportation Research Program (JTRP)

On March 11, 1937, the Indiana Legislature passed an act which authorized the Indiana State Highway Commission to cooperate with and assist Purdue University in developing the best methods of improving and maintaining the highways of the state and the respective counties thereof. That collaborative effort was called the Joint Highway Research Project (JHRP). In 1997 the collaborative venture was renamed as the Joint Transportation Research Program (JTRP) to reflect the state and national efforts to integrate the management and operation of various transportation modes.

The first studies of JHRP were concerned with Test Road No. 1—evaluation of the weathering characteristics of stabilized materials. After World War II, the JHRP program grew substantially and was regularly producing technical reports. Over 1,500 technical reports are now available, published as part of the JHRP and subsequently JTRP collaborative venture between Purdue University and what is now the Indiana Department of Transportation.

Free online access to all reports is provided through a unique collaboration between JTRP and Purdue Libraries. These are available at: <http://docs.lib.purdue.edu/jtrp>

Further information about JTRP and its current research program is available at: <http://www.purdue.edu/jtrp>

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